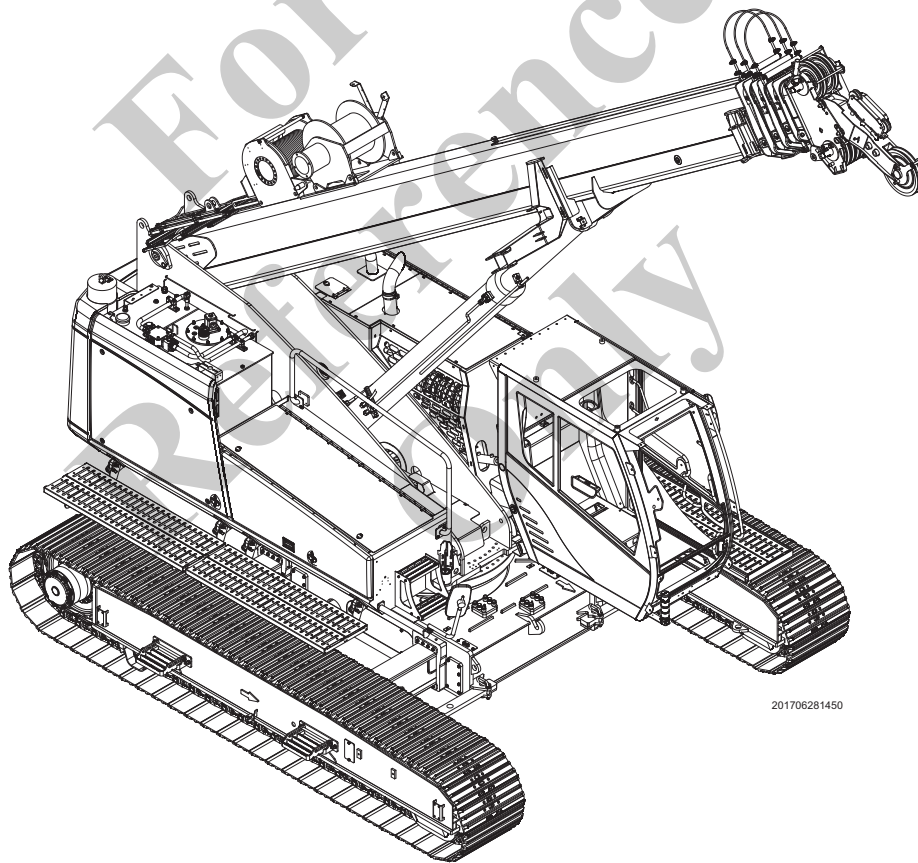


Operation manual

GHC 30

Telescopic crane



Version 3

Read this manual prior to performing any task!

For
Reference
Only

GHC 30, 9, en_US

Supplemental directives

| | | |
|-----------|---|--|
| | | |
| DE | Wenn Sie die Sprache der Betriebsanleitung nicht verstehen, dürfen Sie die Maschine nicht in Betrieb nehmen. Im Bedarfsfall kontaktieren Sie bitte Ihren regionalen Grove-Servicepartner. | |
| EN | If you do not understand the language in which the operating manual is written, you are not permitted to place the machine in service. If necessary contact your regional Grove dealer. | |
| FR | Si vous ne comprenez pas la langue du manuel d'exploitation, vous n'êtes pas autorisé à mettre la machine en service. Si nécessaire, contactez votre revendeur Grove local. | |
| ES | Si no entiende el idioma del manual de instrucciones, usted no está autorizado a poner en funcionamiento la máquina. En caso necesario, póngase en contacto con su distribuidor Grove regional. | |
| PT | Caso não compreenda o idioma do manual de instruções, não poderá colocar a máquina em funcionamento. Se necessário contate o seu fornecedor regional Grove. | |
| IT | In caso di difficoltà di comprensione delle Istruzioni d'uso, si prega di non utilizzare la macchina. All'occorrenza, contattare il proprio rivenditore regionale Grove. | |
| NL | Wanneer u de taal van de handleiding niet begrijpt, mag u de machine niet in bedrijf nemen. Neem indien nodig contact op met uw regionale Grove- dealer. | |
| RU | Запрещается вводить машину в эксплуатацию, если Вы не понимаете языка руководства. В случае необходимости обратитесь к Вашему региональному дилеру Grove. | |
| BG | Ако не разбирате езика на инструкциите за експлоатация, не пускайте машината в експлоатация. Моля, при необходимост се обръщайте към регионалния представител на Grove. | |
| DA | Hvis du ikke forstår sproget, som betjeningsvejledningen er udarbejdet på, må du ikke tage maskinen i drift. Kontakt ved behov din lokale Grove-forhandler. | |
| ET | Kui Te ei peaks kasutusjuhendi keelest aru saama, siis ei tohi Te masinat käiku võtta. Vajaduse korral võtke palun regionaalse Grove'i. | |
| FI | Jos et ymmärrä käyttöohjeen kieltä, konetta ei saa ottaa käyttöön. Ota tarvittaessa yhteyttä paikalliseen Grove-edustajaan. | |
| EL | Αν δεν γνωρίζετε τη γλώσσα των οδηγιών χρήσης, δεν επιτρέπεται να θέσετε σε λειτουργία τη μηχανή. Σε περίπτωση ανάγκης επικοινωνήστε με τον αντιπρόσωπο Grove. | |
| HR | Ako ne razumijete jezik iz uputa za uporabu, ne smijete se služiti strojem. Ako je potrebno, obratite se svom dobavljaču ili regionalnom distributeru Grove. | |
| LV | Ja nesaprotat valodu, kādā sarakstīta lietošanas instrukcija, jūs nedrīkstat darbināt mašīnu. Ja nepieciešams, lūdzu, sazinieties ar vietējo Grove. | |
| LT | Nesuprantant naudojimo instrukcijos kalbos, pradėti eksploatuoti mašiną draudžiama. Prireikus susisieki su Grove. | |
| PL | Jeśli nie rozumieją Państwo języka, w którym sporządzona została instrukcja obsługi, nie wolno Państwu uruchamiać maszyny. W razie potrzeby prosimy o kontakt z regionalnym dystrybutorem Grove. | |
| NO | În situația în care nu înțelegeți limba instrucțiunilor de utilizare, nu este permis să puneți mașina în funcțiune. În caz de necesitate, contactați comerciantul dumneavoastră regional Grove. | |
| SV | Om du inte skulle förstå språket i bruksanvisningen får du inte ta maskinen i drift. Kontakta vid behov din regionala Grove. | |
| SK | Ak nerozumiете jazyku v návode na obsluhu, nesmiete stroj uviesť do prevádzky. V prípade potreby kontaktujte vášho miestneho predajcu spoločnosti Grove alebo priamo spoločnosť Grove Maschinenfabrik GmbH. | |
| SL | Če jezika navodil za uporabo ne bi razumeli, stroja ne smete dajati v obratovanje. Po potrebi se obrnite na svojega regionalnega prodajalca z izdelki Grove. | |

Supplemental directives

| | |
|-----------|--|
| CS | Pokud nerozumíte jazyku, ve kterém je návod napsán, nesmíte stroj uvést do provozu. V případě potřeby kontaktujte svého regionálního prodejce Grove. |
| HU | Amennyiben a kezelési utasítás nyelvét Ön nem érti, úgy tilos a gépet üzembe helyezni. Szükség esetén lépjen kapcsolatba a regionális Grove. |
| IS | Ef notandinn skilur ekki tungumálið sem notkunarleiðbeiningarnar eru á má hann ekki nota vélina. Ef þörf krefur skal leita til söluaðila Grove. |
| NO | Dersom du ikke forstår språket til bruksanvisningen, må du ikke ta maskinen i drift. Ved behov må du ta kontakt med din regionale Grove-forhandler. |
| TR | Kullanma kılavuzunun dilini anlamadığınızda, makineyi işleme alanıza müsaade edilmez. Gerktiğinde lütfen bulunduğunuz ülkedeki yetkili Grove. |

About this operating manual

This manual allows you to use the machine safely and efficiently. The instructions are an integral part of the machine and should be kept in the designated storage compartment. This manual should be accessible at all times. Personnel should have carefully read and understood this manual before any work is done. Working safely requires compliance with all safety information and instructions in this manual. Local occupational health and safety regulations, and general safety regulations also apply for the work area of the machine.

Validity of the document

This manual refers to the machine with various tools.

Spare parts and accessories

Only use original replacement parts and Grove accessory products authorized by the manufacturer. Grove will not be held responsible for any parts or accessory products that have not been approved.

Other applicable documents

- Hydraulic diagram
- Electrical diagram
- Spare parts catalog

Copyright

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For Reference Only

1 Overview

1.1 Overall machine

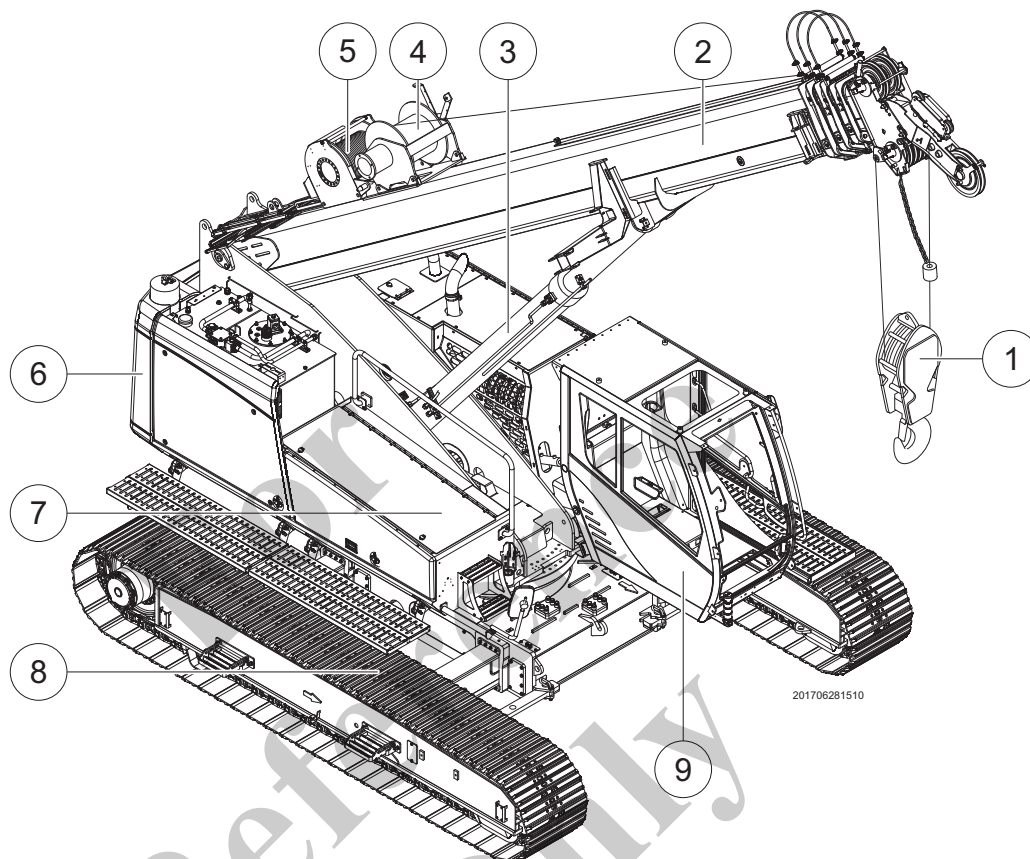


Fig. 1: Components of the machine

- | | | | |
|---|------------------|---|---------------|
| 1 | Load hook | 6 | Counterweight |
| 2 | Main boom | 7 | Uppercarriage |
| 3 | Luffing cylinder | 8 | Undercarriage |
| 4 | Winch 1 | 9 | Cab |
| 5 | Winch 2 | | |

Overview

Undercarriage

1.2 Undercarriage

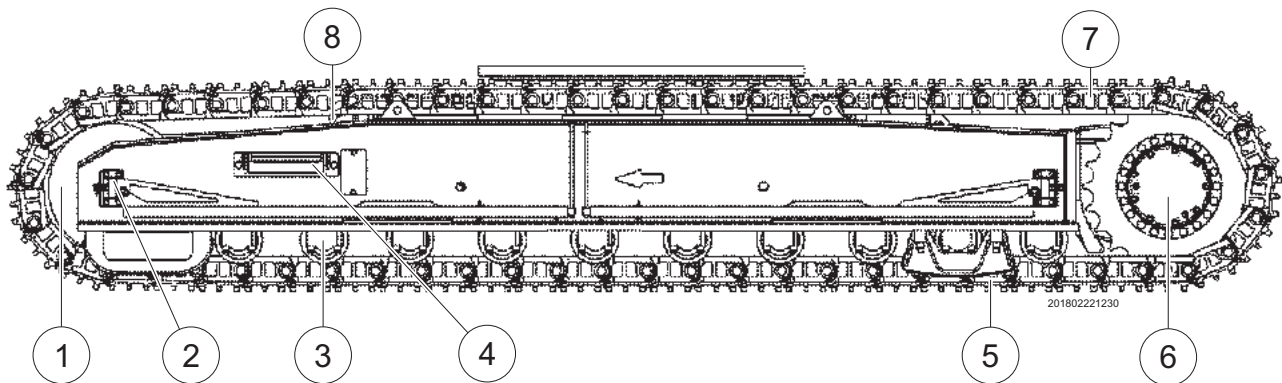


Fig. 2: Components of the undercarriage

- | | | | |
|---|-------------------------------------|---|--|
| 1 | Idler (forward direction of travel) | 5 | Chain guide |
| 2 | Swing barrier protection | 6 | Drive wheel (rear, in direction of travel) |
| 3 | Track roller | 7 | Crawler track |
| 4 | Access ladder | 8 | Carrier roller |

1.3 Cab

Overview

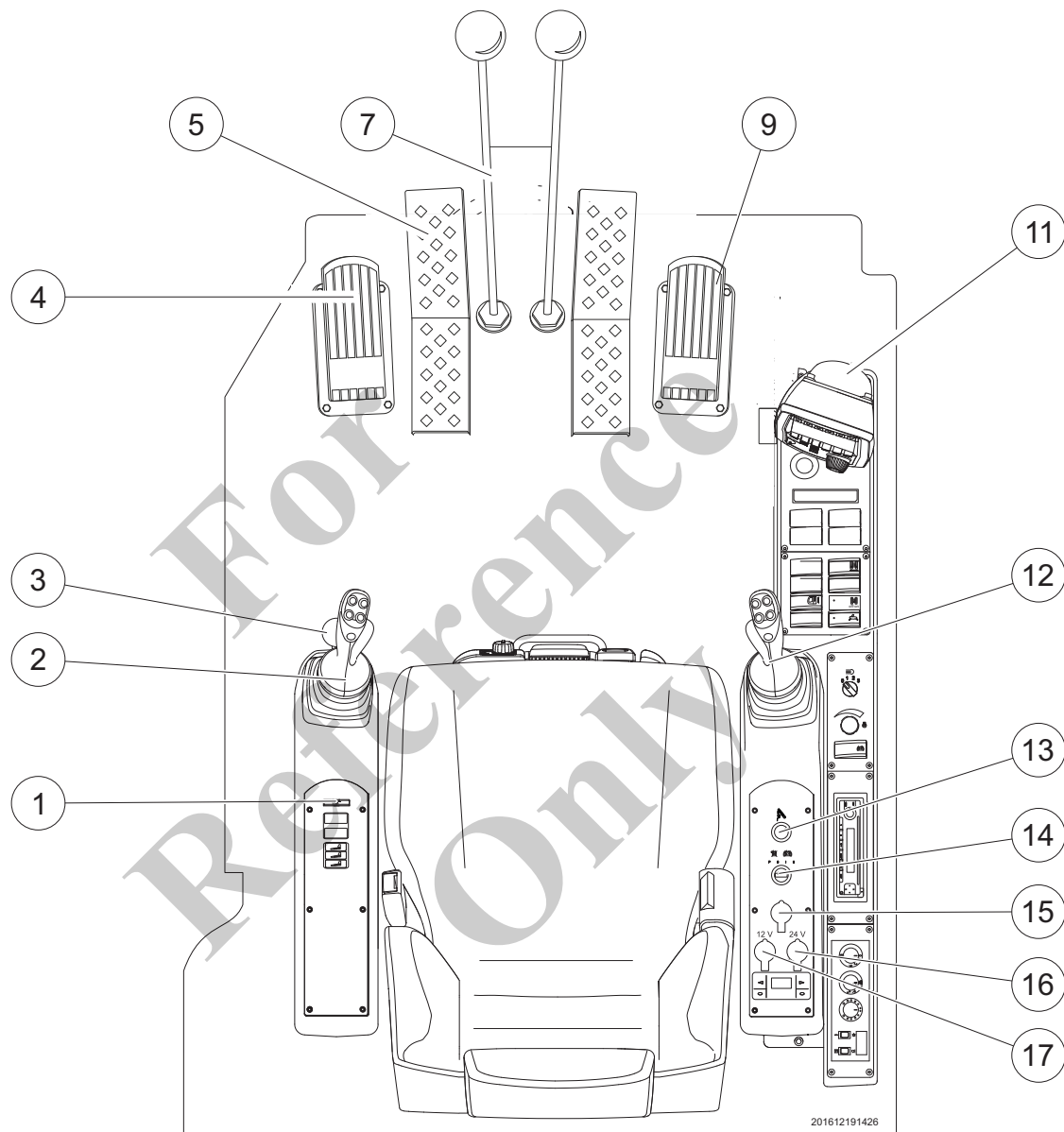


Fig. 3: Operating elements in the cab

- | | | | |
|---|--------------------|----|-----------------------|
| 1 | Seat functions | 11 | SENCON 2.0 |
| 2 | Left joystick | 12 | Right joystick |
| 3 | Safety lever | 13 | Bypass, raise boom |
| 4 | Slewing gear brake | 14 | Ignition switch |
| 5 | Drive pedal | 15 | USB power socket, 5 V |
| 7 | Hand lever | 16 | Power socket, 24 V |
| 9 | Throttle pedal | 17 | Power socket, 12 V |

Overview

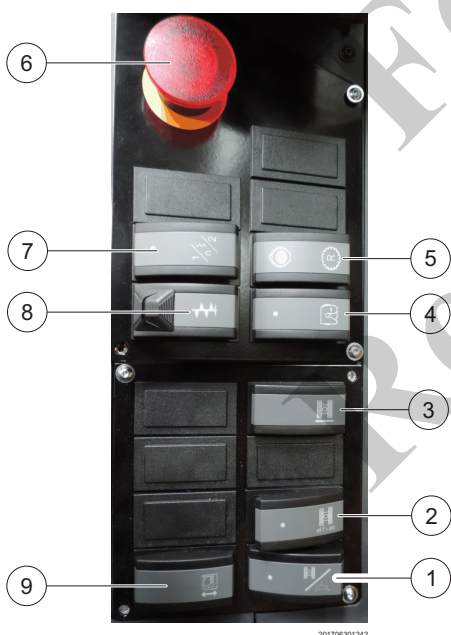
Cab

Control panel, left

- 1 Switch, lumbar support, upper air chamber
- 2 Switch, lumbar support, lower air chamber

Fig. 4: Control panel, left

Front right control panel



- 1 Preselection, travel slow/fast
- 2 Activate drive mode
- 3 Extend undercarriage telescoping
- 4 Opening the auger locking mechanism
- 5 Preselection, pole claw/supplemental hydraulic system
- 6 Emergency STOP
- 7 Drilling speed, slow/fast
- 8 Soil drill
- 9 Tilting the cab

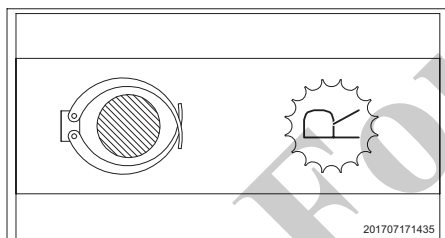
Fig. 5: Front right control panel

⚠ DANGER

Danger to life from preselected supplemental hydraulic system!

- Make sure no one is in the danger zone of the machine while it is in operation.
- Before switching on the supplemental hydraulic system, ensure that there are no objects inside the pole claw or ensure that the pole claw has been removed or disconnected.

The pole claw will fully close when the Preselection pole claw/supplemental hydraulic system switch is set to the supplemental hydraulic system position. Persons near the pole claw may become crushed. Objects inside the pole claw may be cut apart and fall down. This can cause serious injury or death. The machine may become severely damaged.



The switch **Preselection pole claw/supplemental hydraulic system** has three shift positions:

- Front: Pole claw
- Center: Switch disabled
- Rear: Supplemental hydraulic system

Overview

Cab

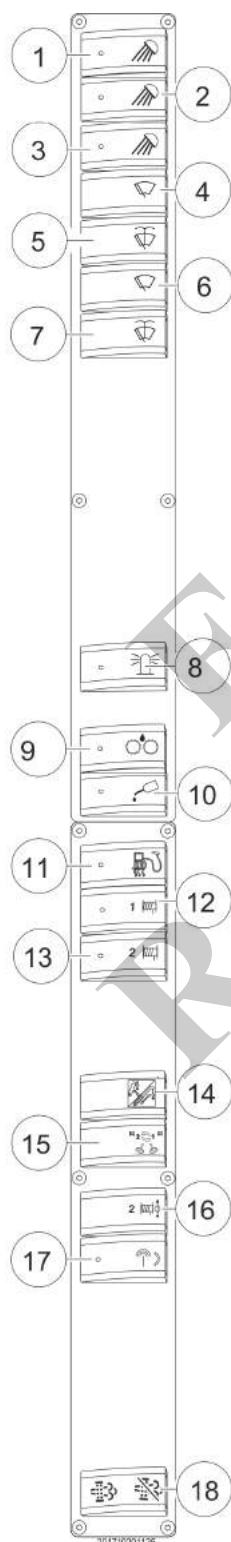
Right control panel

- 1 Hand throttle
- 2 Starting/stopping the diesel engine
- 3 Radio
- 4 Climate control system

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Fig. 6: Right control panel

Upper right control panel



- 1 Work floodlights, cab
- 2 Work floodlights, telescopic boom (option)
- 3 Working floodlights, uppercarriage
- 4 Windshield wiper, windshield
- 5 Washer system, windshield
- 6 Windshield wipers, glass roof panel
- 7 Washer system, glass roof panel
- 8 Flashing alarm lamp
- 9 Slewing ring lubrication
- 10 Central lubrication
- 11 Diesel filter heater
- 12 Activate winch 1
- 13 Activate winch 2
- 14 Changeover rocker - telescope/boom up-down
- 15 Changeover winch 1/winch 2
- 16 Equip winch 2
- 17 Remote radio control (option)
- 18 DEF bypass / regen switch

Fig. 7: Upper right control panel

Overview

Winch

1.4 Winch

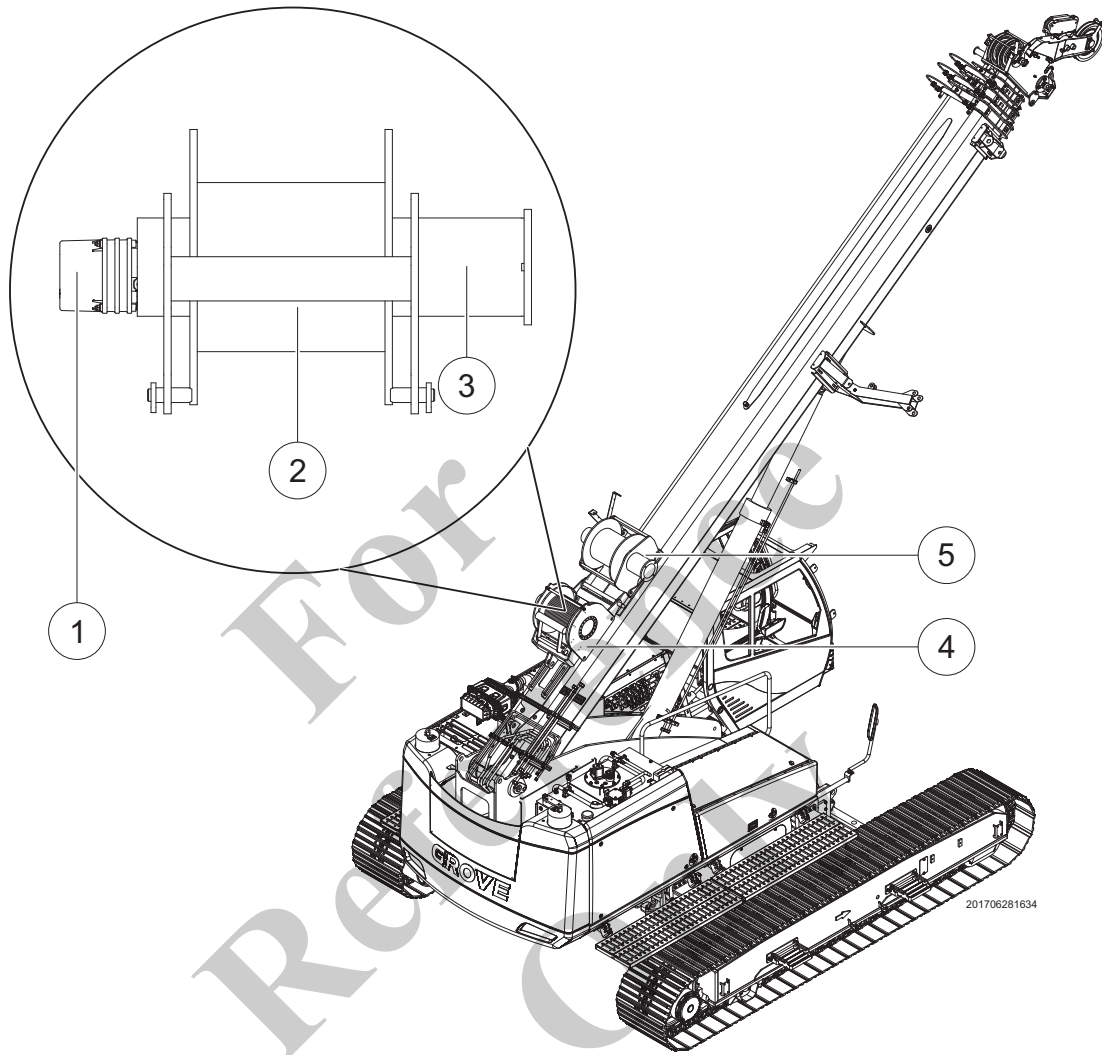


Fig. 8: Winch with motor

- 1 Cam switch - end position monitoring
- 2 Winch
- 3 Winch motor
- 4 Winch 1
- 5 Winch 2

2 Safety

2.1 Symbols in the manual

2.1.1 Warnings

This manual contains safety notices to alert you to hazardous situations. These safety notices are indicated by a preceding signal word. The signal word indicates the severity and the probability of occurrence of the hazard if the information is not observed.

 **DANGER**

Signal word that is used to indicate an imminent hazardous situation. If this situation is not avoided, death or severe injury will result.

 **WARNING**

Signal word that is used to indicate a potentially dangerous situation. If this situation is not avoided, death or severe injury may result.

 **CAUTION**

Signal word that is used to indicate a potentially dangerous situation. If this situation is not avoided, minor or moderate injury could result.

NOTICE

Signal word that is used to indicate a potentially dangerous situation. If this situation is not avoided, damage to the machine or other property damage may result.

2.1.2 Structure of safety instructions

The following example shows the structure of the safety information in this manual. Safety-relevant information is always introduced by a signal word.

 **DANGER**

Type and source of hazard

- The steps you should take to avoid the hazardous situation.

Consequences of non-compliance

2.1.3 Tips and recommendations



This symbol highlights useful tips, recommendations and other information for efficient, failure-free operation.

2.2 Proper use

The machine is solely for use in tasks which correspond to the machine's function and to the function of the work tool.

Intended tasks are:

Safety

Foreseeable misuse

- Crane operations: The grabbing, lifting and loading of loads with a load hook. The load must be attached to the load hook by one or more persons.
- Operation with a personnel platform. The personnel platform is an available option.
- Operation with hydraulically driven tools.
- Operation with an auger for drilling work.
- Operation with pole claw for lifting masts.
- Operation as a carrier device for inserting and removing piling equipment is only allowed,
 - with the maximum wheel track width.
 - with the maximum counterweight.
 - if the total weight of the piling machine, piling equipment, ducts and other attachments is a maximum 80% of the published load capacity values for maximum track width and maximum counterweight.
 - Over the main boom. Operation as carrier over the jib or fly boom is not permitted.
 - If driving or removing pile elements using pile driving equipment is only successful in the vertical direction. Hoisting at an angle or lateral loads on the boom is not permissible,
 - when used for the removal of piling equipment that prevent the transmission of vibrations and impact loads on the crane. In addition, all precautions are to be taken that prevent the transmission of vibrations and impact loads on the crane, or at least minimize them. The removal of piling equipment only with the winch is not permitted.
- Use on a pontoon.

If in doubt as to whether or not the machine is suitable for the current installation, ask a Manitowoc Crane Care Service Partner.

2.3 Foreseeable misuse

If the machine and its attachment tools are not used properly, this can lead to uncontrolled machine behavior, accidents and serious property damage. As a result, persons can be killed and / or seriously injured. Impermissible use excludes any liability on the part of the manufacturer. The risk is borne solely by the user.

- Use of work tools not authorized by the manufacturer.
- Exceeding the permitted safe working loads. The weight of the work tool is part of the load capacity.
- Operation of the machine in non-permitted environmental conditions.
- For the application of insufficient protective machine equipment.
- Operation of the machine outside of the permissible operating temperatures.
- Non-compliance with the pre-heating and warm-up phase.
- Non-compliance with the permissible total weight of the machine with work tools.

- Modifications or alterations to the machine.
This applies also for the installation and use of safety devices and valves, as well as for welding on load bearing parts.
- Not using original spare parts from the manufacturer.
- Pulling jammed loads free.
- Lifting loads at an angle.
- The attached load and work tool bumping into obstacles.
- Operating the machine on insufficiently stable, firm ground.
- Misuse by untrained and uninstructed personnel.
- Failure to perform the necessary inspection and maintenance tasks.
- Lifting, moving, and transport of persons.
- Operation in an explosive environment.

2.4 Residual risks

▲ WARNING

Risk of falling due to overloaded step grid!

- Step grids can be loaded with max. 200 kg (440 lbs) per grid segment.
- Cracks and damages to the step grids must be repaired immediately.

If the step grids are overloaded, they can fall. This can cause serious injury.

▲ WARNING

Danger to life from fire and explosion caused by highly inflammable liquids!

- Do not handle near open flame, fire or any source of ignition.
- Take steps to prevent electrostatic discharge.
- Keep appropriate extinguishing agents (fire blanket, fire extinguisher with CO², powder or foam) on hand.
- Take steps to prevent the buildup of flammable vapors in lower-lying or enclosed areas.
- In case of fire, stop working immediately. Leave the danger area and notify the fire department. Stay out until you are told it is safe to return.
- Keep the machine clean. Remove soiling, especially from fuels and lubricants, as soon as possible.
- Have damaged fuel and hydraulic lines replaced. Do not start the machine.

Fluids used and their emissions can form an explosive mixture when in contact with air and, if ignited, can cause death or serious injury.

Safety

Residual risks

DANGER

Risk of death from electric shock!

- Only qualified electricians may work on the electrical system.
- If there is damage to insulation, disconnect power immediately and arrange for repairs.
- Make sure live parts in electrical systems and equipment are dead before working on them and secure them for the duration of repairs. Follow the five safety rules:
 - Disconnect power.
 - Secure against reconnection.
 - Verify that the system is dead.
 - Ground and short-circuit the system.
 - Provide protection from adjacent live parts.
- Never bypass or disable fuses. When replacing fuses, be sure to use the correct amperage.
- Keep live parts dry. Damp live parts can result in a short-circuit.

Touching live parts can result in death or serious injury from electric shock. Damage to insulation or individual parts can be fatal.

WARNING

Risk of injury through incorrect use of batteries!

- Never short-circuit the battery terminals (positive and negative).
- Never expose batteries to moisture or humidity (rain, salt water, liquids). Do not, in any instance, use a moist or wet battery.
- Do not use or store batteries in locations with atmospheres which risk explosion or in which high temperatures could occur.
- Never attempt to repair, modify, convert or disassemble batteries.
- Batteries must always be protected from falling into the hands of unauthorized persons.
- To avoid fire, over-heating, explosions or leakage of batteries, never expose them to serious shock, high weight loads, or other damaging impacts. Leaked fluids can catch alight.
- Following contact between the eyes and leaked fluids, the eyes must be immediately rinsed beneath the eyelid for at least 15 min. with clear water. When doing so, direct a gentle stream of water onto the eye and do not rub. Immediately seek medical attention.
- Avoid skin contact with leaked fluids. In the case of accidental skin contact, wash the affected skin area with plenty of water and soap.

Incorrect use of batteries poses the risk of the batteries exploding or of harmful fluid leaking from the batteries. The fluid can cause chemical burns to the skin upon contact, and cause blindness through contact with the eyes.

WARNING

Risk to health due to coolants containing glycol!

- Avoid skin contact with coolants.
- Do not eat, drink or smoke when handling coolant. Wash hands before breaks and after use.
- Observe the manufacturer's MSDS for the coolant.
- Wear the personal protective equipment specified in the MSDS when handling coolant.

Coolant contains glycol, which can be seriously harmful to your health when in contact with skin, ingested or inhaled.

Measures to take following contact with coolant:

- Immediately remove soiled or soaked clothing.
- Wash skin for at least 15 min. with plenty of water after contact.
- Thoroughly rinse out eyes for at least 15 min. with plenty of water after contact, and seek medical help.
- Rinse out mouth with water after swallowing coolant, and continue to drink plenty of water. Seek medical help.
- After inhaling aerosols, go into the fresh air.

DANGER

Risk of death or serious injury from fluid escaping under high pressure.

- Never open or work on pressurized hydraulic parts.
- Be sure to keep body parts and objects clear of the escaping fluid. Keep persons out of the danger zone.
- Initiate emergency stop immediately. If necessary, take other steps to reduce the pressure and stop the escaping fluid.
- Collect and dispose of escaped fluid properly.
- Have defective parts repaired immediately.

Fluid can escape from defective lines or parts at high pressure. This fluid can sever limbs, resulting in death or serious injury.

WARNING

Risk of death or serious injury from hydraulic energy.

- Only your authorized Grove Service Partner should work on the hydraulic system.
- Make sure the hydraulic system has been fully depressurized before working on it. Make sure the pressure accumulator has been fully depressurized.
- Do not reach into or tamper with moving machine parts while in operation.
- Do not open covers while in operation.
- Wear tight-fitting, tear-resistant protective clothing in the danger zone.

Hydraulically driven moving parts can cause serious injury.

Safety

Residual risks

WARNING

Risk of injury due to moving parts.

- Do not reach into or tamper with moving machine parts while in operation.
- Never open covers while in operation.
- Observe rundown time: Make sure no parts are moving before opening covers.
- Wear tight-fitting, tear-resistant protective clothing.

Moving parts can cause serious injury.

WARNING

Risk of death or serious injury due to suspended loads.

- Never stand under or in the swinging range of suspended loads.
- Only move loads with supervision.
- Only use approved lifting equipment and slinging gear with sufficient load-bearing capacity.
- Do not use lifting equipment such as ropes and belts that are ripped or frayed.
- Do not place lifting equipment such as ropes and belts on sharp edges and corners, and do not knot or twist them.
- Lower loads to the ground when leaving the work area.

Loads can swing out and fall during hoisting. This can result in serious injury or even death.

WARNING

Risk of injury due to falling objects.

- Do not enter the danger zones during normal operation.
- When entering a danger zone (e. g., during setup), wear a hard hat, safety shoes and protective clothing.

During operation, material can fall or fly off in an uncontrolled fashion, causing serious injury.

WARNING

Risk of death due to improper handling of winches and ropes.

- Observe standards and country-specific accident prevention regulations.
- Never skip scheduled rope and winch maintenance and inspections. Specifically, always change winch oil as scheduled.
- Avoid moving or stopping loads at high speed, and other improper use.
- During inspections, make sure ropes are lubricated, and check for leaks and damage.
- Adapt maintenance and inspection steps to extreme environmental conditions. Contact Grove Customer Service, if necessary.

Improperly handling winches and ropes can cause them to malfunction. This can result in an accident causing injury.

⚠ WARNING

High vibration hazard!

- Do not disable the vibration dampers.
- Do not stand in the vibrating area during operation.

Long-term exposure to high vibrations can result in serious injury and chronic health problems. Vibration dampers isolate the source of vibration from the surrounding area.

⚠ WARNING

Risk of injury due to hot operating fluids!

- Always wear heat-resistant protective clothing and gloves when working with hot operating fluids.
- See if operating fluids are hot before handling. If necessary, allow to cool.

Operating fluids can reach high temperatures during operation. Contact with hot operating fluids can result in serious burns.

⚠ WARNING

Risk of injury due to hot surfaces.

- Always wear heat-resistant protective clothing and gloves when working near hot surfaces.
- Make sure that all surfaces have cooled down before starting any work.

Part surfaces can reach high temperatures during operation. Contact with hot surfaces can result in serious burns.

⚠ WARNING

Risk of injury due to noise.

- As long as it is in compliance with the safety regulations, keep housing, covers, cab doors, and cab windows shut.
- Do not linger in the danger zone.

The noise level in the work area can cause severe hearing damage.

NOTICE

Machine failure due to lightning strike.

- Before restarting the machine following a lightning strike, check that the operating and safety controls are functioning properly.

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

2.5 Danger zone

▲ WARNING

Risk of injury inside machine danger zone.

- Make sure no one is in the danger zone.
- Keep a safe distance from the danger zone.
- The operator should warn persons of any hazards.
 - Shut down the machine if persons do not leave the danger zone despite this warning.
- Only the operator should be in the cab of the machine while it is in operation.
- If the operator's view is restricted while driving and working, a banksman should be used. The communication between the banksman and the machine operator must be ensured.
- Cordon off the area between solid structures and the work area of the machine.
- Observe the instructions of the operating manual.

Persons in the danger zone can be crushed by the machine while it is in operation or struck by falling parts. This can result in serious injury or even death.

▲ WARNING

Risk of death when exceeding configured work area.

- Keep an extra safe distance from persons, machinery and structures near the configured work area.
- Move the machine slowly and carefully.

If machine motions are executed quickly when an optional work area limitation is used, the set work area can be exceeded. This can cause death or serious injury. The machine or nearby structures may be damaged.

▲ WARNING

Risk of injury due to the machine overturning.

- Particularly observe the instructions of this operating manual as regards 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 maximum wind speeds
 - Travel with and without load (permissible incline, ground conditions, uppercarriage and boom position)

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.

The danger zone is the area in which persons can be injured or tools, attachments or loads can be damaged. The danger zone shifts with the travel movements.

Possible danger zones include:

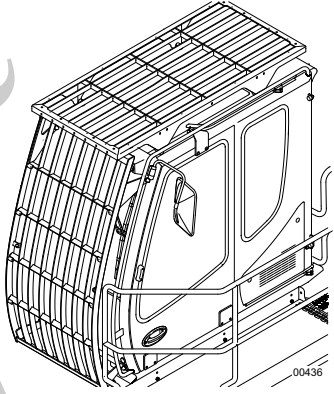
- Areas in which persons can be struck by the slewing motions of the machine.
- Areas in which persons can be injured by the machine moving, rolling or tipping over.
- Areas in which persons can be injured by loads swinging out or falling.
- Areas in which persons can be crushed between the machine and objects such as buildings and scaffolding.
- Areas in which persons can be injured by hot or pressurized substances.
- Areas with hot surfaces.

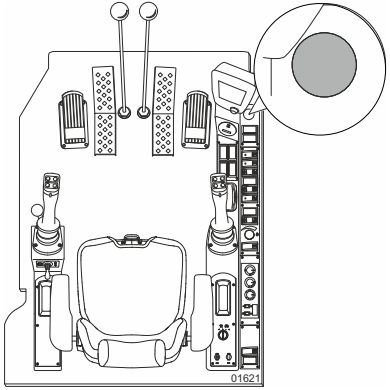
2.6 Safety devices

| Safety feature | Description | Illustration |
|--|--|--------------|
| Load moment limitation | <p>If the crane is nearing the limit of its load capacity, the load moment limitation light emits an acoustic and optical warning signal.</p> <p>If the permissible load moment is exceeded, the load moment limitation switches off all load moment-increasing machine movements.</p> | |
| Protective grating and protective covering | Protective gratings and protective coverings should prevent contact with dangerous machine components. | |
| Safety lever | With the safety lever, the operator can lock all of the work and travel operations during work breaks and before leaving the cab. | |

Safety

Safety devices

| Safety feature | Description | Illustration |
|-------------------------------------|---|---|
| Emergency hammer and emergency exit | If, in an emergency, the exit via the cab door is locked, the operator can exit the cab through the right-hand cab window. The emergency hammer is for breaking the window. | |
| Optional protective roof (FOPS) | The protective roof protects the operator from falling objects. |  A technical line drawing of a crane cab. The cab is shown from a three-quarter front view. It features a prominent protective roof structure made of a grid of vertical and horizontal bars, designed to prevent falling objects from hitting the operator. The drawing includes details of the cab's windows, door, and side mirrors. A small reference number '00436' is visible in the bottom right corner of the illustration. |
| Armored-glass roof window (option) | The protective roof protects the operator from falling objects. | |
| Seat belt | If used correctly, the seat belt prevents the machine driver being thrown through or out of the cab. | |

| Safety feature | Description | Illustration |
|------------------------------|---|--|
| Yellow beacon light (option) | <p>The beacon indicates to those in the vicinity of the machine that the machine is a source of danger.</p> <p>Notice, that the machine is operated by remote radio control.</p> | |
| Emergency STOP | <p>Activation of the emergency stop stops all machine operations.</p> |  |
| Horn and acoustic signals | <p>The horn and acoustic signals indicate to those in the vicinity of the machine that the machine is a source of danger.</p> | |
| Fire extinguisher | <p>The fire extinguisher is used, in the case of fire, to extinguish flames.</p> <p>The storage location of the fire extinguisher in the machine is marked by a relevant sticker.</p> | |
| Lifting limit switch | <p>The lifting limit switch switches off lifting movement in the winch at a determined height. As a result, a collision between the bottom hook block and the pulley head is prevented. In addition, telescopic cranes are powered down and luffing jib switched off.</p> | |

Safety

Safety devices

| Safety feature | Description | Illustration |
|------------------------------|--|--------------|
| Length and angle transmitter | The length and angle transmitter measures both the angle and the length of the telescopic boom. This is transmitted to the RCL. If the length or angle of the telescopic boom fall in the non-permitted area, the RCL switches off all load moment-raising machine operations. | |
| Rope end limiter | The rope end limiter ensures that sufficient rope always remains wound on the winch. If the remaining rope on the winch falls below the permissible length, lowering operations are automatically switched off. | |
| Pressure sensor | The pressure sensors measure the pressure on the piston head and on the rod side of the hoist cylinder. | |



The illustrations for the safety devices are example images. The precise positioning of the safety devices on and in the machine can change.

2.7 Responsibilities of the owner

Routine checks

Inspection by an expert

The machine must be thoroughly inspected by an expert:

- Before initial start-up and before operating the machine after significant modifications
- At least once a year
- As needed 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
- special instruction by the GROVE company

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:

- Power-driven mobile cranes
- Mobile, power-driven derricks
- Truck-mounted cranes

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

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 overseas, the following must be observed:

- Comply with the safety regulations of the country of use.
- Make sure the operators have the necessary qualifications for the intended work.
- Ensure that the contents of this manual are read and fully understood. If necessary, obtain instruction from GROVE in the appropriate official language.

Safety

Personnel qualifications

Dangers of non-compliance with safety instructions

- Failing to observe safety information is dangerous and can put persons, the environment and the machine at risk.
- Failing to observe safety information voids all claims for damages.

Fire extinguisher and first-aid kit

The machine is provided with places for a fire extinguisher and first-aid kit. The owner is obligated to equip the machine with these items. In the case of a missing fire extinguisher or first-aid kit, or if they have defects, please acquire them through GROVE.

2.8 Personnel qualifications

 **DANGER**

- Any personnel in training or being instructed on the machine should be under constant supervision by an experienced specialist.
- Work on the machine's electrical equipment should only be performed by a qualified electrician.
- Work on travel gear, braking and steering systems should only be performed by specially trained technicians.
- Work on hydraulic equipment should only be performed by personnel with specific knowledge of and experience with hydraulic systems.

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

The following selection criteria must be observed:

- Only assign trained or instructed personnel.
- Define responsibilities for operation and maintenance.
- Comply with 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 - excerpt from OSHA regulations (USA)

Operating personnel are those persons authorized by the owner to operate the product. Machine operators must have the following qualifications:

- 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

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 persons are included in the definition of the term 'specialized personnel':

- **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 personnel:** Instructed personnel have been instructed in the following points and are capable of implementing these instructions:
 - The tasks assigned
 - 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 determine if the machine is safe to use:
 - Technical training and adequate knowledge of the machine
 - Applicable occupational health and safety regulations and accident prevention regulations
 - Acknowledged guidelines and standard engineering practice

2.9 Personal protective equipment

Description of personal protective equipment

Personnel should wear personal protective equipment, which will be referenced separately in the individual sections of this manual, while working on and with the machine.

Description of personal protective equipment

| | |
|---|---|
| | <p>Fall arrest safety harness</p> <p>The fall arrest safety harness reduces the risk of injury when falling from a great height.</p> <p>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.</p> <p>Hook-in points are marked by the appropriate sign.</p> |
|  | <p>Hearing protection</p> <p>Hearing protection protects against hearing loss due to noise.</p> |

Safety

Diesel fuel

| | |
|---|--|
|  | <p>Safety goggles</p> <p>Safety goggles protect eyes against flying parts and splashing.</p> |
|  | <p>Protective gloves</p> <p>Protective gloves protect the hands against friction, abrasions, punctures, deep wounds and hot surfaces.</p> |
|  | <p>Hard hat</p> <p>Hard hats protect the head against falling objects, swinging loads and collisions with fixed objects.</p> |
|  | <p>Safety shoes</p> <p>Safety shoes protect feet against crushing, falling parts and slipping on slippery surfaces.</p> |
|  | <p>Protective clothing</p> <p>Protective clothing is tight-fitting, tear-resistant clothing with tight sleeves and no protruding parts.</p> |

2.10 Diesel fuel

The factory filling for diesel fuel conforms to EN 590 as well as ASTM D975 S15 with a sulfur content of < 10 mg/kg.



Fig. 9: Information sign concerning the use of sulfur-free fuel



The use of sulfur-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 an information sign on the diesel tank filler neck. Observe the information in the operating manual for the engine.

NOTICE

Risk of engine damage due to use of high-sulfur fuels.

- Only use fuel with a sulfur content of up to 15 mg/kg.

Fuels with increased sulfur content can cause serious damage to the engine and the exhaust aftertreatment system. This can invalidate the emission certification of the diesel engine and can result in legal consequences for the owner.



The use of fuels with a sulfur content greater than 15 mg/kg is permitted under certain circumstances for engines subject to EU Stage II or IIIa and US EPA Tier 2 or 3 emissions standards. This however requires the use of an engine oil with special properties matched to this requirement. Engine oil filled at the factory is not suitable for this use and must be replaced. Observe the instructions in the operating manual provided by the engine manufacturer.

2.11 Engine oil

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



For engines at the EU exhaust level Stage IV and US EPA Tier 4 final the use of low-ash engine oil of the specifications ACEA E9-08 or API CJ-4 is strictly required. Observe the instructions in the operating manual for the engine.

NOTICE

Engine damage due to use of wrong engine oil!

- Only use engine oils with the specifications ACEA E9-08 or API CJ-4 for engines of exhaust level EU Stage IV and US EPA Tier 4 final.

The use of not permitted engine oils by motors of the exhaust level EU Stage IV and US EPA Tier 4 final damage the exhaust aftertreatment system. This can invalidate the emission certification of the diesel engine and can result in legal consequences for the owner.



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.

2.12 Hand signals

Driver and banksman communicate with each other using the following hand signals when vision is restricted in the drive and work area. The banksman gives the necessary signals to ensure safe operation.

Safety



Hand signals




i Only reliable persons may be used as banksmen. They must receive the necessary training before starting their task.

The guide must not be diverted from this task.

The country-specific guidelines and regulations on the hand signals must be observed.

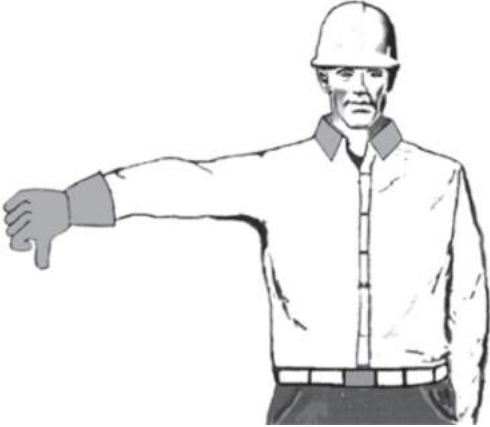

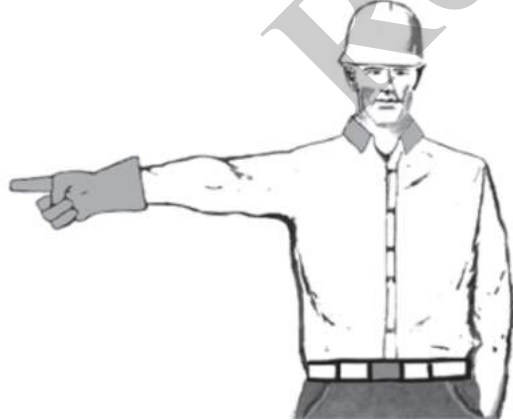
Observe all safety instructions before starting work.

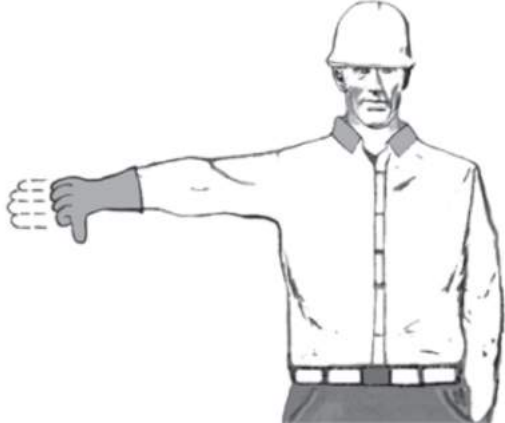
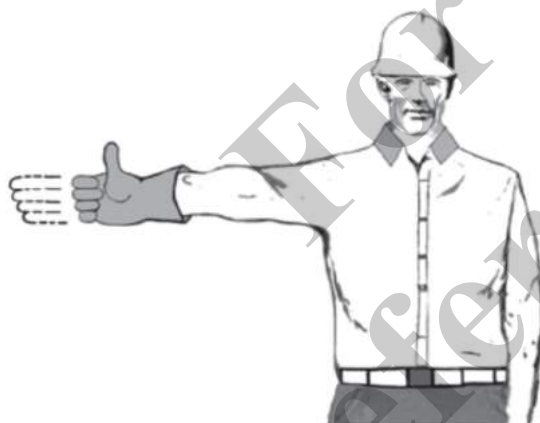

| Sign | Meaning |
|---|------------------------|
|  | Lift load (equipment) |
|  | Lower load (equipment) |

| Sign | Meaning |
|---|---------------------|
|  | Use main winch |
|  | Use secondary winch |
|  | Lift main boom |

Safety




Hand signals



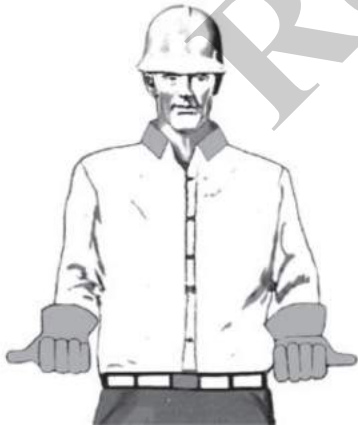
| Sign | Meaning |
|---|----------------------------------|
|  | Lower main boom |
|  | Move slowly |
|  | Slewing the uppercarriage |

| Sign | Meaning |
|---|---|
|  | Lower boom and lift load (equipment) |
|  | Lift boom and lower load (equipment) |
|  | Stop |

Safety




Hand signals

| Sign | Meaning |
|---|-----------------------|
|  | Emergency Stop |
|  | Process |
|  | Pause |

| Sign | Meaning |
|---|---------------------------|
|  | Use both lanes |
|  | Use one lane |
|  | Extending the boom |

Safety

Hand signals

| Sign | Meaning |
|---|--------------------|
|  | Telescope in |
|  | Extending the boom |
|  | Telescope in |

3 Technical data

3.1 Sound 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. Hearing protection is not required.

- Measured sound pressure level LpA (in the cab): < 70 dB
 - Acc. to ISO 11201:1993
- Measured sound power level LwA (outdoor): 103 dB
 - Acc. to Machinery Directive 2000/14/EC

3.2 Rating plate



Fig. 10: Rating plate

- 1 Machine type
- 2 Machine number
- 3 Production year
- 4 Model year

3.3 Crane categorization

Mobile crane for the assembly operation

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

According to ISO 4301 Part 1 and 2, the machine is classified into crane group A1 and is designed and calculated for nominal load spectrum factor Q1 and class of utilization U2.

Technical data

Dimensions and weight > Dimensions and weight

Crane categorization with explanation

| Crane categorization | | Explanation |
|------------------------------|----|--|
| Group classification | A1 | Crane for general hook duties, not used for continuous service. |
| Nominal load spectrum factor | Q1 | Cranes which lift the SWL (safe working load) very rarely and usually only lift light loads. |
| Class of utilization | U2 | Irregular use, maximum number of load cycles 63000. |

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

3.4 Dimensions and weight

3.4.1 Dimensions and weight

Machine with crawler undercarriage

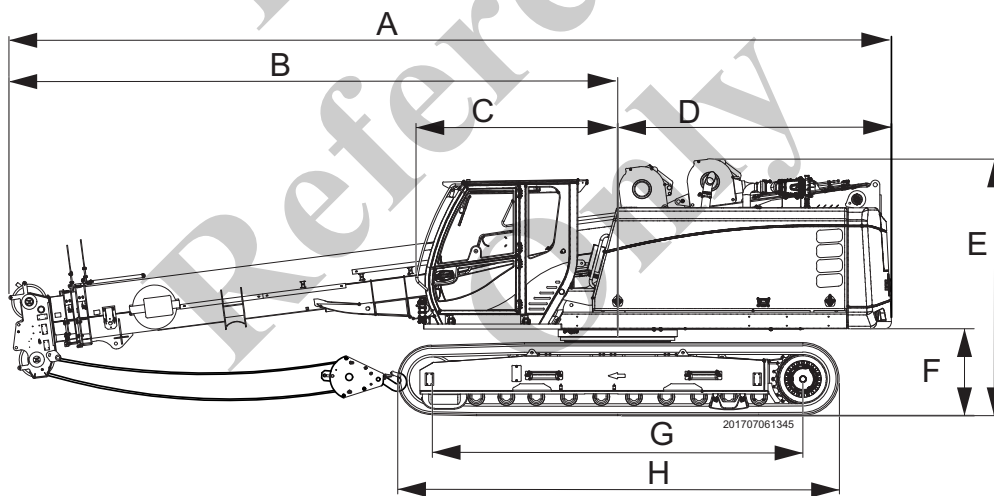


Fig. 11: Machine dimensions

| Position | mm | inch | Position | mm | inch |
|----------|-------|--------|----------|------|--------|
| A | 10582 | 416.61 | E | 3077 | 121.14 |
| B | 7299 | 287.36 | F | 1043 | 41.06 |
| C | 2420 | 95.28 | G | 4444 | 174.96 |
| D | 3283 | 129.25 | H | 5298 | 208.58 |

Technical data

Dimensions and weight > Dimensions and weight

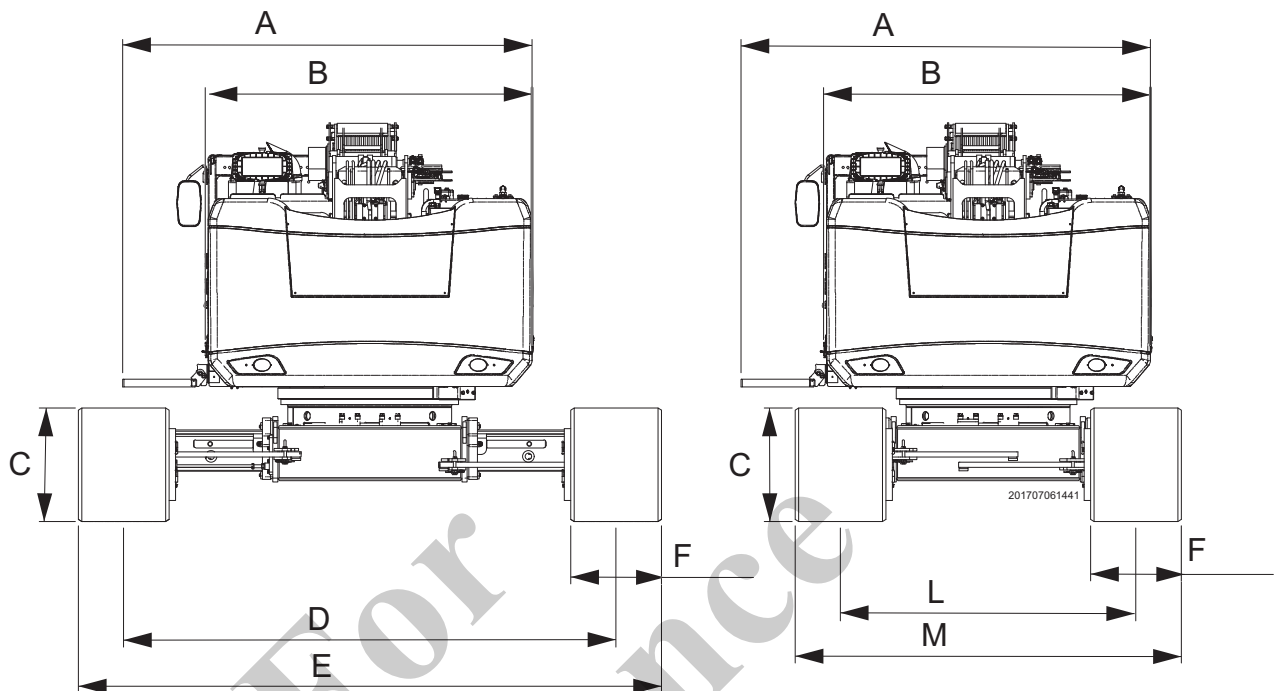


Fig. 12: Dimensions with folded-out walkway

| Position | mm | inch | Position | mm | inch |
|----------|------|--------|----------|------|--------|
| A | 3159 | 124.37 | E | 4500 | 177.17 |
| B | 2523 | 99.33 | F | 700 | 27.56 |
| C | 875 | 34.45 | L | 2280 | 89.76 |
| D | 3800 | 149.61 | M | 2980 | 117.32 |

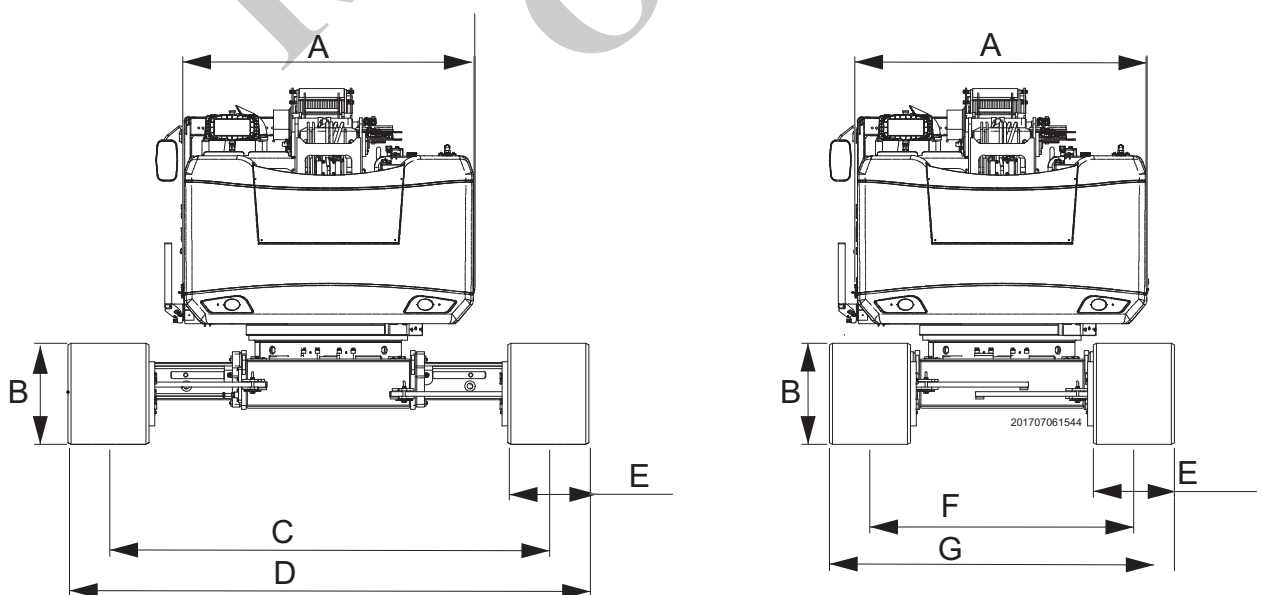


Fig. 13: Dimensions with folded-in walkway

Technical data

Dimensions and weight > Transport dimensions

| Position | mm | inch | Position | mm | inch |
|----------|------|--------|----------|------|--------|
| A | 2523 | 99.33 | E | 700 | 27.56 |
| B | 875 | 34.45 | F | 2280 | 89.76 |
| C | 3800 | 149.61 | G | 2980 | 117.32 |
| D | 4500 | 177.17 | | | |

| Position | mm | inch |
|----------|-----|-------|
| A | 315 | 12.40 |

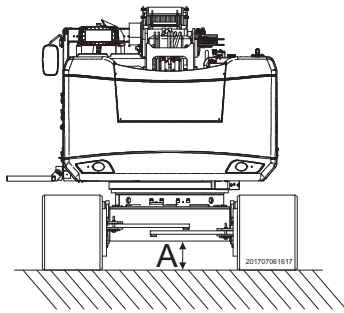


Fig. 14: Ground clearance

Weight

| Machine | with equipment | Weight |
|---|---|----------------------------|
| Machine with 700 mm (27.6") base plates | one hoist winch, 6.5 m (21.3 ft) tip, 25 t (27.6 US t) hook | Approx. 33.2 t (36.6 US t) |
| Machine with 800 mm (31.5") base plates | two hoist winches, 13 m (42.7 ft) tip | Approx. 34.5 t (38.0 US t) |

3.4.2 Transport dimensions

Machine with crawler undercarriage

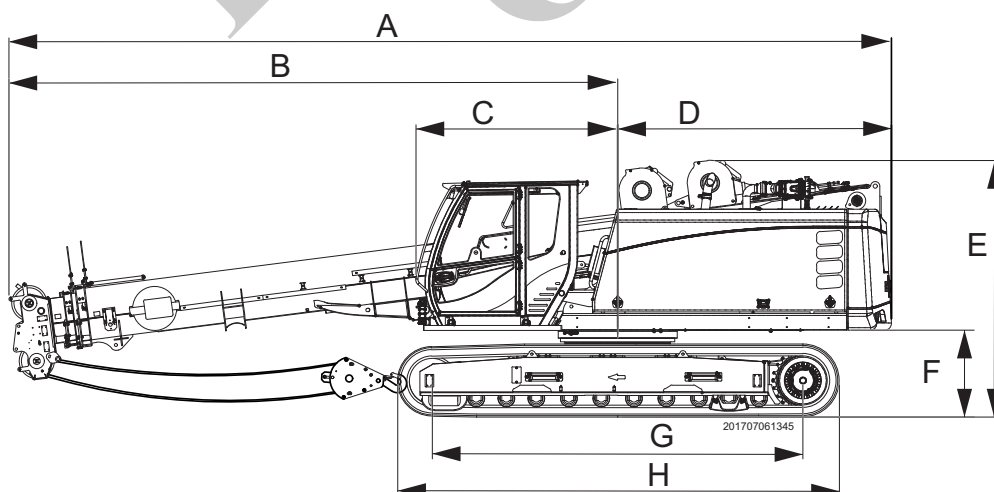


Fig. 15: Machine dimensions

Technical data

Dimensions and weight > Transport dimensions

| Position | mm | inch | Position | mm | inch |
|----------|-------|--------|----------|------|--------|
| A | 10582 | 416.61 | E | 3077 | 121.14 |
| B | 7299 | 287.36 | F | 1043 | 41.06 |
| C | 2420 | 95.28 | G | 4444 | 174.96 |
| D | 3283 | 129.25 | H | 5298 | 208.58 |

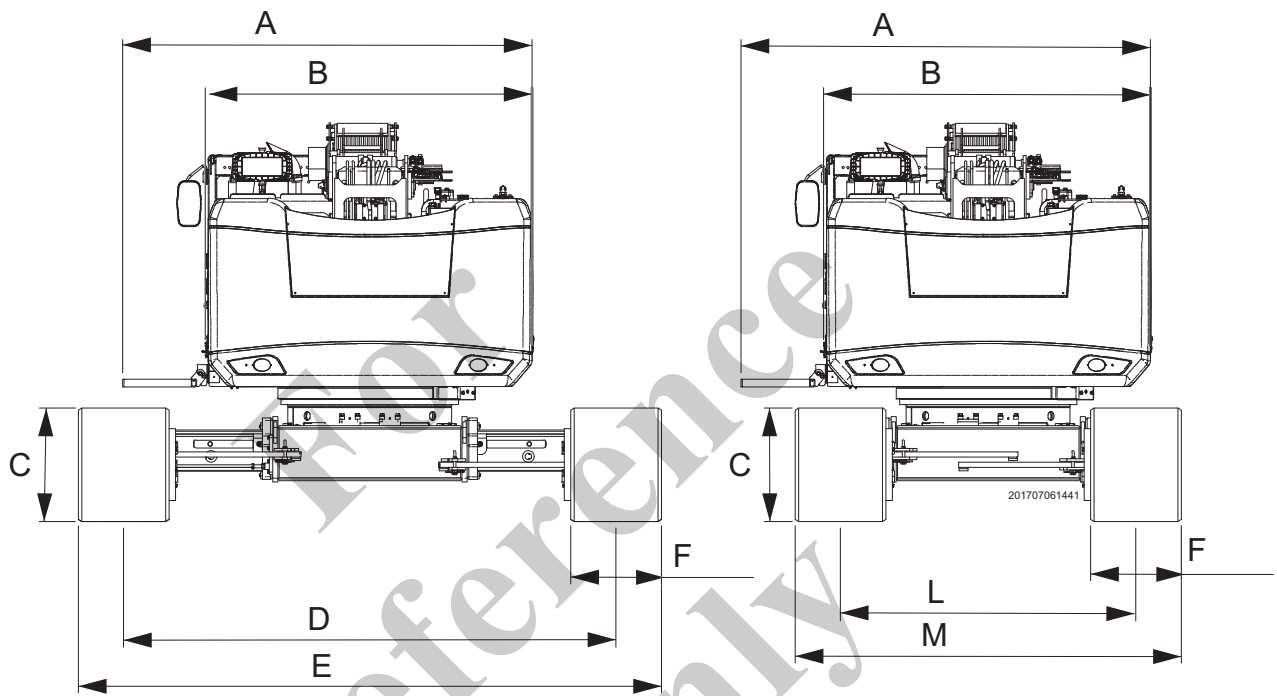


Fig. 16: Dimensions with folded-out walkway

| Position | mm | inch | Position | mm | inch |
|----------|------|--------|----------|------|--------|
| A | 3159 | 124.37 | E | 4500 | 177.17 |
| B | 2523 | 99.33 | F | 700 | 27.56 |
| C | 875 | 34.45 | L | 2280 | 89.76 |
| D | 3800 | 149.61 | M | 2980 | 117.32 |

Technical data

Dimensions and weight > Transport dimensions

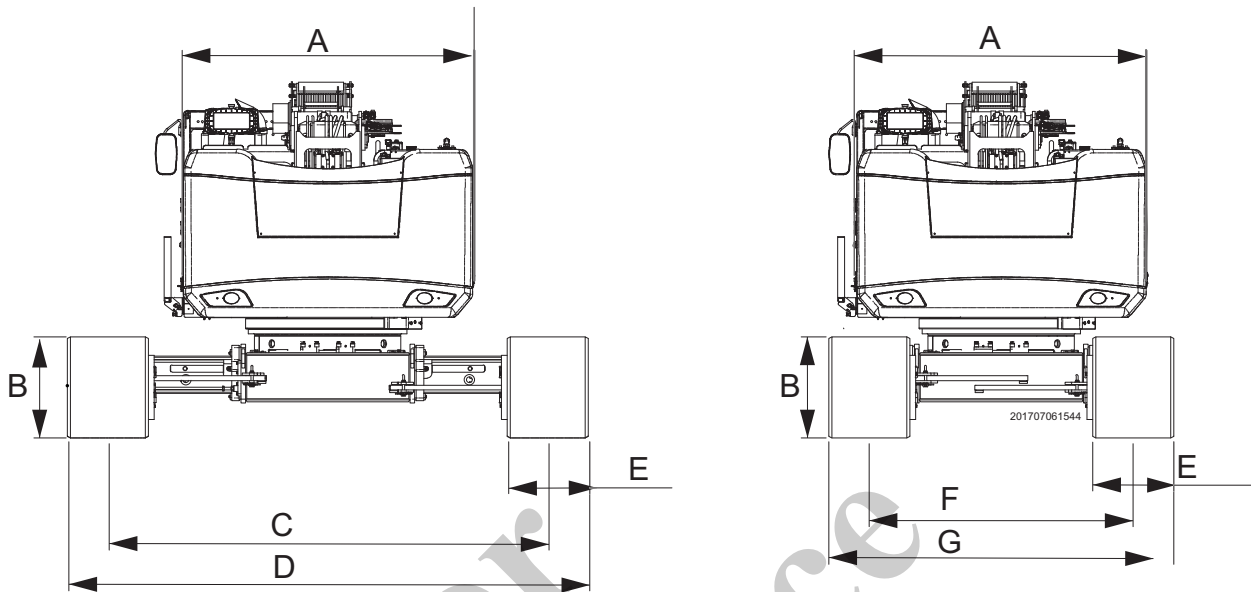


Fig. 17: Dimensions with folded-in walkway

| Position | mm | inch | Position | mm | inch |
|----------|------|--------|----------|------|--------|
| A | 2523 | 99.33 | E | 700 | 27.56 |
| B | 875 | 34.45 | F | 2280 | 89.76 |
| C | 3800 | 149.61 | G | 2980 | 117.32 |
| D | 4500 | 177.17 | | | |

| Position | mm | inch |
|----------|-----|-------|
| A | 315 | 12.40 |

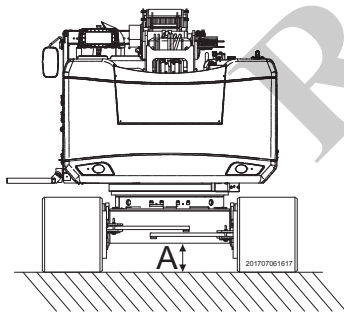


Fig. 18: Ground clearance

Weight

| Machine | with equipment | Weight |
|---|---|----------------------------|
| Machine with 700 mm (27.6") base plates | one hoist winch, 6.5 m (21.3 ft) tip, 25 t (27.6 US t) hook | Approx. 33.2 t (36.6 US t) |
| Machine with 800 mm (31.5") base plates | two hoist winches, 13 m (42.7 ft) tip | Approx. 34.5 t (38.0 US t) |

3.5 Diesel engine

| | | |
|---------------------|-------------------------------|--------|
| Manufacturer | Cummins | |
| Type | QSB4.5 | |
| Power | 127,2 kW (173 HP) at 2500 rpm | |
| Displacement | 275 in ³ | 4.5 l |
| Max. torque | 520 lb-ft | 705 Nm |
| Cylinders | 4 | |
| Emission standard | Level IV | |

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

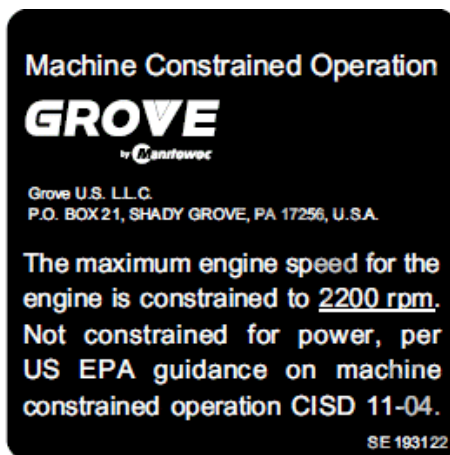


Fig. 19: Sticker, speed limitation

Permitted diesel engine inclinations

| Left | Right | Front | Rear |
|--|-------|-------|------|
| 30° | 30° | 30° | 30° |
| Sufficient oil levels in the engine cannot be guaranteed at greater inclinations. Additional information on the diesel engine is available in the manufacturer's operating manual. | | | |

3.6 Electrical system

| | |
|-----------------|------------|
| Battery voltage | 24 V |
| Batteries | 2 x 155 AH |

3.7 Work speed

| | |
|-------------------------------|--|
| Travel speed | 2.5 km/h (1.55 mph) |
| Slewing speed - uppercarriage | 2.0 U/min (2.0 rpm), continuously variable |

3.8 Hydraulic system

| | |
|--------------------|---|
| Delivery rate | max. 315 lpm (83.2 gpm) for total max output. |
| Operating pressure | 330 bar (4786.2 psi) |

Technical data

Filling capacities

3.9 Vibration

The alarm values for hand-arm vibration (2.5 m/s²) and for full-body vibration (0.5 m/s²) are not exceeded.

3.10 Filling capacities



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 |

3.11 Operational environment

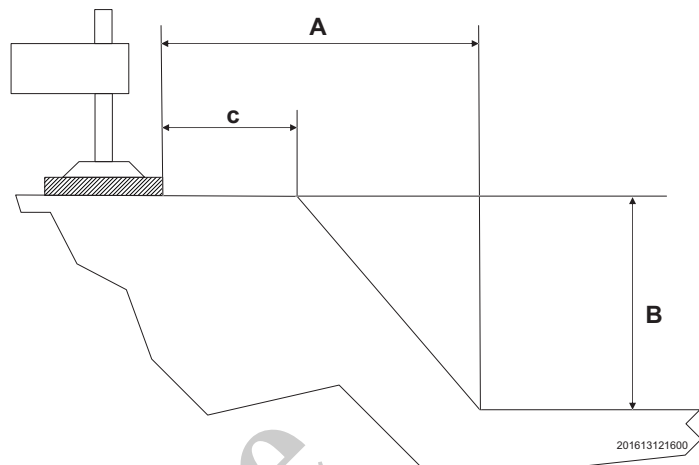


Fig. 20: Safety distance between machine and embankment crown retainer. $A > 2B$ applies.

- A Distance between machine support at the base of the embankment
- B Embankment height
- c Minimum 2 m (6.6 ft)

- Only operate the machine on firm ground with sufficient load-bearing capacity. The ground characteristics must be checked before initial operation.
- Set up the machine at a safe distance from slopes and pits. This distance depends on the type of ground.
- The protective equipment of the machine must be sufficient for the specific application. Possible protective equipment includes protective grating or cab panes of bulletproof glass.
- The work area must be free of any obstacles.
- When the machine is operated underground or in enclosed spaces, these spaces must be sufficiently ventilated.
- The machine must not be operated in a potentially explosive environment.
- The work area of the machine must always be clearly visible.
- The machine can be operated at wind speeds of up to 14 m/s (31 mph).
- The following safety distances to overhead electrical lines must be maintained:

Technical data

Operational environment

Overhead power lines

Safety distances to overhead lines (not for the USA)

| Nominal voltage (kV) | Safety distance (m) |
|----------------------|---------------------|
| to 1 | 1.00 |
| above 1 to 110 | 3.00 |
| above 110 to 220 | 4.00 |
| above 220 to 380 | 5.00 |
| Size unknown | 5.00 |

Power lines (applies to USA)

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

Environmental conditions

| Surrounding area | Level |
|--------------------------------------|--------------------------------------|
| Temperature ¹⁾ | -20 °C to 40 °C (-4 °F to 104 °F) |
| Maximum wind speed | 50 km/h (31 mph) |
| Maximum wading depth | 0.5 m (1.6 ft) |
| ¹⁾ in drive and work mode | |



If the surrounding temperature is outside of the admissible values, contact your Grove Service Partner. If the maximum wading depth is outside of the admissible values, contact your Grove Service Partner.

3.12 Permissible maximum wind speeds

If the wind speed during operation of the machine reaches 31 mph (14 m/s), the machine must be parked in a secure position.



Wind speed can be measured with the optional anemometer.

Procedure at wind speeds above 31 mph (14 m/s)

1. → Lower attached loads.
2. → Set telescopic boom to 70°.
3. → Park the machine.

Procedure at wind speeds above 45 mph (20 m/s)

1. → Lower attached loads.
2. → Completely retract the telescopic boom.
3. → Completely lower telescopic boom.
4. → Park the machine.

3.13 Permissible ground pressure

⚠ WARNING

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

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

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 result in serious injury.

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 | Maximum ground pressure |
|---------------------|--------------------------------------|
| 700 mm (27.6 in) | 54,036 psi (3.8 kg/cm ²) |

Technical data

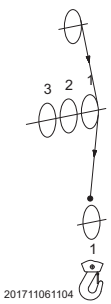
Reeving plan with 32 t (35.3 US t)-Load Hooks

Determination of ground bearing capacity

| Type of ground | | Admissible ground pressure in kg / cm ² | Admissible ground pressure in psi |
|---|--|--|-----------------------------------|
| 1 | Stirred, ground that has not been packed | 0 - 1 | 0 - 14.22 |
| 2 | Natural, obviously untouched ground | | |
| 2.1 | Mud, peat, bog soil, topsoil | 0 | 0 |
| 2.2 | Non-binding, sufficiently solid, seasoned ground | | |
| | ■ Fine to medium sand | 1.5 | 21.34 |
| | ■ Coarse sand to gravel | 2.0 | 28.45 |
| 3 | Cohesive soil | | |
| | ■ Soggy | 0 | 0 |
| | ■ Soft | 0.4 | 5.69 |
| | ■ Firm | 1.0 | 14.22 |
| | ■ Semi-solid | 2.0 | 28.45 |
| | ■ Solid | 4.0 | 56.89 |
| 4 | Artificially packed surface | | |
| 4.1 | Asphalt | 5 - 15 | 71.12 - 213.35 |
| 4.2 | Concrete | | |
| | ■ Concrete group II | 50 - 250 | 711.17 - 3555.84 |
| | ■ Concrete group II | 350 - 550 | 4978.17 - 7822.84 |
| The guidelines in the table must be taken into consideration for implementation planning. | | | |

3.14 Reeving plan with 32 t (35.3 US t)-Load Hooks

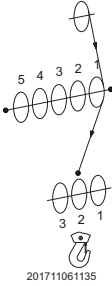
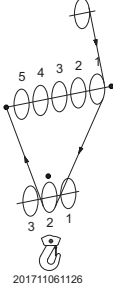
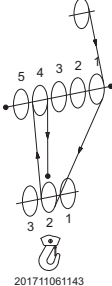



Load hook, maximum load capacity 4 t (4.4 US t), cable diameter 14 mm (0.55")

| |
|---|
|  <p>201711061104</p> |
| <p>1-part 3.5 t (3.8 US t)</p> |

Technical data

Reeving plan with 32 t (35.3 US t)-Load Hooks

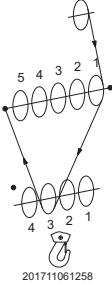
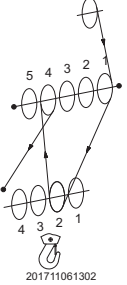
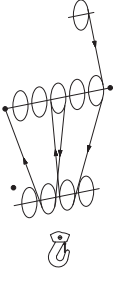
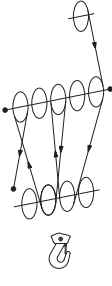
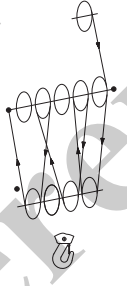
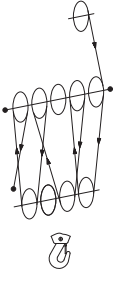
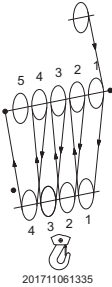

3-roll bottom hook block max. load-bearing capacity: 20 t (27 US t), rope diameter 14 mm (0.55")

| | | |
|--|--|--|
|  <p>201711061135</p> |  <p>201711061126</p> |  <p>201711061143</p> |
| <p>1-part 3.5 t (3.8 US t)</p> | <p>2-part 7 t (7.7 US t)</p> | <p>3-part 10.5 t (11.5 US t)</p> |
|  <p>201711061147</p> |  <p>201711061156</p> |  <p>201711061001</p> |
| <p>4-part 14 t (15.4 US t)</p> | <p>5-part (17.5 t) (19.2 US t)</p> | <p>6-part (20 t) (22.0 US t)</p> |

Technical data

Reeving plan with 32 t (35.3 US t)-Load Hooks

4-roll bottom hook block, maximum load capacity 27.2 t (30 US t), rope diameter 14 mm (0.55")

| | | |
|---|---|---|
|  |  |  |
| <p style="text-align: center;">2-part 7 t (7.7 US t)</p> | <p style="text-align: center;">3-part 10.5 t (11.5 US t)</p> | <p style="text-align: center;">4-part 14 t (15.4 US t)</p> |
|  |  |  |
| <p style="text-align: center;">5-part 17.5 t (19.2 US t)</p> | <p style="text-align: center;">6-part 21 t (23.1 US t)</p> | <p style="text-align: center;">7-part 24.5 t (27 US t)</p> |
|  |  | |
| <p style="text-align: center;">8-part 28 t (30.8 US t)</p> | <p style="text-align: center;">9-part 31.5 t (34.7 US t)</p> | |

The following load limitations for the load hooks should be observed :

- The maximum load capacity of the 32 t (35.3 US t) load hooks for GHC involves 30 machines 27.2 t (29.9 US t).

3.15 Reeving plan with 35 t (38.6 US t)-Load Hooks (Option)

Load hook, maximum load capacity 4 t (4.4 US t), cable diameter 14 mm (0.55")

| |
|--|
| <p>201707191419</p> |
| <p>1-part 3.5 t (3.8 US t)</p> |

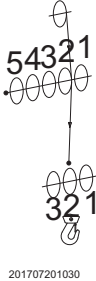
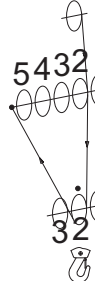




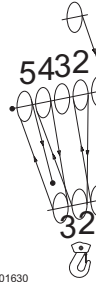
1-roll bottom hook block max. load-bearing capacity: 10.5 t (11.6 US t), rope diameter 14 mm (0.55")

| | | |
|--|--------------------------------------|--|
| <p>201707191637</p> | <p>201707191642</p> | <p>201707191642</p> |
| <p>1-part 3.5 t (3.8 US t)</p> | <p>2-part 7 t (7.7 US t)</p> | <p>3-part 10.5 t (11.5 US t)</p> |

Technical data

Reeving plan with 35 t (38.6 US t)-Load Hooks (Option)

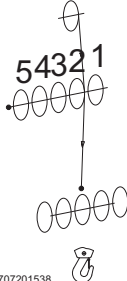
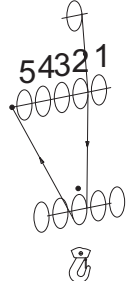
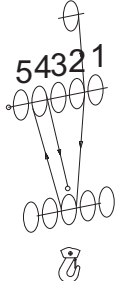
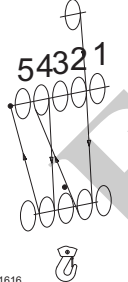
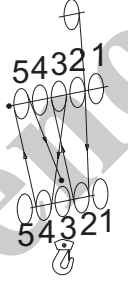
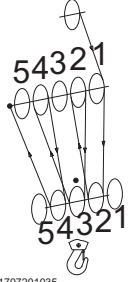
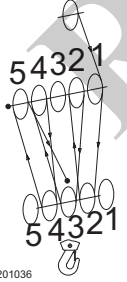

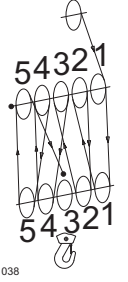
3-roll bottom hook block, maximum load capacity 24.5 t (27 US t), cable diameter 14 mm (0.55")

| | | |
|---|--|--|
|  <p>201707201030</p> |  <p>201707201031</p> |  <p>201707201032</p> |
| <p>1-part 3.5 t (3.8 US t)</p> | <p>2-part 7.0 t (7.7 US t)</p> | <p>3-part 10.5 t (11.5 US t)</p> |
|  <p>201707201033</p> |  <p>201707201620</p> |  <p>201707201625</p> |
| <p>4-part 14 t (15.4 US t)</p> | <p>5-part 17.5 t (19.2 US t)</p> | <p>6-part 21.0 t (23.1 US t)</p> |
|  <p>201707201630</p> | | |
| <p>7-part 24.5 t (27 US t)</p> | | |

Technical data


Reeving plan with 35 t (38.6 US t)-Load Hooks (Option)

5-roll bottom hook block, maximum load capacity 27.2 t (30 US t), rope diameter 14 mm (0.55")

| | | |
|---|---|---|
|  <p>201707201538</p> |  <p>201707201549</p> |  <p>201707201554</p> |
| <p>1-part 3.5 t (3.8 US t)</p> | <p>2-part 7.0 t (7.7 US t)</p> | <p>3-part 10.5 t (11.5 US t)</p> |
|  <p>201707201616</p> |  <p>201707201034</p> |  <p>201707201035</p> |
| <p>4-part 14 t (15.4 US t)</p> | <p>5-part 17.5 t (19.2 US t)</p> | <p>6-part 21.0 t (23.1 US t)</p> |
|  <p>201707201036</p> |  <p>201707201037</p> |  <p>201707201038</p> |
| <p>7-part 24.5 t (27 US t)</p> | <p>8-part 28.0 t (30.8 US t)</p> | <p>9-part 31.5 t (34.7 US t)</p> |

Technical data

Load-bearing capacity > Load lift charts

| | | |
|---|--|--|
|  <p>201707201039</p> | | |
| 10-part 33.0 t (36.3 US t) | | |

The following load limitations for the load hooks should be observed :

- The maximum load capacity of the 35 t (38.6 US t) load hooks for GHC involves 30 machines 27.2 t (29.9 US t).

3.16 Load-bearing capacity

3.16.1 Explanation of the load lift charts

i See applicable load capacities, GHC 30.

3.16.2 Adverse conditions

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

- Soft or uneven ground
- Slopes
- Wind
- Lateral loads
- Swaying loads
- Jerking or sudden stopping of the load
- Inexperience of operating personnel
- Driving with the load

3.16.3 Load lift charts

i See applicable lifting capacities, GHC 30.

4 Make ready for operation

4.1 Safety notifications before start-up

- Protective equipment:
- Safety goggles
 - Hard hat
 - Safety shoes
 - Protective gloves
 - Protective clothing
 - Fall arrest safety harness

- Make sure the machine's safety equipment is complete and mounted properly.
- Ensure that the walkway to the cab is properly mounted.
- Ensure that the uppercarriage railings have been properly mounted.
- Remove any jewelry.
- Secure tools and other loose parts.
- Clean dirty access ladders and other ladders.
- Agree on hand signals with the banksman.
- Obtain information on first aid, rescue, and fire protection options.
- Only enter and leave machines via the provided access ladders and walkways.
- Do not use operating elements in the cab as grip handles.
- Ensure all personnel is outside the danger zone.
- Check that the safety equipment, such as brakes, signal and lighting equipment, functions properly.
- Do not operate machine if a fault has been detected.
- Make sure all control levers are in neutral position.

4.2 Applications planning

4.2.1 Work site usage

The operator must carry out the following checks for the machine usage planning:

Make ready for operation

Applications planning > Pontoon operation

| Check if... | For example: |
|---|---|
| ... the forthcoming usage corresponds with the technical machine data. | In the case of forthcoming crane usage, the required load capacity, reach and hook height must be determined. |
| ... there are external requirements for work in the work site. | In the case of wind, snow, unfriendly temperatures and/or bad visibility, check the effects of these on the machine and its use in the work site. |
| ... all machine parts are fit for operation. | |
| ... the ground conditions are viable for the maximum machine load. | |
| ... in the area of application and during the forthcoming period of use, particular dangers may arise which require special safety measures and/or particular equipment: <ul style="list-style-type: none"> ■ Toxic gas ■ Overhead power lines ■ Pits ■ High-voltage lines ■ Ground wires | |
| ... all danger areas marked and secured in the work site. | |

4.2.2 Pontoon operation

Safety instructions

- Only operate the machine on a pontoon after first consulting with your Grove Service Partner.
- Prevent the machine from slipping on the pontoon.
- All safe working loads only apply for free hanging loads and for the specified wind speeds.
- Traveling with a load is **not** permitted.
- The pontoon must have sufficient load capacity and sufficient dimensions. This is the responsibility of the machine owner.

Machine with crawler undercarriage: Secure against slippage

Fig. 21: Secure machine with stops

- 1 Pontoon level
- 2 Stops

1. → Fasten stable stops on the pontoon (2).

Fig. 22: Secure machine to the tethering points

- 1 Pontoon level
- 2 Lashing chains

2. → Lash the machine to the tethering points on the undercarriage.

Machine with mobile undercarriage: Secure against slippage

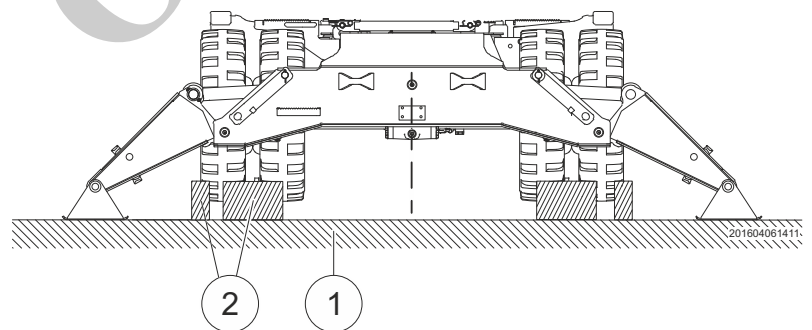


Fig. 23: Secure machine with stops

- 1 Pontoon level
- 2 Stops

Make ready for operation

Initial start-up > Mounting/removing walkways

Fig. 24: Secure machine to the tethering points

1 Lashing points

Usage scenarios on the pontoon and the resulting operation requirements

| The pontoon is... | Additional work operation requirements for the machine |
|---|---|
| <ul style="list-style-type: none"> ■ ... stabilized. ■ ... in a horizontal position. | <ul style="list-style-type: none"> ■ The standard load lift charts without inclination are valid. |
| <ul style="list-style-type: none"> ■ ... stabilized. ■ ... inclined to max. 4°. | <ul style="list-style-type: none"> ■ The optionally available load lift charts with a 2° and 4° inclination are to be used. ■ Use the winch reeving from the standard load lift charts. ■ If necessary, prepare the control of the machine for this use as well (e. g. switching off the slewing gear or using a heeling scale). |
| <ul style="list-style-type: none"> ■ ... not supported. There is little or no swell (e. g. in inland waters). | <ul style="list-style-type: none"> ■ The optionally available load lift charts with a 2° and 4° inclination are to be used. ■ Use the winch reeving from the standard load lift charts. ■ If necessary, prepare the control of the machine for this use as well (e. g. switching off the slewing gear or using a heeling scale). |
| <ul style="list-style-type: none"> ■ ... not supported. There is high swell (e. g. in off-shore use). | <ul style="list-style-type: none"> ■ For this use special offshore standards may perhaps have to be complied with. ■ Specific load lift charts are applicable. ■ Standard load lift charts are not applicable. |

4.3 Initial start-up

4.3.1 Mounting/removing walkways



See Chapter 7.2.1 "Mounting/dismounting walkways" on page 207.

4.3.2 Switching on the battery disconnect switch



1. ➤ Open service access door.
2. ➤ Press the battery disconnect switch.
⇒ The switch is illuminated yellow.
3. ➤ Close the service door.

Fig. 25: Battery disconnect switch

4.3.3 Check machine and accessory equipment

Safety instructions

- Observe the safety instructions in before beginning initial startup.
- Report all irregularities to the person responsible before startup and only put the machine into operation after the removal of all defects.

Make ready for operation

Initial start-up > Check machine and accessory equipment

Checklist for machine and accessory equipment

- Before startup, always look over the following checklist:
 - Familiarize yourself with the machine and its equipment.
 - Only execute tasks for which you are trained and that are in your work area.
 - Are all protective covers and warning signs in place on the machine and in undamaged condition?
 - Is the machine clean enough so there are no hazards caused by soiling (risk of slipping, falling, poor visibility)?
 - Are the windows clean and free of ice and snow?
 - Is the machine stable?
 - Is the running gear undamaged?
 - Is the correct counterweight (ballast) installed?
 - Are the boom sections undamaged?
 - Has all necessary maintenance work been carried out according to the maintenance schedule?
 - Are the oil levels for the hydraulic system, drive engine, and winch displayed as sufficiently full?
 - Are all threaded connections - particularly on the cab - undamaged and tightened?
 - Are all cab fastening and connection elements undamaged and tightened?
 - Is sufficient fuel in the machine's fuel tank?
 - Are the V-belts undamaged and tensioned?
 - Are you aware of the operating and environmental conditions?
 - Do you know the weight of the payload?
 - Is an experienced banksman available, if required?
 - Are the machine and sling devices appropriate for the loads to be attached?
 - Are danger points (power lines, pits, etc.) on the work site marked and secured?
 - Are the side service doors on the uppercarriage closed?
 - Is anyone in the danger zone?
 - Are all winch functions working properly?
 - Are all safety features (brakes, signal and lighting equipment, lifting limit switch) working properly?
 - Is the machine level?
 - Has the lifting limit switch function been checked?
 - Has the boom end limitation function been checked?
 - Has the electronic load moment limitation RCL been checked for function?
 - If necessary, switch the optional battery disconnect switch on or connect the battery terminal.

Make ready for operation

Start-up > Check machine and accessory equipment

4.3.4 Bring machine up to operating temperature

⚠ WARNING

Risk of injury and machine damage.

- Observe the warm-up time.

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 injury.

| Ambient temperature | Warm-up time | Maximum engine speed |
|--------------------------------|----------------|---------------------------------------|
| up to 0 °C (32 °F) | approx. 15 min | Nominal speed - 250 min ⁻¹ |
| -20 °C (-4 °F) to 0 °C (32 °F) | approx. 30 min | |

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

With temperatures below 0 °C (32 °F), an additional warm-up period may be necessary. If the hydraulic system is still slow to respond after the warm-up period, work another 15 minutes at a reduced speed. The following temperature values should be displayed before operating the machine at full speed:

4.4 Start-up

4.4.1 Switching on the battery disconnect switch



1. → Open service access door.
2. → Press the battery disconnect switch.
⇒ The switch is illuminated yellow.
3. → Close the service door.

Fig. 26: Battery disconnect switch

4.4.2 Check machine and accessory equipment

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See ↗ Chapter 4.3.3 “Check machine and accessory equipment” on page 65.

Make ready for operation

Start-up > Starting the diesel engine

4.4.3 Starting the diesel engine

Safety instructions

- If the diesel engine is turned off, wait at least 15 seconds before starting it again.
- Keep service doors, service flaps, and service hoods closed.
- Ensure all personnel is outside the danger zone.
- Only let the diesel engine run outdoors or in well-ventilated areas.
- Do not switch on the diesel engine if a warning sign is affixed on the operating elements.

▲ WARNING

Risk of poisoning due to exhaust gases.

- **Never leave the machine unattended while the diesel engine is running.**
- **Only run the diesel engine outdoors or in well-ventilated areas.**

Inhaling exhaust fumes can cause loss of consciousness or even death.

▲ WARNING

Risk of serious injury due to unintentional activation of the joystick or pedals.

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

Operating the joystick or pedals when starting the machine can result in uncontrolled machine movements. This can result in serious injury.

The following conditions must be met before starting the diesel engine:

- The battery disconnect switch must be switched on.
- The safety lever must be engaged.
- For machines with mobile undercarriages, the following applies: The drive brake must be locked.

1. → Turn the ignition key to the position I.

⇒ The SENCON is switched on.

***i** 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.*

2. → Set the setup status in the SENCON.

Fig. 27: SENCON loading screen

3. → Sound the horn. Push the button (1) on the right joystick.

⇒ The horn must sound.

4. → Check SENCON for potential faults and warning messages.

⇒ Serious faults must be resolved before the machine can be put into operation.

5. → Turn the ignition key to position II.

Fig. 28: Horn

Make ready for operation

Shutting down the machine



Alternatively to the ignition key, the diesel engine can be started with the **Start/stop diesel engine** on the lower, right-hand control panel. The ignition key must be at I.

4.4.4 Bring machine up to operating temperature



See Chapter 4.4.4 “Bring machine up to operating temperature” on page 70.

4.5 Startup after preservation

Proceed as follows if you want to re-commission the machine:

1. Remove the corrosion protection agent in a suitable manner, for example with a high-pressure cleaner and the appropriate cleaning additives (be careful around sensitive components and electronic components!).
2. All bare surfaces and bearing points must be oiled or greased according to the maintenance 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, et cetera) 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, designate and adequately secure danger zones at the work site.
10. Align the machine horizontally.
11. Warm up the machine sufficiently before work implementation.

4.6 Shutting down the machine

The machine must be decommissioned if

- Wind speeds in accordance with section *Operational environment* have been reached.
- the machine will not be used for a longer period of time.

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- The manufacturer recommends retracting the telescopic boom when decommissioning the machine.
- If the telescopic boom cannot be brought into the required boom position during commissioning, bring the telescopic boom to the point suitable for the maximum admissible wind speed.
 - Stabilize the machine. This means: Push-beams and cylinders are extended or the support lugs are secured.
- During decommissioning, parking in a non-secured manner is not permitted.

If that is not possible, the boom (when in the specified boom position up to the maximum permitted wind speed) can be brought into a park position to shut down the machine.

Proceed as follows for decommissioning:

1. → Choose as dry and dust-free storage location as possible.
2. → Switch off the machine.
3. → Clean machine according to maintenance manual.
4. → Fill up operating fluids and lubricants.
5. → Turn off the battery disconnect switch or disconnect the battery terminals.
6. → Lubricate machine according to maintenance manual.
7. → Bare metal parts, e.g. the hydraulic cylinder. Conserve piston rods according to maintenance manual.

i Permissible ambient temperatures See Operational environment.

4.7 Preservation and storage

The following measures are necessary for longer periods of machine preservation and storage.

- Select a safe storage location.
- Place attachments on wooden planks, prevent them from freezing up.
- Perform maintenance for 2000 hours of operation (annual).
- Retract all cylinders as far as possible.
- Thoroughly clean and dry bare surfaces and bearing points. Then coat with a corrosion preventative. The protective film must cover the surface completely without any bare spots.
- Prop up mobile machines, the tires should not touch the ground. Coat the support cylinders with corrosion protection.
- Disconnect batteries. Check voltage once a month. At least 12.4 V needed. Charge batteries as needed.
- Fill the fuel and hydraulic oil tanks up to the maximum fill levels.
- Check the diesel fuel for its storage suitability (min. - 40 °C/- 104 °F).

Make ready for operation

Preservation and storage

- If the machine will be stored at temperatures below - 40 °C(- 40 °F) for longer periods of time, protect all LCD displays.
- Ensure that there is sufficient antifreeze in the cooling system. Adjust the proportion of antifreeze to the respective cooling system and the outside temperatures. **Do not empty the cooling system under any circumstances!**
- Check operating fluid levels regularly.
- Apply preservatives to diesel filler neck and protect against rust.
- Prepare the drive engine for storage. Follow the instructions in the operating manual provided by the engine manufacturer.
- If the machine will be stored for a longer period of time, contact the service organization of the engine manufacturer and take additional preservation measures.
- Protect the exhaust from the ingress of water and foreign bodies.
- Protect air filter from the ingress of foreign objects.
- Protect all components from the effects of erosion.
- Cover or thoroughly grease all ropes.
- Provide alerts that clearly indicate the preservation status of the machine. Affix an information sign on the engine and cab.
- Close off all points of access to the machine.

Comply with the instructions specified in the warranty conditions.

i

For Reference Only

5 SENCON 2.0

5.1 SENCON 2.0

For
Reference
Only

Fig. 29: SENCON loading screen

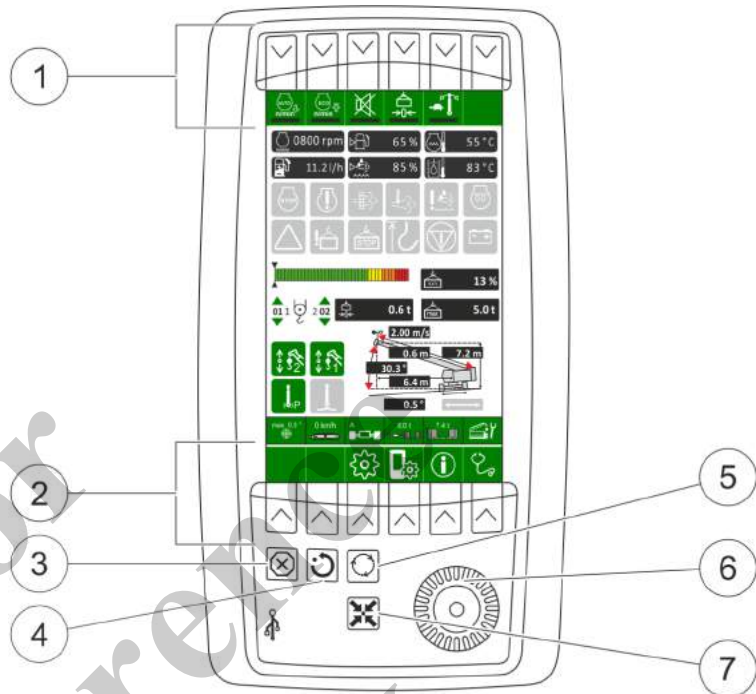
This chapter describes the SENCON 2.0 diagnostic and control system. The SENCON is used to read current machine operating data and statistically evaluate it as needed. It can also be used to configure various machine parameters and diagnose errors.

SENCON 2.0

Controls overview > Overview

5.2 Controls overview

5.2.1 Overview



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Fig. 30: SENCON control elements

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

5.2.2 Show

| Icon | Name | Description |
|------|---|--|
| | Automatic idle | <p>Automatic idle automatically lowers the engine speed for pauses in work. This saves fuel and protects the environment. Automatic idle has three stages:</p> <ul style="list-style-type: none"> ■ Stage 1: 1440 rpm after a 5 second pause in work. ■ Stage 2: Idling speed after a 13 second pause in work. ■ Stage 3: 5 minutes after stage 2 the diesel engine turns itself off. <p>Settings</p> <p>On</p> <p>Off</p> |
| | EcoMode | <p>EcoMode reduces max. rpm. This saves fuel and protects the environment.</p> <p>Settings</p> <p>On</p> <p>Off</p> |
| | Switching the RCL audible warning device on/off | <p>The RCL's audible warning device is enabled on machine start and can be disabled by the operator. If a warning tone activates after an engine start, the warning signal can be deactivated after 5 seconds. Once disabled, the corresponding warning icon displays the error.</p> <p>Settings</p> <p>On</p> <p>Off</p> |
| | Tare load | <p>The tare function will set the load capacity display at 0 t. This function is disabled once the boom is moved.</p> <p>Settings</p> <p>On</p> <p>Off</p> |
| | Uppercarriage slewing speed | <p>The slewing speed of the uppercarriage can be reduced for more precise movement.</p> <p>Settings</p> <p>On</p> <p>Off</p> |

SENCON 2.0

Controls overview > Menu icons

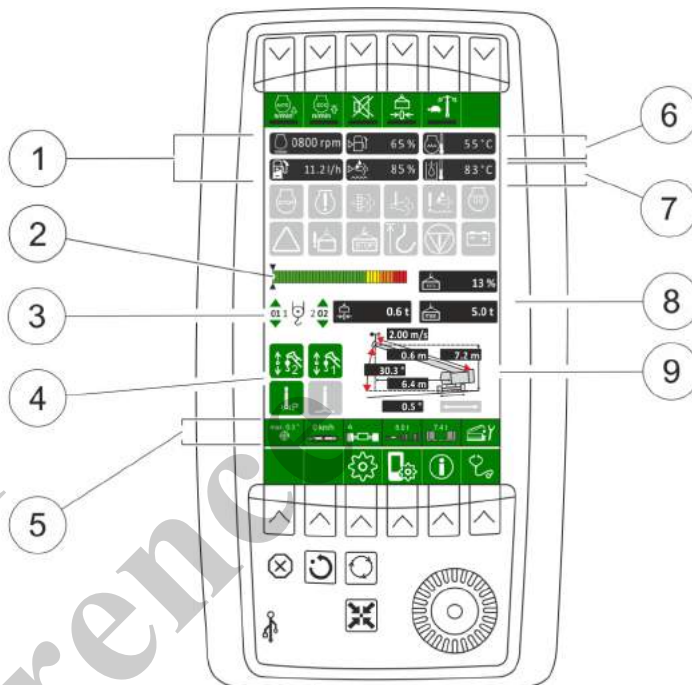
5.2.3 Menu icons

| Icon | Name | Description |
|------|-----------------|--|
| | Setup | Configure the RCL operating parameters for the required operating mode. |
| | Device settings | Configure device properties: <ul style="list-style-type: none">■ Language■ Setting■ Display brightness■ Units■ USB■ Request access |
| | Info | <ul style="list-style-type: none">■ Diesel engine speed curve■ Machine information■ Registration 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 used for communication with your manufacturer service partner. |

For Reference Only

5.3 Start screen

5.3.1 Overview



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Fig. 31: Start screen

- 1 Operating status
- 2 Load capacity scale
- 3 Winch parameters
- 4 Joystick assignment and Slew uppercarriage notification icons
- 5 Configured RCL operating mode parameters
- 6 Diesel engine notification and warning icons
- 7 Machine and RCL notification and warning icons
- 8 Actual safe working load/maximum safe working load
- 9 Working diagram

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

SENCON 2.0

Start screen > Operating status

5.3.2 Operating status

The display (1) shows the most frequent necessary values of the operating status in a single glance.

The operating status can appear in different colors:

- Grey: Operating status is within normal tolerances.
- Orange: Operating status is about to exceed normal tolerances.
 - Take corrective action soon.
- Red: Operating status has exceeded normal tolerances.
 - Park the machine immediately.
 - Take corrective action immediately.
 - Only operate the machine when the error has been corrected.



*If a parameter field contains the value **EEEE**, an error has occurred. Faults can only be corrected by personnel authorized by Grove-. If a parameter field contains the value **----**, the value is not available.*

| Icon | Description | Action |
|------|--------------------------|---|
| | Diesel engine speed | |
| | Diesel fuel level | Grey: <ul style="list-style-type: none">■ Diesel fill level normal. Orange: <ul style="list-style-type: none">■ Refuel as soon as possible. Red: <ul style="list-style-type: none">■ Refuel immediately. |
| | Coolant temperature | Grey: <ul style="list-style-type: none">■ Coolant temperature normal. Orange: <ul style="list-style-type: none">■ Reduce load on diesel engine. Red: <ul style="list-style-type: none">■ Lower attached loads.■ Run diesel engine at idle speed. |
| | Current fuel consumption | |

| Icon | Description | Action |
|------|---|---|
| | DEF level | Grey: ■ DEF level normal. Orange: ■ Refill DEF tank at the next opportunity. Red: ■ Refill DEF tank immediately. |
| | Hydraulic oil temperature | Grey: ■ Hydraulic oil temperature normal. Orange: ■ Lower attached loads. ■ Switch off the diesel engine. ■ Check combination cooler for soiling. ■ Clean soiled cooler. Red: ■ Lower attached loads. ■ Switch off the diesel engine. ■ Check combination cooler for soiling. ■ Clean soiled cooler. |
| | Actual load capacity, not tared | Grey: ■ Standard actual load capacity. Red: ■ The actual load capacity exceeds the maximum load capacity for the configured setup status. |
| | Actual load capacity, tared | Grey: ■ Standard actual load capacity. Red: ■ The actual load capacity exceeds the maximum load capacity for the configured setup status. |
| | Maximum load capacity for the configured setup status in per cent | |
| | Maximum load capacity for the adjusted setup state in tons | |

SENCON 2.0

Start screen > Telescopic boom and Slew uppercarriage notification icons

5.3.3 Telescopic boom and Slew uppercarriage notification icons

Notifications and warning icons (4), (6) and (7) show if the operating values are within the normal range.

Telescopic boom and Slew uppercarriage notification icons

| Icon | Description | Status |
|------|-------------|--|
| | | Winch 1 is operated with the left joystick. Winch 2 is operated with the right joystick. Switch position: |
| | | Winch 2 is operated with the left joystick. Winch 1 is operated with the right joystick. Switch position: |
| | | Soil drill function active |
| | | Soil drill function inactive |
| | | Slewing gear holding brake engaged. The slewing gear holding brake is engaged once the ignition is turned on. The uppercarriage cannot be slewed as long as the slewing gear holding brake is engaged. |
| | | Slewing gear holding brake not applied. |
| | | Slewing gear freewheel disengaged. |

| Icon | Description | Status |
|------|-------------|---|
| | | 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. |

i The number fields in the upper, right-hand corner of the notification and warning icons display the current number of status and warning notifications requiring acknowledgment. If the number field is highlighted in red, there are unacknowledged status and warning notifications. If the number field is highlighted in gray, there are no unacknowledged status and warning notifications.

5.3.4 Diesel engine notification and warning icons

Notifications and warning icons (4), (6) and (7) show if the operating values are within the normal range.

Diesel engine notification and warning icons

| Icon | Description | Status |
|------|-----------------------------|--|
| | Serious diesel engine fault | Grey: <ul style="list-style-type: none"> ■ Diesel engine functioning properly. Red: <ul style="list-style-type: none"> ■ Park machine at safe location immediately. ■ Inform the manufacturer service partner. ■ Only operate machine once error has been corrected. |
| | Diesel engine error | Grey: <ul style="list-style-type: none"> ■ Diesel engine functioning properly. Orange: <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |

SENCON 2.0

Start screen > Diesel engine notification and warning icons

| Icon | Description | Status |
|------|--|---|
| | Depletion level of exhaust aftertreatment system | <p>Grey:</p> <ul style="list-style-type: none"> ■ Automatic cleaning of the exhaust aftertreatment system. ■ Depletion level of exhaust aftertreatment system normal. <p>Orange:</p> <ul style="list-style-type: none"> ■ Depletion level of exhaust aftertreatment system high. ■ Manually activate exhaust aftertreatment system regeneration as soon as possible. <p>Orange and strikethrough:</p> <ul style="list-style-type: none"> ■ Automatic cleaning of the exhaust aftertreatment system suppressed. ■ Activate automatic exhaust aftertreatment system cleaning soon. <p>Flashing:</p> <ul style="list-style-type: none"> ■ Fill level very high, at the next opportunity the speed <i>will be automatically</i> increased. |
| | Exhaust temperature | <p>Grey:</p> <ul style="list-style-type: none"> ■ Exhaust temperature normal. <p>Orange:</p> <ul style="list-style-type: none"> ■ Exhaust temperature high. ■ Exhaust aftertreatment system regeneration active. |
| | DEF [®] quality | <p>Grey:</p> <ul style="list-style-type: none"> ■ DEF quality normal. <p>Orange:</p> <ul style="list-style-type: none"> ■ Drain DEF tank. ■ Fill DEF tank. |
| | Preheating | <p>Grey:</p> <ul style="list-style-type: none"> ■ Diesel engine ready to start. <p>Orange:</p> <ul style="list-style-type: none"> ■ Diesel engine preheating. |
| | Battery | <p>Grey:</p> <ul style="list-style-type: none"> ■ Battery charging. <p>Red:</p> <ul style="list-style-type: none"> ■ Alternator cannot charge battery. |

5.3.5 RCL notification and warning icons

RCL notification and warning icons

| Icon | Possible statuses | Explanation |
|------|-------------------|---|
| | | Grey: ■ RCL is functioning properly. |
| | | Orange: ■ RCL error ■ Check error number in Diagnostics window. ■ Inform the manufacturer service partner. |
| | | Red: ■ RCL error ■ Check error number in Diagnostics window. ■ Inform the manufacturer service partner. |
| | | Grey: ■ Safe working load normal. |
| | | Orange: ■ Safe working load about to be exceeded. |
| | | Red: ■ Safe working load exceeded. |
| | | Red and strikethrough: ■ RCL bypassed. |
| | | Grey: ■ Lifting limit switch not tripped. |
| | | Red: ■ Lifting limit switch tripped. |
| | | Red: ■ Lifting limit switch bypassed. |

SENCON 2.0

Start screen > Machine notification and warning icons

5.3.6 Machine notification and warning icons

Machine notification and warning icons

Notifications and warning icons (4), (6) and (7) show if the operating values are within the normal range.

| Icon | Possible statuses | Explanation |
|------|-------------------|--|
| | | Grey: ■ No error. |
| | | Orange: ■ Check error number in Diagnostics window. ■ Inform the manufacturer service partner. |
| | | Orange: ■ Check error number in Diagnostics window. ■ Inform the manufacturer service partner. |
| | | Red: ■ Check error number in Diagnostics window. ■ Inform the manufacturer service partner. |
| | | The emergency stop is deactivated. All machine functions are available. |
| | | The emergency stop is activated. The machine is shut down. |

5.3.7 Working diagram

Fig. 32: Working diagram

- 1 Wind speed (option)
- 2 Telescopic boom length
- 3 Telescopic boom angle
- 4 Working radius
- 5 Machine inclination
- 6 Telescopic boom height
- 7 Outrigger monitoring/track width monitoring

The directions of movement of the work equipment are indicated in the working diagram by triangles. The following table explains the possible displays of the directions of movement.

| Icon | Name | Description |
|------|--|--|
| | Directions of movement of work equipment | Grey: <input type="checkbox"/> Value not available. Green: <input type="checkbox"/> Work equipment can be moved. Red: <input type="checkbox"/> Work equipment cannot be moved. Limit switch engaged. Strikethrough: <input type="checkbox"/> Limit switch bypassed. |

5.3.8 Winch parameters

- 1 Direction of movement display
- 2 Reeving number
- 3 Winch number

Fig. 33: Winch parameters

SENCON 2.0

Set-up status > Opening setup status

5.4 Set-up status

5.4.1 Opening setup status

In the **setup status** window, the operational parameters of the load moment limitation are adjusted for the desired operation mode. The setup status window automatically appears after the ignition is turned on and the SENCON starts.

Opening setup status

→ Press the **Setup** menu button.

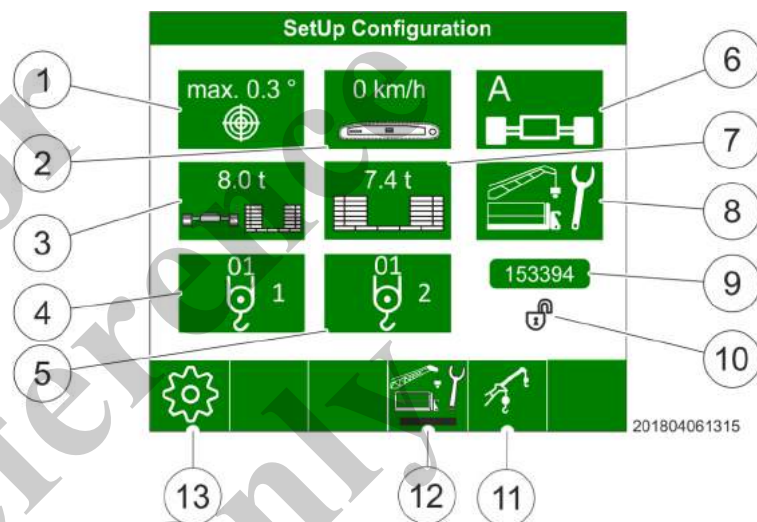


Fig. 34: Setup (example representation)

- 1 Machine inclination
- 2 Pick & Carry/Stationary Work switch
- 3 Undercarriage ballast
- 4 Winch 1 reeving
- 5 Reeving winch 2 (option).
- 6 Track width
- 7 Counterweight
- 8 Attachments and setup program
- 9 Operating mode code
- 10 Load change lock
- 11 Tilt-up panel lifting
- 12 Setup equipment
- 13 Menu key setup





Operating mode code (9) flashes during RCL parameter setting.



When the actual safe working load is greater than the load specified for the load changing lock, the load changing lock (10) prevents changes to the operating parameters of the RCL. When load change lock is engaged, a closed-lock icon appears. When load change lock is disengaged, an open-lock icon appears. Load change lock can be reset by turning the ignition off, then back on. Once the actual safe working load returns to the acceptable range or the attached load is set on the ground, load change lock is reset.

Menu icons setup status

| Icon | Description | Status |
|---|-----------------------|------------------------------|
|  | Setup equipment | Settings On Off |
|  | Tilt-up panel lifting | Settings On Off |

Virtual setup

Three softkeys for setup programs are available:

- "Setup equipment" 
- "Tilt-up panel lifting" 

| Select operating mode | Tasks |
|---|---------------------|
| <p>"Setup equipment"</p> <p>Maximum track width and maximum counterweight are required</p> | All setup work |
| <p>Tilt-up panel lifting</p> <p>"Tilt-up panel lifting" can be selected in the application with attached auxiliary jib. This function is not permitted with a fly boom attachment. The load-bearing capacity of the machine is reduced to a strand count of max. 2 strands. The previously selected strand counts are overwritten. A change in the strand counts is not possible.</p> | Two winch operation |

The function "virtual setup" makes it possible to easily change the respective setup modes. The controller prevents an actually impermissible setup program from being selected.

A change in the setup mode is possible by pressing the softkey button. A further pressing of the softkey changes back to the previous setup state.








5.4.2 Oberwagenneigung angeben

Im Fenster **Oberwagenneigung** wird die maximal zulässige Oberwagenneigung während des Arbeitsbetriebs angegeben.

SENCON 2.0

Set-up status > Entering winch reeving

Fig. 35: Oberwagenneigung

1.  SCROLL-Rad drücken.
 - ⇒ Ein schwarzer Rahmen zeigt den gewählten LMB-Parameter an.
2.  SCROLL-Rad drehen, bis der LMB-Parameter **Oberwagenneigung** ausgewählt ist.
3.  SCROLL-Rad drücken.
 - ⇒ Das Einstellungsfenster **Oberwagenneigung** wird geöffnet.
4.  SCROLL-Rad drehen, um den gewünschten Wert einzustellen.
5.  SCROLL-Rad drücken.
6.  Bei Bedarf weitere LMB-Parameter einstellen.
7.  SET-Taste drücken.
 - ⇒ Die LMB-Parameter werden gespeichert. Der Startbildschirm wird angezeigt.

5.4.3 Entering winch reeving

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

Fig. 36: Winch reeving

- 1 Configured reeving
- 2 Winch number
- 3 Area for specification of winch reeving. Specification from 0 to maximum is possible. (The maximum number depends on the type).

1. → Press the SCROLL wheel.
 - ⇒ The selected RCL parameter is highlighted by a black frame.
2. → Turn the SCROLL wheel until the RCL parameter **Winch Reeving 1** or **Winch Reeving 2** is selected.
3. → Press the SCROLL wheel.
 - ⇒ The **Winch Reeving** settings window opens.
4. → Turn the SCROLL wheel to the desired setting.
5. → Press the SCROLL wheel.
6. → Configure other RCL parameters as needed.
7. → Press the SET button.
 - ⇒ The RCL parameters are saved. The start screen reappears.

Two reeved hooks

If two hooks are hooked on the crane, but only one of them is used to lift loads. The following settings must be carried out:

- For the load-bearing hook, set the reeving "**1 to maximum**".
- For the non-load-bearing hook it must be set to "**0**". This prevents the reduction of the load-bearing capacity on the smaller of the two reevings.

 **DANGER**

No RCL monitoring

No load may be lifted on the non-load-bearing hook with the set strand number "0", as there is no RCL monitoring here.

SENCON 2.0

Set-up status > Configuring track width

5.4.4 Configuring track width

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

Fig. 37: Track width

- A **Maximum** track width; outrigger width
- B Medium track width; outrigger width
- C Minimum track width; machine free-standing

1. Press the SCROLL wheel.
 - ⇒ The selected RCL parameter is highlighted by a black frame.
2. Turn the SCROLL wheel until the **Track width** RCL parameter is selected.
3. Press the SCROLL wheel.
 - ⇒ The track width settings window opens.
4. Turn the SCROLL wheel to the desired setting.
5. Press the SCROLL wheel.
6. Configure other RCL parameters as needed.
7. Press the SET button.
 - ⇒ The RCL parameters are saved. The start screen reappears.

5.4.5 Specifying attachments and starting the setup program

Fig. 38: Attachments and setup program

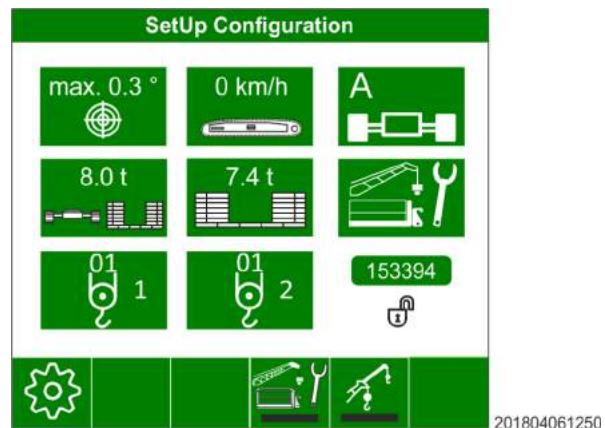
- 1 Fly boom, 6.5 m (21.3 ft.)
- 2 Main boom
- 3 Fly boom, 13 m (42.7 ft.)
- 4 Main boom with elevating work platform
- 5 Fly boom, 6.5 m (21.3 ft) in 40° position
- 6 Fly boom, 13 m (42.7 ft) in 40° position
- 7 Setup program
- 8 Auxiliary jib
- 9 Fly boom with elevating work platform

1. → Press the SCROLL wheel.
 - ⇒ The selected RCL parameter is highlighted by a black frame.
2. → Scroll the SCROLL wheel until the RCL-parameter **Attachments and setup program** is selected.
3. → Press the SCROLL wheel.
 - ⇒ The **Attachments and setup program** settings window opens.
4. → Turn the SCROLL wheel to the desired setting.
5. → Press the SCROLL wheel.
6. → Configure other RCL parameters as needed.
7. → Press the SET button.
 - ⇒ The RCL parameters are saved. The start screen reappears.

SENCON 2.0

Set-up status > Specifying attachments and starting the setup program

Softkey "Setup attachment"



The softkey icon provides the possibility for an immediate change in the setup mode without needing to further change RCL parameters.

The control prevents a currently invalid set-up program from being selected.

Pressing the "Setup attachment" softkey immediately switches to the respective setup mode.

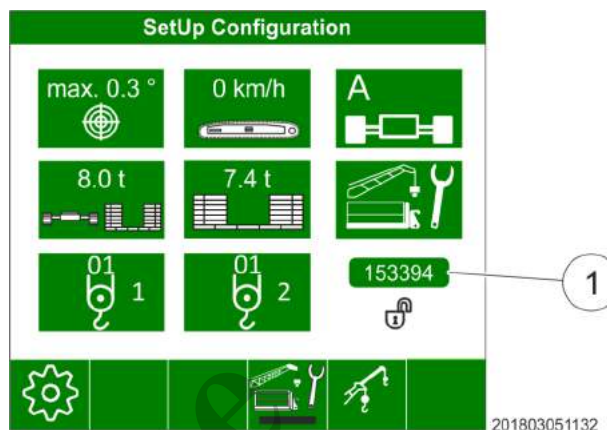
Disabling this menu icon changes the setting back to the previously set up state.

The following set-up work can be carried out with the "Setup attachment" softkey:

- Reeving
- Attaching the undercarriage ballast
- Setting up the auxiliary jib
- Setting up the fly boom

Only install the “setup attachment” if the following conditions apply:

- Maximum track width
- Maximum counterweight



1. → Press the softkey in the “setup state” window.

- ⇒ ■ The “Setup attachment” mode is activated.
- The RCL code (1) in the display changes to corresponds with the “setup” load lift chart.
- The previous machine configuration (setup state) changes only in the display of the boom settings (setup attachment symbol), all other symbols (track width, UC ballast, rear ballast, etc.) remain in the default state on the display.



2. → Press the “Setup attachment” softkey again.

- ⇒ The softkey is deactivated and the setting switches back the previously set setup state.



Once the ignition is switched off, the executed function is cleared.

Track width monitoring is active for the setup attachment.

The lifting limit switch is automatically bridged from a boom angle below 20°.


SENCON 2.0

Set-up status > Enter counterweight

Tilt-up panel lifting softkey



Second hook (only on the auxiliary jib)

- Activation of the operating mode via the softkey  in the display. After activation, the load-bearing capacity of the machine is reduced to max. 2 strands (the RCL overwrites the previously chosen strand count and accepts no changes of the strand count).



Once the ignition is switched off, the strand count is reset to the initial value.

NOTICE

Further precautions and requirements follow to ensure secure operation.

5.4.6 Enter counterweight

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

Fig. 39: Counterweight (example representation)

1. ➤ Press the SCROLL wheel.
 - ⇒ The selected RCL parameter is highlighted by a black frame.
2. ➤ Turn the SCROLL wheel until the **Counterweight** RCL parameter is selected.
3. ➤ Press the SCROLL wheel.
 - ⇒ The **Counterweight** settings window opens.
4. ➤ Turn the SCROLL wheel to the desired setting.
5. ➤ Press the SCROLL wheel.
6. ➤ Configure other RCL parameters as needed.
7. ➤ Press the SET button.
 - ⇒ The RCL parameters are saved. The start screen reappears.

5.5 Setup

The **Setup** window contains functions needed for attaching the counterweight. It also displays the machine inclination using an electronic level.

Opening Setup

1. → Press the **Setup** menu button.
2. → Move the SCROLL wheel one position to the right.

Fig. 40: Setup (example representation)

- 1 Electronic level
- 2 Machine inclination



The setup depends on the machine model. The advice symbols for setup are shown in the following table. Please make sure that the setup is related to the machine model. It is possible that the symbols described here do not exist in your machine.

Setup advice symbols

| Icon | Description | Status |
|------|---------------------------------|---|
| | Uppercarriage at 0° | Green: ■ Uppercarriage is at 0°. Gray: ■ Uppercarriage is not at 0°. |
| | Uppercarriage locking mechanism | Green: ■ Uppercarriage is locked. Gray: ■ Uppercarriage is unlocked. |

SENCON 2.0

Set speed of crane control functions

| Icon | Description | Status |
|------|----------------------------------|---|
| | Left counterweight locking bolt | Green: ■ Left locking bolt is locked. Gray: ■ Left locking bolt is unlocked. |
| | Right counterweight locking bolt | Green: ■ Right locking bolt is locked. Gray: ■ Right locking bolt is unlocked. |
| | Counterweight position | Green: ■ Counterweight is in upper position. Gray: ■ Counterweight is not in upper position. |

Setup menu icons

| Icon | Description | Status |
|------|---------------------------------|--|
| | Locking/unlocking uppercarriage | Settings Uppercarriage locked. Uppercarriage unlocked. |
| | Enable/disable ballasting mode | Settings Ballasting mode enabled. Ballasting mode disabled. |

5.6 Set speed of crane control functions

The **Speed** window sets the speeds of the crane control functions.

Open speed window

The starting point for the following steps is the start screen:

1. ➤ Press the **Setup** menu button.
2. ➤ Turn the SCROLL wheel until the "Speed" window is visible.
3. ➤ Press the SCROLL wheel to select the "Speed" window.

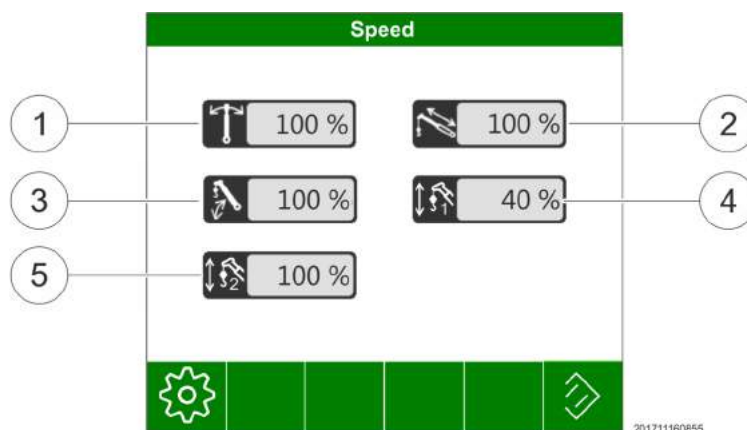


Fig. 41: Speed window

- 1 Slewing the uppercarriage
- 2 Extending and retracting the telescopic boom
- 3 Lifting and lowering the telescopic boom
- 4 Lift and lower loads (winch 1)
- 5 Lift and lower loads (winch 2)

Menu icons speed

| Icon | Name | Description |
|------|-------|---------------------------|
| | Reset | Reset to standard values. |

Slewing the uppercarriage

Set the speed of the RCL parameter **Turn uppercarriage**.

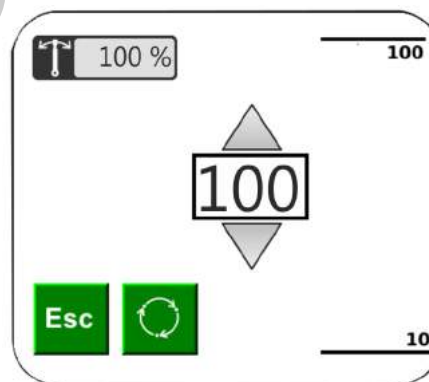


Fig. 42: Slewing the uppercarriage

Prerequisite for the following steps is the selection of the "Speed" window:

SENCON 2.0

Set speed of crane control functions

The selected RCL parameter is highlighted by a black frame.

1. ➤ Turn the SCROLL wheel until the **Slewing the uppercarriage** RCL parameter is selected.
2. ➤ Press the SCROLL wheel.
⇒ The **slewing the uppercarriage** settings window opens.
3. ➤ Press the SCROLL wheel.
4. ➤ Turn the SCROLL wheel to the desired setting.
5. ➤ Press the SCROLL wheel.
6. ➤ Press the SET button.
⇒ The RCL parameters are saved.

Extending and retracting the telescopic boom

Set-up RCL parameter **Extend and retract telescopic boom.**

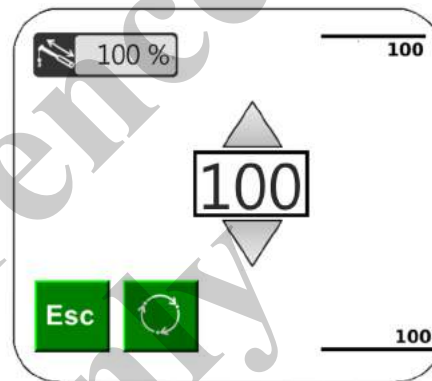


Fig. 43: Extending and retracting the telescopic boom

Prerequisite for the following steps is the selection of the "Speed" window:

The selected RCL parameter is highlighted by a black frame.

1. ➤ Turn the SCROLL wheel until the **Extending and retracting the telescopic boom** RCL parameter is selected.
2. ➤ Press the SCROLL wheel.
⇒ The **Extending and retracting the telescopic boom** setting window opens.
3. ➤ Press the SCROLL wheel.
4. ➤ Turn the SCROLL wheel to the desired setting.
5. ➤ Press the SCROLL wheel.
6. ➤ Press the SET button.
⇒ The RCL parameters are saved.

Lifting and lowering the telescopic boom

Set the speed of the RCL parameter **raise and lower telescopic boom.**

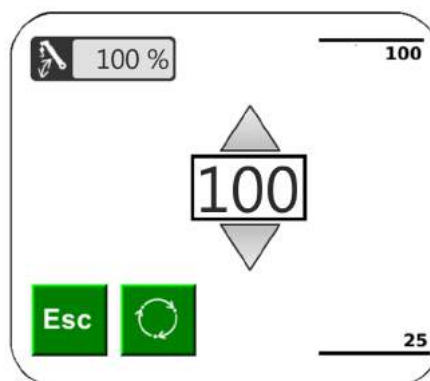


Fig. 44: Lifting and lowering the telescopic boom

Prerequisite for the following steps is the selection of the "Speed" window:

The selected RCL parameter is highlighted by a black frame.

1. → Turn the SCROLL wheel until the **Lifting and lowering the telescopic boom** RCL parameter is selected.
2. → Press the SCROLL wheel.
 - ⇒ The **Lifting and lowering the telescopic boom** setting window opens.
3. → Press the SCROLL wheel.
4. → Turn the SCROLL wheel to the desired setting.
5. → Press the SCROLL wheel.
6. → Press the SET button.
 - ⇒ The RCL parameters are saved.

Lift and lower loads

Set the speed of the RCL parameter **Raise and lower loads**.

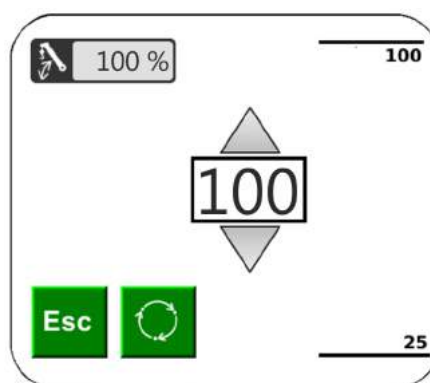








Fig. 45: Lift and lower loads

Prerequisite for the following steps is the selection of the "Speed" window:

SENCON 2.0

Set response behavior of crane control functions

The selected RCL parameter is highlighted by a black frame.




1.  Turn the SCROLL wheel until the **Lifting and lowering loads** RCL parameter is selected.
2.  Press the SCROLL wheel.
⇒ The **Lifting and lowering loads** setting window opens.
3.  Press the SCROLL wheel.
4.  Turn the SCROLL wheel to the desired setting.
5.  Press the SCROLL wheel.
6.  Press the SET button.
⇒ The RCL parameters are saved.

5.7 Set response behavior of crane control functions

The **Characteristics** of the crane control functions are set in the response behavior window.

Open window characteristic

The starting point for the following steps is the start screen:

1.  Press the **Setup** menu button.
2.  Turn the SCROLL wheel until the "Characteristics" window is visible.
3.  Press the SCROLL wheel to select the "characteristics" window.

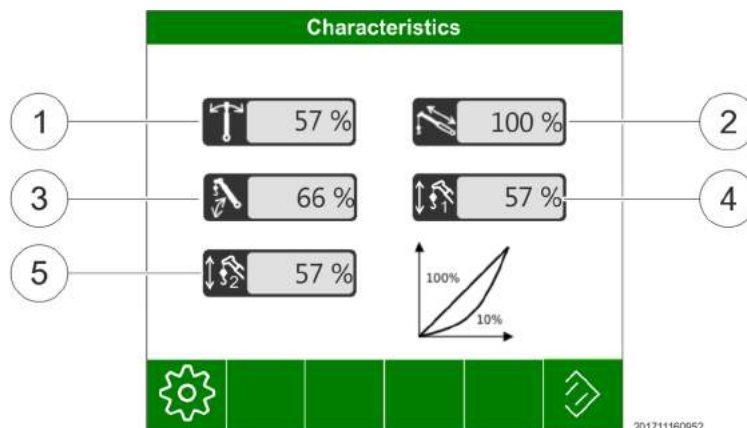


Fig. 46: Characteristics window

- 1 Slewing the uppercarriage
- 2 Extending and retracting the telescopic boom
- 3 Lifting and lowering the telescopic boom
- 4 Lift and lower loads (winch 1)
- 5 Lift and lower loads (winch 2)

Menu icons speed

| Icon | Name | Description |
|------|-------|---------------------------|
| | Reset | Reset to standard values. |

Slewing the uppercarriage

Set the response of the RCL parameter **Turn uppercarriage**.

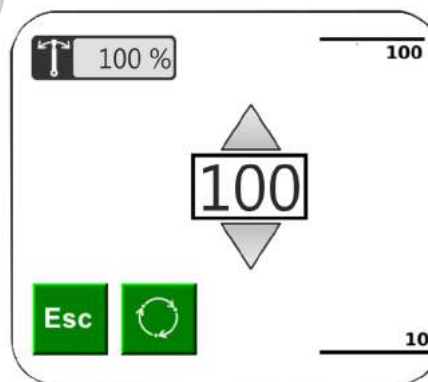


Fig. 47: Slewing the uppercarriage

The precondition for the following steps is the selection of the "Characteristics" window:

SENCON 2.0

Set response behavior of crane control functions

The selected RCL parameter is highlighted by a black frame.

1. ➤ Turn the SCROLL wheel until the **Slewing the uppercarriage** RCL parameter is selected.
2. ➤ Press the SCROLL wheel.
⇒ The **slewing the uppercarriage** settings window opens.
3. ➤ Press the SCROLL wheel.
4. ➤ Turn the SCROLL wheel to the desired setting.
5. ➤ Press the SCROLL wheel.
6. ➤ Press the SET button.
⇒ The RCL parameters are saved.

Extending and retracting the telescopic boom

Set-up the response of the RCL parameter **Extend and retract telescopic boom**.

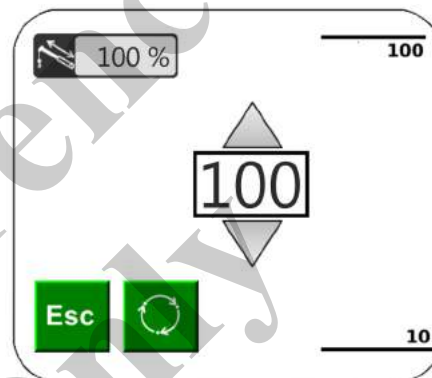


Fig. 48: Extending and retracting the telescopic boom

The precondition for the following steps is the selection of the "Characteristics" window:

The selected RCL parameter is highlighted by a black frame.

1. ➤ Turn the SCROLL wheel until the **Extending and retracting the telescopic boom** RCL parameter is selected.
2. ➤ Press the SCROLL wheel.
⇒ The **Extending and retracting the telescopic boom** setting window opens.
3. ➤ Press the SCROLL wheel.
4. ➤ Turn the SCROLL wheel to the desired setting.
5. ➤ Press the SCROLL wheel.
6. ➤ Press the SET button.
⇒ The RCL parameters are saved.

Lifting and lowering the telescopic boom

Set the response of the RCL parameter **raise and lower telescopic boom**.

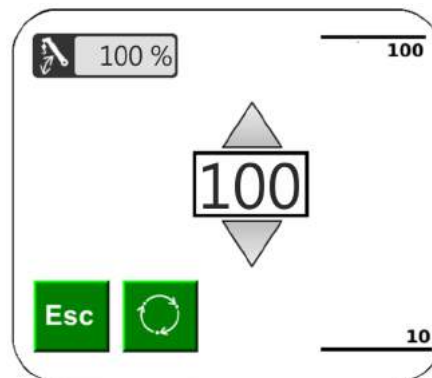


Fig. 49: Lifting and lowering the telescopic boom

The precondition for the following steps is the selection of the "Characteristics" window:

The selected RCL parameter is highlighted by a black frame.

1. → Turn the SCROLL wheel until the **Lifting and lowering the telescopic boom** RCL parameter is selected.
2. → Press the SCROLL wheel.
 - ⇒ The **Lifting and lowering the telescopic boom** setting window opens.
3. → Press the SCROLL wheel.
4. → Turn the SCROLL wheel to the desired setting.
5. → Press the SCROLL wheel.
6. → Press the SET button.
 - ⇒ The RCL parameters are saved.

Lift and lower loads

Set the response of the RCL parameter **Raise and lower loads**.

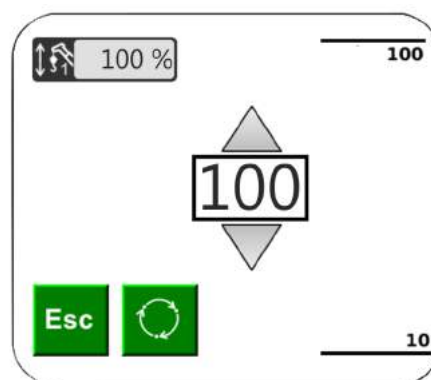








Fig. 50: Lift and lower loads

SENCON 2.0

Setting the language

The precondition for the following steps is the selection of the "Characteristics" window:

The selected RCL parameter is highlighted by a black frame.

1.  Turn the SCROLL wheel until the **Lifting and lowering loads** RCL parameter is selected.
2.  Press the SCROLL wheel.
 - ⇒ The **Lifting and lowering loads** setting window opens.
3.  Press the SCROLL wheel.
4.  Turn the SCROLL wheel to the desired setting.
5.  Press the SCROLL wheel.
6.  Press the SET button.
 - ⇒ The RCL parameters are saved.

5.8 Setting the language

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



Opening the language settings

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

Fig. 51: Language settings

- 1 New > New language
- 2 Current > Current language
- 3 Available languages

Setting the language

1.  Press the SCROLL wheel.
 - ⇒ Language selection is enabled.
2.  Turn the SCROLL wheel to the required language.

3. → Press the SET button.

5.9 Setting brightness

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

Opening the brightness settings

1. → Press the **Device settings** menu button.
2. → Move the SCROLL wheel one position to the right.

Fig. 52: Setting brightness

- 1 Display
- 2 Buttons

Setting brightness

1. → Press the SCROLL wheel.
 - ⇒ A black frame indicates the selected brightness setting.
2. → Turn the SCROLL wheel to the required brightness setting.
 - 1 Display
 - 2 Buttons
3. → Press the SCROLL wheel to set the brightness.
 - ⇒ The selection box is green. The brightness can be adjusted.
4. → Turn the SCROLL wheel to adjust the brightness.
5. → Press the SET button.

5.10 Setting date and time

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

SENCON 2.0

Setting units

Opening date and time settings

1. ➤ Press the **Device settings** menu button.
2. ➤ Move the SCROLL wheel two positions to the right.

Fig. 53: Setting

- 1 Time setting
- 2 Date setting
- 3 Time format 12/24 h
- 4 Set time
- 5 Date format
- 6 Set date

Setting date and time

1. ➤ Press the SCROLL wheel.
⇒ A black outline shows the selected field.
2. ➤ Turn the SCROLL wheel until the field you want to edit is highlighted.
3. ➤ Press the SCROLL wheel.
⇒ The frame turns green. The value can be adjusted.
4. ➤ Turn the SCROLL wheel to adjust the value.
5. ➤ Press the SET button.

5.11 Setting units

The displayed units are set in the **Unit system** window.

Opening the units settings

1. ➤ Press the **Device settings** menu button.
2. ➤ Move the SCROLL wheel three positions to the right.

Fig. 54: Unit system

- 1 Temperature unit setting
- 2 Pressure unit setting
- 3 Weight unit setting
- 4 Length unit setting
- 5 Volume unit setting

Setting units

1. → Press the SCROLL wheel.
⇒ A black frame indicates the selected unit setting.
2. → Press the SCROLL wheel.
⇒ The selection box appears for the unit being set.
3. → Turn the SCROLL wheel to set a value.
4. → Press the SET button.

5.12 USB

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

Fig. 55: USB

SENCON 2.0

General information

5.13 Request access

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

Fig. 56: Request access

5.14 General information

The **General information** window displays general information about the machine and the SENCOR.

Opening General information



1.  Press the **Info** quick-select button.
2.  Move the SCROLL wheel two positions to the right.

Fig. 57: General information

- 1 Machine number
- 2 SENCOR serial number
- 3 Software version

5.15 Registration information

The **Registration information** window can only be used by manufacturer-authorized personnel for diagnostics and configuration purposes.

Fig. 58: Registration information

5.16 Speed ranges of the diesel engine

The **Drive engine** window measures how long the diesel engine is operated within a speed range. The values measured in the speed ranges are displayed in a histogram. The measurement starts at the time of the initial startup of the machine and cannot be reset.

Speed ranges are shown as a percentage of total operation. For example, the diesel engine ran at 25% of the total operating time at 751 to 850 rpm, and 75% of the total operating time at 851 to 1490 rpm.

Open the speed ranges of the diesel engine

1. → Press the **Info** menu button.
2. → Move the SCROLL wheel two positions to the right.

SENCON 2.0

Winch line pull

Fig. 59: Speed ranges of the diesel engine

1 Total diesel engine operating hours

5.17 Winch line pull

The **Winch** window measures how long each winch is operated within a line pull range. The measurement starts at the time of the initial startup of the machine and cannot be reset.

Line pull ranges are shown as a percentage of total operation. For example, the winch 1 ran at 25% of the total operating time with 2.5 t to 12.5 t (2,7 US t to 13,7 US t) line pull, and 75% of the total operating time at 12.5 t to 25 t (13,7 US t to 27,5 US t) line pull.

Line pull is shown in decitons. The value **125** on the x-axle indicates a line pull of 12.5 t (13,7 US t).

Opening winch line pull ranges

1. ➤ Press the **Info** menu button.
2. ➤ Move the SCROLL wheel three positions to the right.
⇒ Line pulls of the winch 1 are shown.
3. ➤ Turn the SCROLL wheel four steps to the right.
⇒ Line pulls of the winch 2 are shown.

Fig. 60: Winch line pull 1

1 Total winch operating hours

For
Reference
Only

SENCON 2.0

Diagnostics > Overview

5.18 Diagnostics

5.18.1 Overview

In the diagnostic windows **Active Faults Engine**, **Active Faults RCL** and **Active Faults Machine** the current machine conditions and faults will be shown.

Some fault messages can be resolved by the operator. Steps for troubleshooting are found in the overview of the status messages on [Chapter 5.18.6 "Messages" on page 117](#).

If the error message is not in the overview, it must be sent to your manufacturer service partner. Be sure to include the SPN code and FMI code with the error message. This information allows the Service Partner to diagnose the fault and take appropriate measures.

- 1 Icon, orange or red depending on severity of error
- 2 OC (Occurrence Count): Frequency of the error
- 3 SPN code (Suspect Parameter Number)
- 4 FMI code (Failure Mode Indicator)
- 5 Brief description of SPN code
- 6 Brief description of FMI code

Fig. 61: Sample fault message



Arrows in the **Diagnostics** window indicate that not all faults that have occurred can be displayed. Scroll through the list using the SCROLL wheel.



The SPN code contains the sensor or actuator that triggers the message. The FMI code is the unique error code for an SPN code.

5.18.2 Active Faults Engine

The current diesel engine fault is indicated in the window **Active Faults Engine**.

Opening Active Faults Engine

→ Press the **Diagnostics** menu button.

For
Reference
Only

Fig. 62: Diagnostics will window Active faults engine

SENCON 2.0

Diagnostics > Previous faults machine

5.18.3 Previous faults machine

The previous fault of the whole machine is indicated in the window **Previous faults machine**.

Opening Previous faults machine

1. → Press the **Diagnostics** menu button.
2. → Move the SCROLL wheel three positions to the right.

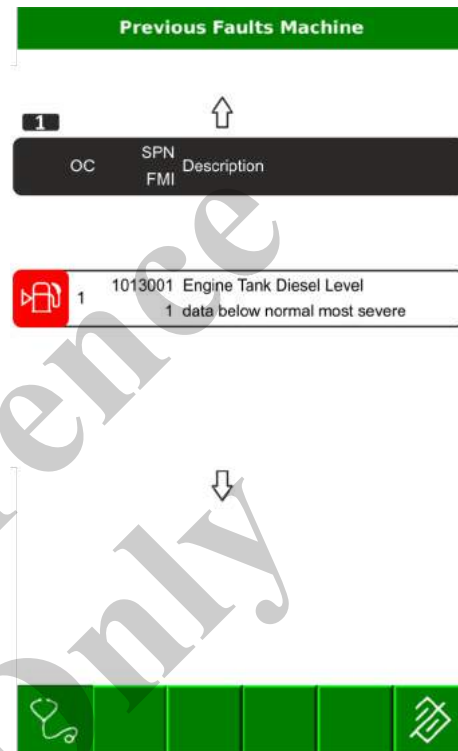



Fig. 63: Previous faults machine diagnostics window

Previous faults machine menu icons

| Icon | Name | Description |
|---|----------------------------|------------------------------|
|  | Acknowledging error memory | The errors are acknowledged. |

5.18.4 Active Faults RCL

The current fault of the load moment limitation is indicated in the window **Active Faults RCL**.

Open the Active Faults RCL

1. → Press the **Diagnostics** menu button.
2. → Move the SCROLL wheel one position to the right.

For
Reference
Only

Fig. 64: Active Faults RCL diagnostics windows

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Diagnostics > Active Faults Machine

5.18.5 Active Faults Machine

The current fault of the whole machine is indicated in the window **Active Faults Machine**.

Opening Active Faults Machine

1. ➤ Press the **Diagnostics** menu button.
2. ➤ Move the SCROLL wheel two positions to the right.

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Reference
Only

Fig. 65: Active Faults Machine diagnostics window

5.18.6 Messages



Some errors and status messages are dependent on the configuration and may not be displayed.

Overview of status messages

| SENCON symbol | SPN | FMI | Description | Solution |
|---------------|------------------------|---------------|--|---|
| | 1011001 | 15 16 | Hydraulic oil temperature too high | <ul style="list-style-type: none"> ■ Run diesel engine at idle speed. ■ Check cooler for soiling and clean as needed. |
| | 1011002 | 0 15 16 | Hydraulic return line filter contaminated Acknowledgment required! | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | 1011003 | 0 15 16 | Hydraulic leakage oil filter contaminated Acknowledgment required! | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | 1011004 | 0 15 16 | HydroClean filter contaminated Acknowledgment required! | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | 1011007 | 17 18 | Hydraulic oil level too low Acknowledgment required! | <ul style="list-style-type: none"> ■ Park machine in maintenance position immediately. ■ Add hydraulic oil. |
| | Various codes possible | 9 | CAN network error | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |

Overview of engine messages

| SENCON symbol | SPN | FMI | Description | Solution |
|---------------|-----|---------------|---|--|
| | 95 | 16 | Fuel filter contaminated | <ul style="list-style-type: none"> ■ Replace fuel filter. |
| | 97 | 15 16 | Water in fuel | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | 100 | 1 18 | Diesel engine oil pressure too low Acknowledgment required! | <ul style="list-style-type: none"> ■ Switch off diesel engine immediately. ■ Check diesel engine oil level and add engine oil as needed. |
| | 101 | 0 15 16 | Crankcase pressure too high | <ul style="list-style-type: none"> ■ Check crankcase breather line and clean as needed. ■ Inform the manufacturer service partner. |

SENCON 2.0

Diagnostics > Messages

| SENCON symbol | SPN | FMI | Description | Solution |
|---------------|------|---------------------------|---|--|
| | 105 | 0 15 16 18 | Intake manifold temperature too high | <ul style="list-style-type: none"> ■ Run diesel engine at idle speed. ■ Switch off the diesel engine. ■ Let diesel engine cool. ■ Check combination cooler for soiling and fan for functioning, and clean as needed. |
| | 110 | 0 15 16 18 31 | Coolant temperature too high | <ul style="list-style-type: none"> ■ Run diesel engine at idle speed. ■ Switch off the diesel engine. ■ Let diesel engine cool. ■ Check combination cooler for soiling and clean as needed. |
| | 111 | 1 17 18 | Coolant level low | <ul style="list-style-type: none"> ■ Switch off the diesel engine. ■ Let diesel engine cool. ■ Add coolant. |
| | 174 | 0 15 16 | Fuel temperature too high | <ul style="list-style-type: none"> ■ Run diesel engine at idle speed. ■ Check fuel level and add fuel as needed. |
| | 175 | 16 | Diesel engine temperature too high | <ul style="list-style-type: none"> ■ Run diesel engine at idle speed. ■ Check oil level and add oil as needed. |
| | 623 | 31 | Engine warning Acknowledgment required! | <ul style="list-style-type: none"> ■ Write down all engine warnings. ■ Inform the manufacturer service partner. |
| | 624 | 31 | Engine warning Acknowledgment required! | <ul style="list-style-type: none"> ■ Switch off the diesel engine. ■ Write down all engine warnings. ■ Inform the manufacturer service partner. |
| | 1761 | 1 17 18 | DEF level low | <ul style="list-style-type: none"> ■ Add DEF |
| | 4096 | 31 | | |
| | 3364 | 1 15 18 | DEF quality poor | <ul style="list-style-type: none"> ■ Check DEF quality using a refractometer. ■ Drain DEF tank. ■ Add fresh DEF. |
| | 4334 | 18 | DEF pressure too low | <ul style="list-style-type: none"> ■ Check DEF level. ■ Check DEF lines. ■ Check DEF tank filter. ■ Inform the manufacturer service partner. |

| SENCON symbol | SPN | FMI | Description | Solution |
|---------------|---------|---------------|--|---|
| | 5394 | 5 7 | DEF dosing unit not working. | ■ Inform the manufacturer service partner. |
| | 1013001 | 17 18 | Fuel level too low | ■ Refuel machine. |
| | 1014000 | 15 | Air filter contaminated Acknowledgment required! | ■ Inform the manufacturer service partner. |
| | | 31 | Wait-to-start-light on | ■ Start engine once message is no longer displayed. |
| | | 1 17 18 | Exhaust gas temperature too low Acknowledgment required! | ■ Inform the manufacturer service partner. |

For Reference Only

SENCON 2.0

Diagnostics > Network

5.18.7 Network

The window **Network** shows the condition and operating status of the sensors and actuators of the machine. Two CAN bus systems are used to connect the sensors and actuators to the SENCON:

- **CAN 1** is the connection to the machine functions. Here is the status of the individual and network nodes is shown.
- **CAN 2** is the connection to the diesel engine functions.

Open network

1. → Press the **Diagnostics** menu button.
2. → Turn the SCROLL wheel four steps to the right.

For
Reference
Only

Fig. 66: Network diagnostics window

Open the detailed view of a Can bus

1. → In the window **Network** turn the SCROLL wheel.
⇒ A black frame indicates the selected Can bus.
2. → Turn the SCROLL wheel to select the required Can bus.
3. → Press the SCROLL wheel.

Fig. 67: Detailed view of CAN 1

For
Reference
Only

SENCON 2.0

Diagnostics > Incoming signals

5.18.8 Incoming signals

The window **Input Vector CanOpen** shows the signals that the sensors and actuators send to the SENCOR on the machine. The **Input Vector CanOpen** window can be used by manufacturer-authorized service personnel for diagnostic purposes.



Depending on the type of sensor or actuator, the actual and target values are output in mA, V, or as the logical values 1 or 0. Values outside the defined range can indicate a sensor/actuator fault.

Displaying incoming signals

1. → Press the **Diagnostics** menu button.
2. → Turn the SCROLL wheel five steps to the right.

For
Reference
Only

Fig. 68: Diagnostics window for incoming signals

- 1 Sensor/actuator signal value
- 2 Operating state symbol
- 3 Sensor/actuator output value
- 4 Sensor/actuator description
- 5 Sensor/actuator operating state description

5.18.9 Transmitting signals

The window **Output Vector** shows the output signal value that the SENCON sends to the other control device of the machine. The **Output Vector** window can be used by manufacturer-authorized service personnel for diagnostic purposes.



Depending on their intended purpose, sensors can transmit data as digital values, as voltage or amperage. Values outside the defined range can indicate a sensor/actuator fault.

Displaying outgoing signals

1. → Press the **Diagnostics** menu button.
2. → Turn the SCROLL wheel six steps to the right.

For
Reference
Only

Fig. 69: Diagnosis window for outgoing signals

- 1 Actual output signal value in mA
- 2 Output signal symbol
- 3 Target value in mA
- 4 Output description
- 5 Output state description

Operation

Safety instructions for operation

6 Operation

6.1 Safety instructions for operation

- Protective equipment:
- Safety shoes
 - Hearing protection
 - Protective clothing
 - Fall arrest safety harness
 - Protective gloves
 - Hard hat

Before drive and/or work mode

- Agree on *Safety* Observe the instructions.
- Take note of the environmental conditions (for example: visibility, wind speeds, etc.) during operation of the machine.
- Take note of the machine's performance specifications and the related load lift chart. See Section *Technical data*.
- Agree on the hand signals, see Section *Safety* with the banksman.
- Ensure that all covers and safety devices are installed and functioning correctly. For an overview of the safety devices, see Section *Safety devices*.
- Close but do not lock all doors.
- Ensure that the machine's protective equipment (protective grating, cab panes made from bulletproof glass, etc.) is sufficient for its application.
- Ensure that persons who work on or with it are trained or instructed for these tasks.
- If the machine is being operated underground or in enclosed spaces, make sure that these spaces are sufficiently ventilated.
- The machine must not be operated in a potentially explosive environment.
- Ensure that attachment points and attachment ropes have adequate load-bearing capacity.
- Check the functionality and operating mode of the load moment limitation (RCL) using the appropriate operating modes and load lift charts. **Only** bypass the load moment limitation (RCL) in the operation situations which are described in this manual.

During drive and/or work mode

- Carry out all operating steps in accordance with this manual.
- Wear the appropriate personal protective clothing during machine operation. See ↪ *Chapter 2.9 "Personal protective equipment" on page 33*.
- Only carry out machine operations if the machine is on secure, level ground with sufficient soil stability.
- Take care to properly attach the loads. Attached loads breaking away can cause damage to the machine and/or injury to persons.

- Monitor the machine for defects during your shift.
 - Notify your supervisor and the oncoming operator of any defects discovered.
 - Stop working if defects are discovered that threaten operational safety.
- Maintain a safe distance from overhead power lines.
- Do not transport persons with the machine.
- Only operate the machine from the driver seat or with the remote control (option).
- Take note of the banksman's hand signals during operation.
- The work area must be free of any obstacles.
- Ensure all personnel is outside the danger zone.
- For long drive operations, position the boom in the direction of travel, and hook in and secure the bottom hook block to the undercarriage.

After the completion drive and/or work mode

- Park the machine after the completion of drive and/or work mode. See [Chapter 6.35 "Parking the machine" on page 205](#).

6.2 Safe entry and exit

Safety measures and rules of conduct

- Enter and exit machine only when stationary and after the cab has been lowered completely - never - during any motion.
- Use the steps and/or access ladders provided to enter and exit.
- If necessary, clean steps and access ladders before 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.
- Pivot the uppercarriage relative to the undercarriage so that safe entry/exit is ensured via the steps.



Mobile undercarriage

Only in extreme emergencies and with great care is the cab to be entered or exited via the wheel hub and the tire.

6.3 Start-up

Safety instructions

⚠ WARNING

Danger of serious injury and machinery damage if machine not checked!

- Perform routine inspections of the machine according to the maintenance schedule before start-up.

Failure to properly perform routine maintenance can result in unexpected functioning. As a result, persons in the danger zone could be seriously injured.

Operation


Machine key

WARNING

Danger of serious injuries to persons in the machine's danger zone!

- **Ensure that there is no one located in the danger zone of the machine before startup.**

Persons in the machine's danger zone could be caught by machine movements and seriously injured.

- Before start-up, carry out checks specified in Section *Check machine and accessory equipment* See  *Chapter 4.3.3 "Check machine and accessory equipment" on page 65.*

6.4 Machine key

Ignition key

Application

- Ignition switch
- Cab door
- Side service hatch on uppercarriage

Fig. 70: Ignition key

Key for maintenance hood

Application

- Maintenance hood on uppercarriage

Fig. 71: Key for maintenance hood

Storage compartment key

Application

- Storage compartments on the undercarriage

Fig. 72: Storage compartment key


Tank cap key

Application

- Tank cap

Fig. 73: Tank cap key

6.5 Shift position of the ignition switch

i The ignition switch will only function once the battery disconnect switch has been turned on. See Section  Chapter 6.10 “Switching on the battery disconnect switch” on page 136. The ignition switch cannot function when the battery disconnect switch is off.

| Ignition key position | Meaning |
|-----------------------|----------------------------|
| P | Enable fuel pump |
| 0 | Ignition OFF |
| I | Ignition ON |
| II | Starting the diesel engine |

Fig. 74: Ignition switch

6.6 Adjusting the driver seat

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

i The following description of the driver seat contains optional functions.

Safety instructions

⚠ WARNING

Risk of accident due to machine movements!

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

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

Operation

Adjusting the driver seat

⚠ CAUTION

Damage to health due to improperly adjusted driver seat!

- **Adjust the driver seat before starting up the machine or when switching operators.**

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

- The driver seat is designed for a driver with a weight up to 150 kg (330.7 lbs).
- Always only adjust one function at a time.
- Do not use the driver seat as a climbing aid.
- Do not place any objects on the driver seat.
- Do not cover the driver seat.
- The driver seat must be adjusted so that the operator can always reach the pedals even when the road surface is poor.

Adjusting the operator weight and seat height

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

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

Fig. 75: Adjusting the operator weight and seat height

Adjusting the shock absorbance

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

1. → To increase the damping force, move the lever (1) up.
2. → To decrease the damping force, move the lever (1) down.

Fig. 76: Adjusting the shock absorbance

Adjusting the position of the seat surface

The position of the seat surface can be adjusted lengthwise.

1. → Move the lever (/1) up and push the seat surface back or forwards.
2. → Release the lever.
 - ⇒ The seat surface must audibly engage.

After locking, it must not be possible to change the position anymore.

Fig. 77: Adjusting the position of the seat surface

Operation

Adjusting the driver seat

Length adjustment of the driver seat

The position of the driver seat can be adjusted lengthwise.

1. ➤ Pull the handle (1) up and push the driver seat back or forwards.

2. ➤ Release the handle.

⇒ The driver seat must audibly engage.

After locking, it must not be possible to change the position anymore.

Fig. 78: Adjusting the seat position

Adjusting the inclination of the seat surface

1. ➤ Push lever (1) upwards.

2. ➤ Adjust the desired inclination by increasing or decreasing your weight on the front or back of the seat surface.

3. ➤ Release the lever.

⇒ The seat surface must audibly engage.

After locking, it must not be possible to change the position anymore.

Fig. 79: Adjusting the seat inclination

Length adjustment of the driver seat with the brackets

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

1. ➤ Pull the handle (1) up and push the driver seat with the brackets back or forwards.

2. ➤ Release the handle.

⇒ The driver seat with the brackets must audibly engage.

After locking, it must not be possible to change the position anymore.

Fig. 80: Adjusting the seat position with the brackets

Adjusting the inclination of the arm rests

1. → Turn the handwheel (1) outwards.
⇒ The arm rest is raised.
2. → Turn the handwheel inwards.
⇒ The arm rest is lowered.

Fig. 81: Adjusting the arm rest inclination



The arm rests can be folded back if necessary.

Adjusting the inclination of the backrest

1. → Push lever (1) upwards.
2. → Adjust the desired inclination by increasing or decreasing your weight on the backrest.
3. → Release the lever.
⇒ The backrest must audibly click into place.
After locking, it must not be possible to change the position anymore.

Fig. 82: Adjusting the backrest inclination

Operation

Adjusting the driver seat

Adjusting the height of the headrest

- ➔ Pull the headrest up or down until the desired height is reached.
- ⇒ The headrest must noticeably click into the individual positions.

Fig. 83: Adjusting the headrest



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

Adjusting the lumbar support

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

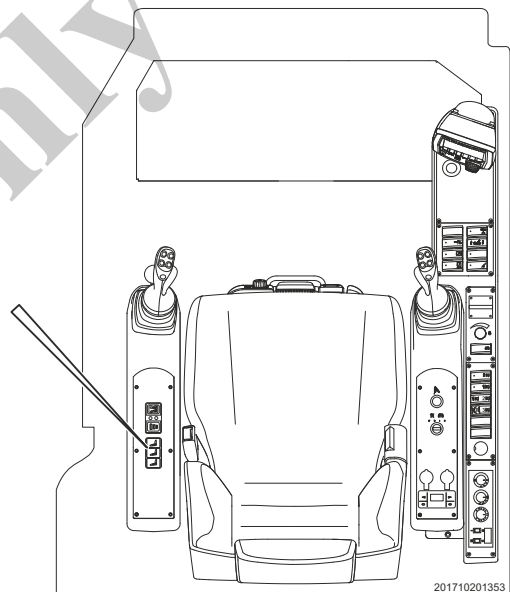


Fig. 84: Adjusting the lumbar support

- 1 Switch, lumbar support, upper air chamber
- 2 Switch, lumbar support, lower air chamber

1. ➔ Push the switches (1), (2) up to increase the curvature.
2. ➔ Push the switches (1), (2) down to decrease the curvature.

Switching the seat heater on and off

1. → Push the switch (1) down.
⇒ The seat heater is switched on.
2. → Push the switch up.
⇒ The seat heater is switched off.

Fig. 85: Seat heater switch

Switching the horizontal suspension on and off

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

1. → Switch the lever (1) to the position **I**.
⇒ The horizontal suspension is switched on.
2. → Switch the lever to the position **0**.
⇒ The horizontal suspension is switched off.

When the horizontal suspension is switched off, the lever must engage in the position **0**. In addition, push the driver seat back until it audibly engages.

After locking, the horizontal suspension must not move anymore.

Fig. 86: Horizontal suspension

6.7 Cab lighting

The inside light and spot light are found to the top right inside the cab.

Operation

Rearview mirror

Turning the inside light on and off

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

Fig. 87: Interior light



The inside light is only turned on and off by the cab door when the switch is in position **I**.

Turning the reading light on and off

1. → Turn the switch (1) to **I**.
 - ⇒ This turns on the reading light (2).
2. → Turn the switch to **0**.
 - ⇒ This turns the spotlight off.

Fig. 88: Spotlight



The beam can be moved by adjusting the reading light.

6.8 Rearview mirror

Adjusting the rearview mirror

Carry out individual rearview mirror adjustments before starting up the machine or changing operators.

If necessary, call a second person for support.

Clean rearview mirror before startup if dirty.

6.9 Sun visor and roller shade

The cab is equipped with a sun visor and a sun shade.

Fold sun visor

1. → If glare is coming from in front: Fold the sun visor (1) to **I**.
2. → If glare is coming from above: Fold the sun visor to **II**.

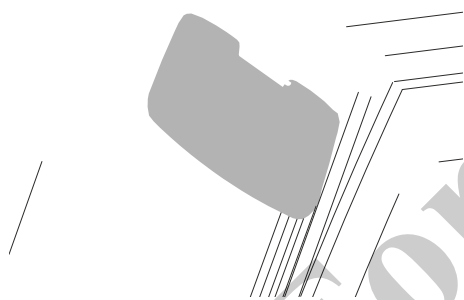


Fig. 89: Sun visor

1. → Secure sun shade (1) to the handle (2) and hook in position **I**.
2. → To roll up the sun shade, hold onto the handle, unhook, and return to initial position.

Fig. 90: Roller shade

Operation

Windshield > Opening the windshield

6.10 Switching on the battery disconnect switch



Fig. 91: Battery disconnect switch

1. ▶ Open service access door.
2. ▶ Press the battery disconnect switch.
⇒ The switch is illuminated yellow.
3. ▶ Close the service door.

6.11 Turning off the battery disconnect switch



Fig. 92: Battery disconnect switch

1. ▶ Open service access door.
2. ▶ Press the yellow battery disconnect switch.
⇒ After 10 minutes of blinking, the switch stops lighting up.
3. ▶ Close the service door.

⚠ DANGER

Risk of death from electric shock!

- Before starting work on live parts, make sure that the battery disconnect switch is off.

Contact with live parts immediately after switching off the battery disconnect switch poses a risk of electrocution.

6.12 Windshield

6.12.1 Opening the windshield

NOTICE

Damage to windshield wiper arm due to incorrect operation.

- Never activate the windshield wiper with the windshield open.

If the windshield wiper is activated with the windshield open, the windshield wiper arm can be damaged.

1. → Press locking mechanism (1).
2. → Push handles (2) forward.

Fig. 93: Opening the windshield

6.12.2 Closing front windshield

- Raise handles (2).
 - ⇒ Make sure the windshield audibly locks into both locking mechanisms (1).

Fig. 94: Windshield

Operation

Machine lighting > Switching the beacon on and off (option)

6.13 Opening the door windows

- ➔ Pull the locking mechanism of the door windows (1) back and open the window.

Fig. 95: Opening the door windows

6.14 Machine lighting

6.14.1 Switching the work lights on and off

The switches for the work lights are on the upper control panel.

1. ➔ Turn the ignition key to the position I.
2. ➔ Turn the **Work lights** switch to the right.
 - ⇒ Work light turns on.
3. ➔ Turn the **Work lights** switch to the left.
 - ⇒ Work light turns off.

6.14.2 Switching the beacon on and off (option)

The switch for the beacon is on the upper control panel.

1. ➔ Turn the **Beacon** switch to the right.
 - ⇒ Beacon is switched on.

2. → Turn the **Beacon** switch to the left.
⇒ Beacon is switched off.

6.15 Power sockets

- 1 USB power socket, 5 V
- 2 Power socket, 12 V
- 2 Power socket, 24 V

The sockets are located on the lower right control panel. The power sockets are only operational if the ignition key is in position **I**.

Fig. 96: Power sockets

i An electric accessory can be plugged in to the power socket 5 V (1 A) up to a max. of 5 W. An electric accessory can be plugged in to the power socket 12 V (10 A) up to a max. of 120 W. An electric accessory can be plugged in to the power socket 24 V (10 A) up to a max. of 240 W.

Operation

Camera system

6.16 Radio

The radio is found on the right control panel beside the driver seat.

Fig. 97: Radio (example representation)



For information on operating the radio, see the radio manufacturer's operating manual.

6.17 Camera system

The machine is equipped with a camera system that allows the operator to remotely view the winch and the areas next to and behind the machine.

WARNING

Risk of injury due to restricted view!

- Make sure the camera system is working and configured properly before starting up the machine or changing operators.
- Only operate the camera system in TIMER OFF mode.
- Clean dirty camera lenses.
- Machines with a non-functional camera system may only be operated with the assistance of a banksman.

Accidents can occur as a result of incorrectly installed cameras, distorted, or misaligned camera images. The camera system is only an aid and does not release the operator from exercising due caution.

Positions of the camera on the machine

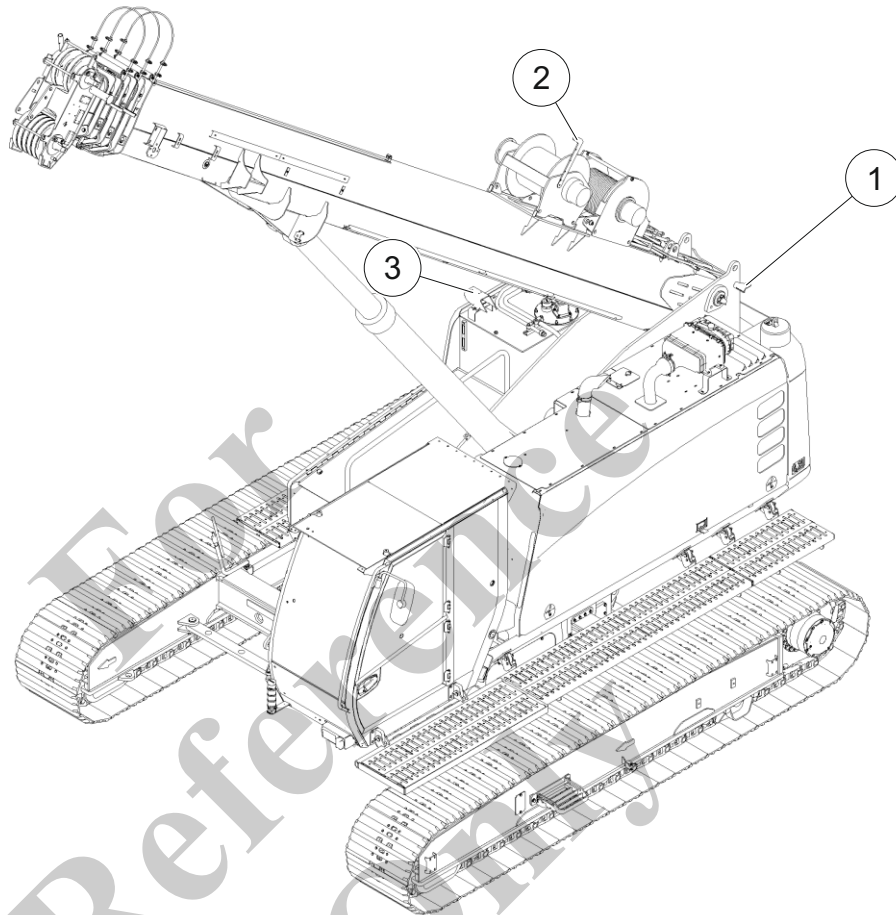


Fig. 98: Positions of the camera on the machine

- 1 Camera, backside
- 2 Camera, winch
- 3 Camera, side

Operation

Camera system

Install the camera on the side and backside

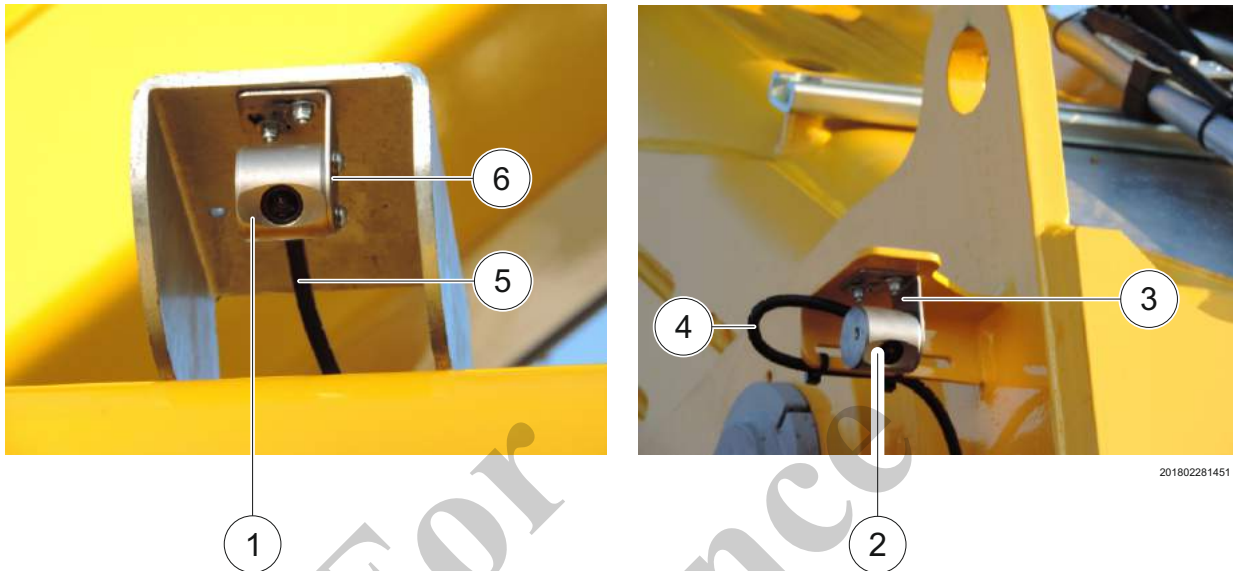


Fig. 99: Camera on the backside and the side

- 1 Camera, side
- 2 Camera, backside
- 3 Holder, backside

- 4 Control cable, backside
- 5 Control cable, side
- 6 Holder, side

Special tool:

- Wrench for M8 screw

Materials:

- 2 cameras with mounting kit

1. ➤ Position the camera on the rear side with bracket in the intended position on the machine.

i Comply with the torque.

2. ➤ Secure the camera bracket on the back using the M8 mounting screw provided.

3. ➤ Connect the associated control cable to the control cable of the camera.

4. ➤ Position the camera on the side with bracket in the intended position on the machine.

i Comply with the torque.

5. ➤ Secure the camera on the side with bracket using the M8 mounting screw provided.

6. ➤ Connect the associated control cable to the control cable of the camera.

Install the camera on the winch



Fig. 100: Camera, winch

- Special tool: ■ Wrench for M8 screw
 Materials: ■ 1 camera with mounting kit

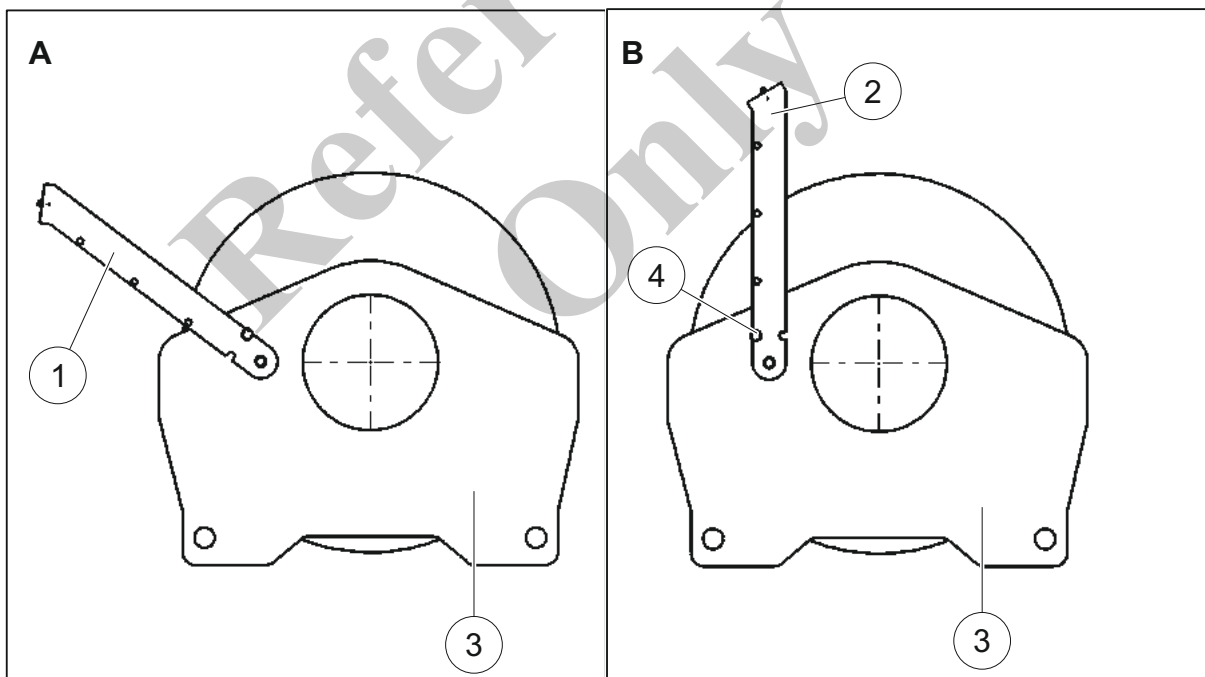


Fig. 101: Transport and working position of the camera, winch

- | | | | |
|---|----------------------------------|---|--------------------------------|
| A | Transport position | 2 | Holder in the working position |
| B | Working position | 3 | Winch |
| 1 | Holder in the transport position | | |

Operation

Camera system

4 Mounting screws M8x20

1. → Place the holder in the working position.

i Comply with the torque.

2. → Fix the holder in the working position with the hexagonal screw M8x20.

3. → Position the camera on the holder.

i Comply with the torque.

4. → Secure the camera with the appropriate mounting screws.

5. → Connect the associated control cable to the control cable of the camera.

Set the camera system close to the machine

All cameras are installed.

1. → Park the machine.

2. → Turn the ignition key to I.

3. → Turn on the camera system.

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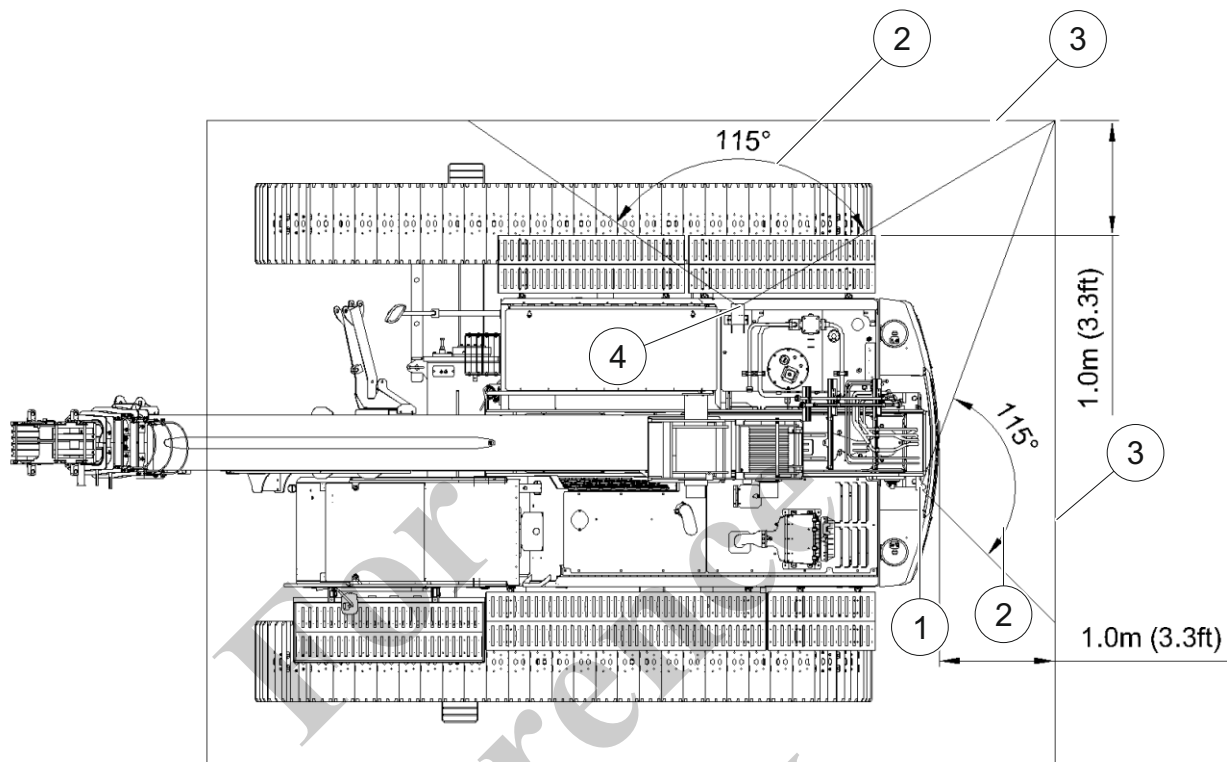


Fig. 102: Field of view for camera, backside and camera, side in close range

- 1 Camera, backside
- 2 Field of view angle
- 3 Close range
- 4 Camera, side

4. → Set the camera (1) and the camera (4) to the specified field of view angle and the near range.

⇒ The field of view angle is 115°.

The close range is 3.3ft.

Operation

Camera system

Switch on the display

1. ➤ Swivel the display (1) so that the image is easily recognizable.
 2. ➤ Turn the ignition key to position I.
 - ⇒ The camera image is shown on the display, the **Operating display** LED (1) lights up.
- i** If the camera image is not displayed, switch on the monitor with the button (2).*

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Fig. 103: Camera system display

Adjusting the display

For Reference Only


Fig. 104: Display operating elements

- 1 Operating display
- 2 Display on/off button
- 3 Day/night button
- 4 Plus button
- 5 Minus button
- 6 Menu button
- 7 Camera select button
- 8 Presentation mode button

Day/night switch

1. ➤ Press the button.
 - ⇒ In **Night** mode, the camera image displayed is darker.
2. ➤ Press the button again.
 - ⇒ In **Day** mode, the camera image displayed is brighter.


Presentation mode

Up to four cameras can be installed on the machine. The following presentation modes can be toggled between with the button :

- Single image
- Split image
- Image in three
- Image in four

→ Select the desired presentation with the button .

Camera selection

In the presentation mode **single image** and in the presentation mode **split image** the cameras can be selected with the button .

→ Select the desired camera display with the button .

- In single image mode you can choose between cameras 1, 2, 3, and 4.
- In split image mode you can choose between cameras 1/2, 2/3, 3/4, 4/1, 1/3 and 2/4.

Menu settings

→ Press the  button.

⇒ The menu selection appears on the monitor.

BRIGHTNESS
 CONTRAST
 COLOR
 STANDARD
 LANGUAGE
 MIRRORING
 VIDEO
 POC ON / OFF
 TIMER ON / OFF
 TIMER SETUP
 FINISH

Operation

Camera system

Select language

1. ▶ Press the button.
⇒ The menu selection appears on the monitor.
2. ▶ Navigate the menu item **LANGUAGE** with the buttons
3. ▶ Press the button.
⇒ The language selection appears on the monitor.
4. ▶ Select the desired language with the buttons
5. ▶ Press the button.
⇒ The selected language will be marked with a .
6. ▶ Navigate the menu items **FINISH** with the buttons
7. ▶ Press the button in order to exit the menu item.

Select power-on mode (POC)

In the **POC ON** mode, the display is switched on and off via the ignition switch. In the **POC OFF** mode the display can be switched on and off separately with the button when the ignition is switched on.

1. ▶ Press the button.
⇒ The menu selection appears on the monitor.
2. ▶ Navigate the menu item **POC** with the buttons
3. ▶ Press the button in order to switch between **POC OFF** and **POC ON**.
4. ▶ Navigate the menu items **FINISH** with the buttons
5. ▶ Press the button in order to exit the menu item.

Setting brightness

1. ▶ Press the button.
⇒ The menu selection appears on the display.
2. ▶ Navigate the menu item **brightness** with the buttons
3. ▶ Press the button.
⇒ The current settings appear on the display.
4. ▶ Set the desired brightness with the buttons
5. ▶ Press the button in order to exit the menu item.

Set the contrast

1. → Press the button.
⇒ The menu selection appears on the display.
2. → Navigate the menu item **contrast** with the buttons
3. → Press the button.
⇒ The current settings appear on the display.
4. → Set the desired contrast with the buttons
5. → Press the button in order to exit the menu item.

Set the color saturation

1. → Press the button.
⇒ The menu selection appears on the display.
2. → Navigate the menu item **color** with the buttons
3. → Press the button.
⇒ The current settings appear on the display.
4. → Set the desired color saturation with the buttons
5. → Press the button in order to exit the menu item.

Reset settings

1. → Press the button.
⇒ The menu selection appears on the display.
2. → Navigate the menu item **standard** with the buttons
3. → Press the button.
⇒ The factory settings are reapplied.
4. → Navigate the menu items **FINISH** with the buttons
5. → Press the button in order to exit the menu item.

Operation

Camera system

Mirror camera image

1. ▶ Press the button.
⇒ The menu selection appears on the display.
2. ▶ Navigate the menu item **mirroring** with the buttons
3. ▶ Press the button.
⇒ The camera selection appears on the display.
4. ▶ Choose the mirroring camera with the buttons.
5. ▶ Press the button.
⇒ The mirroring camera will be marked with a .
6. ▶ Navigate the menu item **BACK** with the buttons
7. ▶ Press the button in order to exit the menu item.

Set the video system

Through setting the **Video system** the monitor's color-transfer system can be set to PAL, NTSC or automatic.

1. ▶ Press the button.
⇒ The menu selection appears on the display.
2. ▶ Navigate the menu item **video** with the buttons
3. ▶ Press the button.
⇒ The system selection appears on the display.
4. ▶ Choose the desired video system with the buttons
5. ▶ Press the button.
⇒ The chosen video system will be marked with a .
6. ▶ Navigate the menu item **BACK** with the buttons
7. ▶ Press the button in order to exit the menu item.








Set timer mode

WARNING

Risk of injury due to incorrectly configured camera system

- Only operate the camera system in **TIMER OFF** mode.

The operator may lose orientation via the camera display due to automatically alternating camera images. This can lead to accidents.

1. → Press the  button.
⇒ The menu selection appears on the display.
2. → Navigate the menu item **TIMER ON / OFF** with the buttons  .
3. → Press the  button in order to switch between **TIMER ON** and **TIMER OFF**.
⇒ Select **TIMER OFF** mode.
4. → Navigate the menu items **FINISH** with the buttons  .
5. → Press the button  in order to exit the menu item.

Timer setup



*As the camera system can only be operated in **TIMER OFF** mode, no adjustments are necessary in the **TIMER SETUP** menu.*

6.18 Windshield wiper and windshield washer system

6.18.1 General

The switches for the windshield wipers and the windshield washer system are on the upper control panel.

The windshield wiper switch has three settings.

6.18.2 Overview of windshield wiper switches

NOTICE

Damage due to water entering the cab interior!

- Before activating the mopping water system close the cab windows so that no mopping water can enter the cab interior.

If the mopping water system is activated when the cab windows are open, the mopping water may enter the cab interior and cause damage.

Operation

Windshield wiper and windshield washer system > Windshield wiper and windshield washer system

- 1 Windshield wiper, upper windshield
- 2 Washer system, upper windshield
- 3 Windshield wipers, glass roof panel
- 4 Washer system, glass roof panel

Fig. 105: Windshield washer system

6.18.3 Switching windshield wiper on and off

NOTICE

Damage to windshield wiper arm due to incorrect operation.

- **Never activate the windshield wiper with the windshield open.**

If the windshield wiper is activated with the windshield open, the windshield wiper arm can be damaged.

1. ▶ Turn the ignition key to the position I.
2. ▶ Turn the switch to the middle setting.
 - ⇒ The windshield wiper wipes slowly.
3. ▶ Turn the switch to the right.
 - ⇒ The windshield wiper wipes quickly.
4. ▶ Press the switch left.
 - ⇒ The windshield wiper is off.

6.18.4 Windshield wiper and windshield washer system

The switches for the windshield wipers and the windshield washer system are on the upper control panel.

The windshield wiper switch has three settings.

6.19 Climate control system

6.19.1 Functions of the climate control system

The climate control system allows the cab to be heated and cooled.



- Keep windows and cab door closed to ensure effective air conditioning when the climate control system is switched on.
- Switch the climate control system at least once a month in order to increase its life span.

- 1 Blower speeds
- 2 Temperature
- 3 Air distribution
- 4 Switch, fresh air/recirculating air mode
- 5 Switch, cooling mode on/off

For Reference Only

Fig. 106: Climate control system

Functions of the climate control system

Fresh air mode (4) allows the cab to be quickly dehumidified when the windows are fogged up.

Recirculating air mode (4) allows a faster heating up of the cab, a higher maximum temperature in heating mode, and a faster cooling of the cab in cooling mode.



The air in the cab is recirculated, i.e., little fresh air is drawn in from the outside. Do not leave this mode on for more than 15 minutes, or air quality in the cab will noticeably deteriorate. Make sure enough fresh air is entering the cab.

Operation

Switching on diesel filter heating (option)

The air in the cab will not be cooled if the cooling mode is switched off (5).

6.19.2 Switching on the climate control system

1. ➤ Turn the ignition key to the position I.
2. ➤ Open the air nozzles.
3. ➤ Switch on the blower (1).
4. ➤ Set the desired temperature using the temperature control (2).
5. ➤ Set the air distribution of the blower (3).
6. ➤ Switch cooling mode on or off with the button (5).

6.20 Switching on diesel filter heating (option)

The diesel filter heating can be used for pre-warming of the diesel filter at low temperatures.



If the coolant temperature drops below 5 °C, the manufacturer recommends turning the diesel heater on. The coolant temperature is displayed on the SENCON.

1. ➤ Turn the **Diesel filter heating** to the right.
 - ⇒ The diesel filter heating is switched on. The indicator light lights up until the fuel reaches operating temperature.

2. ➤ Turn the **Diesel filter heating** to the left.
 - ⇒ The diesel filter heating is switched off.

6.21 Safety lever positions

When the safety lever is engaged, the machine cannot move. In order to move the machine, the safety lever must be pushed forward.

Fig. 107: Safety lever positions

6.22 Starting / stopping / jump-starting the diesel engine

6.22.1 Starting the diesel engine

Safety instructions

- If the diesel engine is turned off, wait at least 15 seconds before starting it again.
- Keep service doors, service flaps, and service hoods closed.
- Ensure all personnel is outside the danger zone.
- Only let the diesel engine run outdoors or in well-ventilated areas.
- Do not switch on the diesel engine if a warning sign is affixed on the operating elements.

⚠ WARNING

Risk of poisoning due to exhaust gases.

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

Inhaling exhaust fumes can cause loss of consciousness or even death.

⚠ WARNING

Risk of serious injury due to unintentional activation of the joystick or pedals.

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

Operating the joystick or pedals when starting the machine can result in uncontrolled machine movements. This can result in serious injury.

Operation

Starting / stopping / jump-starting the diesel engine > Starting the diesel engine

The following conditions must be met before starting the diesel engine:

- The battery disconnect switch must be switched on.
- The safety lever must be engaged.
- For machines with mobile undercarriages, the following applies: The drive brake must be locked.

1. → Turn the ignition key to the position **I**.

⇒ The SENCON is switched on.

***i** 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.*

2. → Set the setup status in the SENCON.

Fig. 108: SENCON loading screen

3. → Sound the horn. Push the button (1) on the right joystick.

⇒ The horn must sound.

4. → Check SENCON for potential faults and warning messages.

⇒ Serious faults must be resolved before the machine can be put into operation.

5. → Turn the ignition key to position **II**.

Fig. 109: Horn



*Alternatively to the ignition key, the diesel engine can be started with the **Start/stop diesel engine** on the lower, right-hand control panel. The ignition key must be at I.*

6.22.2 Stopping a diesel engine

Turn off the diesel engine

1. → Lower any attached loads and the boom to the ground.
2. → Leave the diesel engine idling for 5 - 10 minutes.
3. → Turn the ignition key to position 0.
4. → Turn off the battery disconnect switch.



*Alternatively to the ignition key, the diesel engine can be stopped with the **Start/stop diesel engine** switch. The ignition key must be at I. A longer stopping of the engine should always be carried out via the ignition key. Only use the **Start/stop diesel engine** for a short-term stopping of the engine.*

6.22.3 Jump starting diesel engines

The machine is equipped with a 24 volt starting system. Make sure the donor battery has the same voltage.

Operation

Starting / stopping / jump-starting the diesel engine > Jump starting diesel engines

WARNING

Risk of injury through incorrect use of batteries!

- Never short-circuit the battery terminals (positive and negative).
- Never expose batteries to moisture or humidity (rain, salt water, liquids). Do not, in any instance, use a moist or wet battery.
- Do not use or store batteries in locations with atmospheres which risk explosion or in which high temperatures could occur.
- Never attempt to repair, modify, convert or disassemble batteries.
- Batteries must always be protected from falling into the hands of unauthorized persons.
- To avoid fire, over-heating, explosions or leakage of batteries, never expose them to serious shock, high weight loads, or other damaging impacts. Leaked fluids can catch alight.
- Following contact between the eyes and leaked fluids, immediately rinse the eyes beneath the eyelid with clear water for at least 15 min. When doing so, direct a gentle stream of water onto the eye and do not rub. Immediately seek medical attention.
- Avoid skin contact with leaked fluids. In the case of accidental skin contact, wash the affected skin area with plenty of water and soap.

Incorrect use of batteries poses the risk of the batteries exploding or of harmful fluid leaking from the batteries. The fluid can cause chemical burns to the skin upon contact, and cause blindness through contact with the eyes.

Materials: Bridging cable with minimum cross-section 70 mm²

1.  Turn off the battery disconnect switch.
2.  Remove the battery cover.

Fig. 110: Connect positive pole

3. → Connect the positive pole (+) of the donor battery (1) and the machine battery (2) with a suitable jumper cable.

Fig. 111: Connect the donor battery's negative pole with the machine

4. → Using a suitable jumper cable, connect the negative pole (-) of the battery (1) to the engine block or an unpainted metal part connected to it on the side of the machine.
5. → Start the engine of the donor battery.
6. → Turn on the battery disconnect switch.
7. → If startup works, let the diesel engine run for a few minutes.
8. → Switch off the diesel engine and the battery disconnect switch.
9. → Loosen the jump cable on the negative pole.

Operation

Load moment limitation (RCL) > Mode of operation

10. ▶ Loosen the jump cable on the negative pole.

11. ▶ Replace the battery cover.

6.23 Load moment limitation (RCL)

6.23.1 Safety instructions

- The load moment limitation (RCL) is a safety device.
- Before working on and with the machine, set the RCL operating mode.
- The RCL settings must correspond with the setup status of the machine and the activity to be carried out.
- The RCL may only be bypassed in case of emergency or in the event of component failure to shut down the machine in a safe condition.
- The weight of the load handling devices must be subtracted from the maximum safe working loads. Load-handling devices are:
 - Suspension gear
 - Traverses
 - Load hook
 - Bottom hook blocks
 - Hoisting ropes between bottom hook block and pulley head
- Have the malfunction remedied as quickly as possible.

6.23.2 Mode of operation

The RCL gives the operator information needed to operate the machine within the operating ranges specified by the manufacturer.

The operator's experience, prudence and judgment are required to ensure safe operation of the RCL.

Using sensors, the RCL monitors machine functions and continuously provides the performance data of the machine to the operator. This data changes continuously as the machine moves. When the machine approaches the maximum load rating, the RCL warns the operator via a warning tone and a visual signal.

If the machine reaches the inadmissible area of operation, any machine movements which increase the machine load moment are shut down. In order to unload the machine after the RCL is tripped, the **Lower loads** and **Retract telescopic boom** movements can still be executed.

RCL displays in the cab

In the cab, the SENCON displays the current load capacity and the machine's permissible load torque.

Warning icon for RCL

| Icon | Possible statuses | Explanation |
|------|-------------------|---|
| | | Grey: <ul style="list-style-type: none"> ■ Safe working load normal. |
| | | Orange: <ul style="list-style-type: none"> ■ Safe working load about to be exceeded. |
| | | Red: <ul style="list-style-type: none"> ■ Safe working load exceeded. ■ Warning tone is sounded. |
| | | Red and strikethrough: <ul style="list-style-type: none"> ■ RCL bypassed. |

Once the bottom hook block has been drawn into contact with the lifting limit switch weight, the RCL disables the **Lift load**, **Lower telescopic boom** and **Extend telescopic boom** functions.

Warning icon for lifting limit switch

| Icon | Possible statuses | Explanation |
|------|-------------------|--|
| | | Grey: <ul style="list-style-type: none"> ■ Lifting limit switch not tripped. |
| | | Red: <ul style="list-style-type: none"> ■ Lifting limit switch tripped. |
| | | Red: <ul style="list-style-type: none"> ■ Lifting limit switch bypassed. |

Operation

Load moment limitation (RCL) > Set-up status

RCL display on the outside of the machine

Outside of the cab, the light (1) displays the current load capacity and the machine's permissible load torque.

Fig. 112: RCL light

Light display - normal operation

| Load capacity | Speed reduction up to 25 % | Date display | Visual | Acoustic |
|---------------|----------------------------|--------------|--------------|--|
| < 90% | No | No | Green light | - |
| 90% to 100% | No | No | Yellow light | - |
| > 100% | No | Yes | Red light | Interval honking disengageable after 5 s |

Light display - RCL bypassed

| Load capacity | Speed reduction up to 25 % | Date display | Visual | Acoustic |
|---------------------------|----------------------------|--------------|------------------------------------|-------------------|
| No load torque monitoring | Yes | Yes | Flashing red light Yellow light | Continuous signal |

6.23.3 Set-up status

The RCL operating parameters for the required operating mode are configured in the **Setup status** window on the SENCON. The setup status window automatically appears after the ignition is turned on and the SENCON starts.



See Chapter 5.4 "Set-up status" on page 86.

6.23.4 Operating modes table

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

| Incline [°] | Track width | Rear ballast (minimum) | Main boom / Attachment | Offset [°] | Config code |
|-------------|-------------|------------------------|------------------------|------------|-------------|
| 0.3 | C | 11.025 lbs or 5.0 t | Setup | 0 | 151894 |
| 0.3 | A | | HA | 0 | 157801 |
| 0.3 | B | | HA | 0 | 154801 |
| 0.3 | C | | HA | 0 | 151801 |
| 2.0 | A | | HA | 0 | 257801 |
| 2.0 | B | | HA | 0 | 254801 |
| 2.0 | C | | HA | 0 | 251801 |
| 4.0 | A | | HA | 0 | 357801 |
| 4.0 | B | | HA | 0 | 354801 |
| 4.0 | C | | HA | 0 | 351801 |
| 0.3 | A | | HA | 0 | 177801 |
| 0.3 | B | | HA | 0 | 174801 |
| 0.3 | C | | HA | 0 | 171801 |
| 2.0 | A | | HA | 0 | 277801 |
| 2.0 | B | | HA | 0 | 274801 |
| 2.0 | C | | HA | 0 | 271801 |
| 4.0 | A | | HA | 0 | 377801 |
| 4.0 | B | | HA | 0 | 374801 |
| 4.0 | C | | HA | 0 | 371801 |
| 0.3 | A | | HA-S | 0 | 157831 |
| 0.3 | B | | HA-S | 0 | 154831 |
| 0.3 | C | | HA-S | 0 | 151831 |
| 2.0 | A | | HA-S | 0 | 257831 |
| 2.0 | B | | HA-S | 0 | 254831 |
| 2.0 | C | | HA-S | 0 | 251831 |
| 4.0 | A | | HA-S | 0 | 357831 |
| 4.0 | B | | HA-S | 0 | 354831 |
| 4.0 | C | | HA-S | 0 | 351831 |
| 0.3 | A | | HA-S | 0 | 177831 |
| 0.3 | B | | HA-S | 0 | 174831 |
| 0.3 | C | | HA-S | 0 | 171831 |
| 2.0 | A | | HA-S | 0 | 277831 |
| 2.0 | B | | HA-S | 0 | 274831 |
| 2.0 | C | HA-S | 0 | 271831 | |
| 4.0 | A | HA-S | 0 | 377831 | |
| 4.0 | B | HA-S | 0 | 374831 | |
| 4.0 | C | HA-S | 0 | 371831 | |
| 0.3 | A | SA6.5 | 0 | 157844 | |
| 0.3 | A | SA6.5 | 40 | 157846 | |

Operation

Load moment limitation (RCL) > Bypass RCL

| Incline [°] | Track width | Rear ballast (minimum) | Main boom / Attachment | Offset [°] | Config code |
|-------------|-------------|------------------------|------------------------|------------|-------------|
| 0.3 | A | | SA6.5 | 0 | 177844 |
| 0.3 | A | | SA6.5 | 40 | 177846 |
| 0.3 | A | | SA13 | 0 | 157854 |
| 0.3 | A | | SA13 | 0 | 177854 |
| 0.3 | A | | SA13 | 40 | 157856 |
| 0.3 | A | | SA13 | 40 | 177856 |
| 0.3 | A | | HA-HAB | 0 | 157813 |
| 0.3 | A | | SA-HAB | 0 | 157825 |

| Abbreviation | Explanation | Abbreviation | Explanation |
|--------------|---|--------------|-----------------------------|
| HA | Main boom | SA13 | Fly boom (13 m (42.7 ft)) |
| HA-S | Auxiliary jib | A | extended (3.8 m (12.47 ft)) |
| HA- / SA-HAB | Main boom / fly boom with elevating work platform | B | middle (3.05 m (10 ft)) |
| SA6.5 | Fly boom (6.5 m (21.3 ft)) | C | retracted (2.3 m (7.5 ft)) |

6.23.5 Bypass RCL

Safety instructions

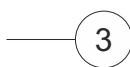
- The key switch for bypassing the RCL must only be activated by authorized personnel in the event of an emergency or component failure.
- In the case of bypassed RCL, a shutdown does not take place as soon as the machine arrives in an unauthorized operating area.
- In the case of bypassed RCL, the lifting limit switch and the radial limit do not function.
- Take corrective action immediately.

In setup mode or in work mode it may be necessary to bypass the RCL following a shutdown due to overload. The RCL is bypassed via a key switch.

Bypass RCL

1. ▶ Start the diesel engine.
2. ▶ Wait until the SENCON has booted.
3. ▶ Pull the safety lever.

4. → Press key switch (2) and push button (3) simultaneously.
 - ⇒ RCL is bypassed. A visual and acoustic warning signal is switched on in and outside of the cab. This cannot be turned off. The following accompanying symbol appears on the SENCON.



Activate RCL after bypass

- Release the key switch (2) or the push button (3) or switch off the ignition and then switch it back on.

6.24 Warm-up the machine

▲ WARNING

Risk of injury and machine damage.

- Observe the warm-up period.

Operating the machine without allowing sufficient time for warm-up can damage the diesel engine and other components. Machine functions will be adversely affected. This can result in injury.

By temperatures under 0 °C (32 °F), an additional warm-up period may be necessary. If the hydraulic system is still slow to respond after the warm-up period, work another 15 minutes at a reduced speed.

Before operating the machine at full speed, the following temperature values must be shown on the SENCON display:

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

Operation

Setting the fail-safe speed on the central electrical system

1. ▶ Let the diesel engine run at idle speed for 3 minutes after starting.
2. ▶ Increase the diesel engine speed gradually until the nominal speed reaches -250 rpm without a load.
3. ▶ When the coolant temperature reaches about 20 °C (68 °F), burden the diesel engine through the careful introduction of hydraulic functions.
4. ▶ Continue to warm-up the machine.

6.25 Setting engine speed

The hand throttle is located on the lower right-hand panel.

1. ▶ Turn the hand throttle to the right.
⇒ The speed is increased.
2. ▶ Turn the hand throttle to the left.
⇒ The speed is decreased.

Fig. 113: Hand throttle

The speed is displayed on the SENCON beside the relevant symbol.

6.26 Setting the fail-safe speed on the central electrical system

If the SENCON or the hand throttle fail, the engine speed can be set using the fail-safe speed switch in the switch cabinet.

The fail-safe speed switch has three switch positions:

| Switch position | Function |
|-----------------|------------------------------|
| Top | Maximum engine speed |
| Center | Fail-safe speed switched off |
| Bottom | Reduced engine speed |

1. ▶ Open the rear, left service hatch.
2. ▶ Remove the cover from the switch cabinet.

3. → Open protective covering (1).
4. → Set switch to the desired position.
5. → Close protective covering.
6. → Attach the cover to the switch cabinet.

Fig. 114: Speed selection switch in switch cabinet

6.27 Starting central lubrication (option)

The central lubrication system lubricates all bearing points for the operating equipment as well as the slewing ring track. The cycle for the automatic lubrication process is factory-set to one hour. If needed, additional lubrication processes can be introduced. The central smearing system is only operational for running diesel engines.

- Turn the **Central lubrication** button to the right.
 - ⇒ The lubrication process is started manually.

6.28 Exhaust aftertreatment system

DEF

DEF is a urea-based solution used in the exhaust aftertreatment of diesel engines to reduce nitrogen oxides.

⚠ CAUTION

Health hazard from contact with DEF!

- **Wear protective clothing, safety goggles and protective gloves.**
- **Avoid contact with eyes and skin.**

DEF can cause eye irritation if it comes into contact with the eyes.

Operation

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

NOTICE

Risk of serious damage to parts due to crystallizing DEF!

- 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.
- Do not spill DEF onto hoses or wiring.

If DEF is not immediately and continuously removed, it crystallizes and can cause serious damage. DEF can damage hoses and cables beyond repair.

| Icon | Description | Action |
|------|-------------|--|
| | DEF level | Grey: <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. |

6.29 DEF/system for reducing nitrogen oxides (for 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 any parts of the machine that come into contact with DEF with water.
- Rinse out the DEF tank with distilled water only.

DEF

DEF is a urea-based solution used in the exhaust aftertreatment of diesel engines to reduce nitrogen oxides. In North America it is known as **Diesel Exhaust Fluid (DEF)**.

Nitrogen oxides

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

DEF factory filling

The factory filling of DEF meets the following standards:

- ISO 22241-1
- DIN 70700
- ASTM D7821

Alternative names for DEF

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

- Catalyst Solution
- 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:

- *Contamination in the DEF circuit*
- *Direct sunlight*

Storing DEF

DEF can be stored for 3 to 6 months under the following conditions:

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



Information

Check the quality of the DEF with a refractometer before starting up machines that have been in storage. Observe SENCON error messages and refill or replace the DEF as needed. See the DEF manufacturer's MSDS for more information.

Preheating DEF

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

DEF supply unit

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

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



Information

Turn the ignition back on after pressing the emergency stop button. 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.

Operation

Remote radio control (option)



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.

6.30 Remote radio control (option)

Control elements

For
Reference
Only

Fig. 115: Control elements of the remote radio control

- | | | | |
|---|-------------------------------------|---|---|
| 1 | Starting/stopping the diesel engine | 6 | Working speed core functions, slow/fast |
| 2 | Emergency STOP | 7 | RCL audible signals on/off |
| 3 | Increase/reduce speed | | |
| 4 | Display | | |
| 5 | LED operating indicator | | |

- 8 Horn/release remote radio control
- 9 Crane mode/drive mode
- 10 Remote radio control on/off

Explanation of the control elements

| No. | Function | Description |
|-----|--|---|
| 1 | Starting/stopping the diesel engine | The diesel engine is stopped with the button. |
| 2 | Emergency STOP | After activation, the emergency STOP immediately halts the operation of the machine. In order to put the remote radio control back in operation after an emergency STOP, the horn must be activated. |
| 3 | Increase/reduce speed | This button adjusts the speed of the diesel engine. <ul style="list-style-type: none"> ■ Pressing the button forward increases speed. ■ Pressing the button backward reduces speed. ■ If the button for 1 s is held down in a position, the maximum speed or idling speed is set. |
| 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 | Working speed of the core functions, slow/fast | The core operations of the machine functions are selected with the switch. <ul style="list-style-type: none"> ■ Pressing the switch forward preselects the slow working speed. ■ Pressing the switch backward preselects the fast working speed. |
| 7 | RCL audible signals on/off | The remote radio control emits audible signals from the RCL. This button turns off the audible signals. |
| 8 | Changeover crane mode/drive mode Changeover 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 horn/remote start button must be pressed before the remote radio control over the switch (10) can be turned on. |
| 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. |

Operation

Remote radio control (option)

i The emergency STOP functions can be controlled with the LED operating display. When the emergency Stop is pressed the LED blinks faster.

i An intermittent tone indicates that the battery is low. The remote radio control is turned off after about 30 s.

Joystick assignment

For Reference Only

Fig. 116: 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 | Raise winch 1 Drive right crawler backward |
| III | Slew uppercarriage left | III | | III | Lift boom |
| IV | Slew uppercarriage right | IV | | IV | Lower boom |

i The switches **Changeover switch rock/telescope boom** and **Changeover winch 1 - winch 2** on the control panel in the cab are non-functional when the remote radio control is in use. The radio remote control of drive mode is disabled when the lifting working platform is attached.

Fig. 117: Joystick assignment of remote radio control

Enabling the remote radio control

1. → Switch on the ignition.
2. → Push the switch **radio operation on/off** above the control panel to the right.
3. → Exit the cab.
4. → Sound the horn on the remote radio control.
5. → Start the diesel engine with the switch **diesel engine start/stop** on the remote radio control.
6. → Perform the desired functions using the control lever.

i The beacon on the cab indicates that the machine is being remotely controlled.

Operation

Remote radio control (option)

Description of the machine data on the display of the remote radio control

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

Fig. 118: Display of the machine data on the remote radio control

- 1 Status display of the operating status
- 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 operating status values are found outside of the normal range, a warning signal (3) appears next to its respective field. 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. <ul style="list-style-type: none">■ Operating status is about to exceed normal tolerances.■ Take corrective action soon. |
| | The entire field is filled. <ul style="list-style-type: none">■ Operating status has exceeded normal tolerances.■ Park the machine immediately.■ Take corrective action immediately.■ Only operate the machine when the error has been corrected. |

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. 119: Operating status display on the remote radio control

| No. | 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 AdBlue level | No warning: ■ DEF level (AdBlue level) normal. Half of the field filled: ■ Fill the DEF tank (AdBlue tank) at the next opportunity. Entire field filled: ■ Fill the DEF tank (AdBlue tank) as quickly as possible. |
| 4 | Telescopic boom height | |
| 5 | Working radius | |
| 6 | Actual safe working load | |

Operation

Remote radio control (option)

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

Notification and warning messages

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

Fig. 120: Notification and warning messages on the remote radio control

| No. | Name | Statuses |
|-----|--|--|
| 1 | Serious diesel engine fault | <p>No warning:</p> <ul style="list-style-type: none"> ■ Diesel engine functioning properly. <p>Two fields filled:</p> <ul style="list-style-type: none"> ■ Park machine at safe location immediately. ■ Contact your Grove Service Partner. ■ Only operate machine once error has been corrected. |
| 2 | Diesel engine error | <p>No warning:</p> <ul style="list-style-type: none"> ■ Diesel engine functioning properly. <p>Two fields filled:</p> <ul style="list-style-type: none"> ■ Contact your Grove Service Partner. |
| 3 | Depletion level of exhaust aftertreatment system | <p>No warning:</p> <ul style="list-style-type: none"> ■ Automatic cleaning of the exhaust aftertreatment system. ■ 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. |

Operation

Remote radio control (option)

| No. | Name | Statuses |
|-----|---|--|
| 4 | Automatic cleaning of the exhaust aftertreatment system suppressed. | <p>No warning:</p> <ul style="list-style-type: none"> ■ Automatic cleaning of the exhaust after treatment system active. <p>Two fields filled:</p> <ul style="list-style-type: none"> ■ Automatic cleaning of the exhaust aftertreatment system suppressed. ■ 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 | <p>No warning:</p> <ul style="list-style-type: none"> ■ Safe working load normal. <p>One field filled:</p> <ul style="list-style-type: none"> ■ Safe working load about to be exceeded. <p>Two fields filled:</p> <ul style="list-style-type: none"> ■ Safe working load exceeded. |

| No. | Name | Statuses |
|-----|----------------------|---|
| 9 | RCL bypassed | <p>No warning:</p> <ul style="list-style-type: none"> ■ RCL is active. <p>One field filled:</p> <ul style="list-style-type: none"> ■ RCL is bypassed. |
| 10 | Lifting limit switch | <p>No warning:</p> <ul style="list-style-type: none"> ■ Lifting limit switch not tripped. <p>One field filled:</p> <ul style="list-style-type: none"> ■ Lifting limit switch tripped. |

6.31 Emergency generator (option)

In the case of an emergency or an engine failure all machine movement can be carried out. The emergency generator of the machine makes possible the movement of the machine in spite of a failing engine. The control lever in the cab controls the movement of the following functions

- Turning the uppercarriage right / left
- Telescopic boom forward / backward
- Telescopic boom on / off
- Winch up / down

WARNING

- The emergency generator is not intended for long-term operation. The possible service life of the emergency implementation is dependent on the battery capacity and the burden of the emergency generator.
- All movements in emergency operation take place at reduced speed.
- Observe national and international regulations, state-specific accident prevention regulations, professional regulations and the security instruction of the supplemental documentation.

Improper use of the emergency generator can lead to serious injury and death.



If the national regulations of the machine's country of operation differ from these recommendations, always follow the stricter procedure.

Emergency operation



A 7.5 kW power supply is required for emergency operation. It must be made available by the operator.

Operation

Assignment of the joysticks and pedals

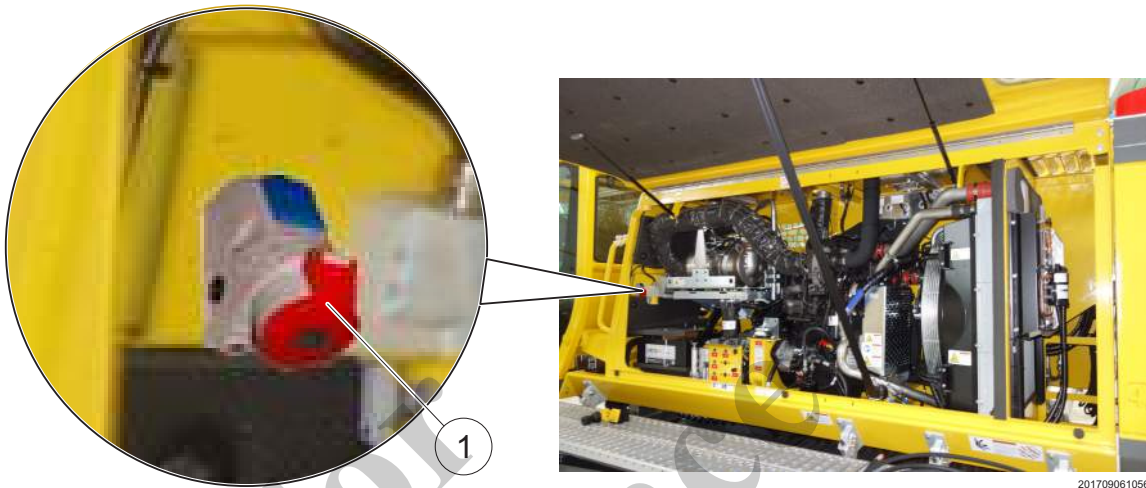


Fig. 121: Connection socket for 7.5kW power supply

Activating Emergency Operation

1. ▶ Enter the cab.
2. ▶ Switch the ignition key to position I.
3. ▶ Pull the safety lever back.
4. ▶ Open the service flap.
5. ▶ Activate the emergency pump with the switch on the upper right of the control panel.
6. ▶ Push the safety lever forward.
7. ▶ Carry out the necessary emergency operation.
8. ▶ At the end of the emergency operation, switch off the switch on the upper right of the control panel.
 - ⇒ The emergency pump is deactivated.
9. ▶ Switch the ignition key to position 0.
 - ⇒ The machine is turned off.



Fig. 122: Emergency pump switch

6.32 Assignment of the joysticks and pedals

NOTICE

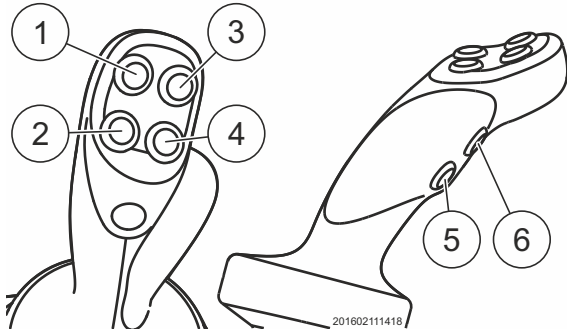
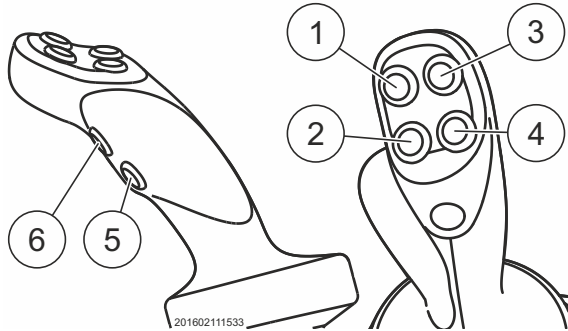
Risk of machine damage due to improper handling of slewing gear brake.

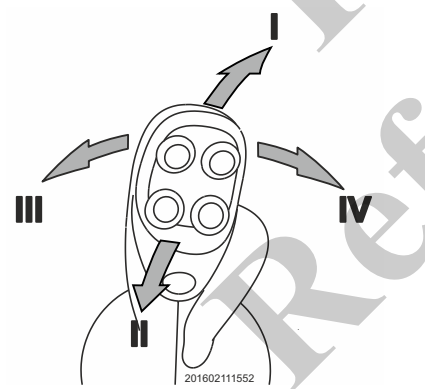
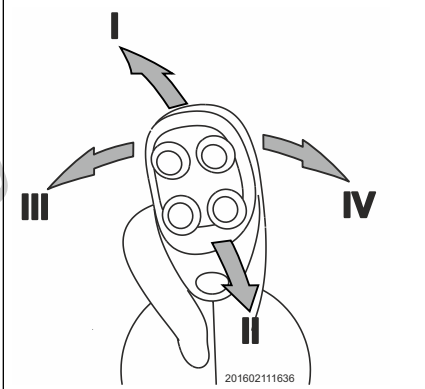
Using the slewing gear brake during work mode may damage the machine.

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

Operation

Assignment of the joysticks and pedals

| Left joystick | | Right joystick | |
|---|-------------------------------|--|---------------------------------|
|  | |  | |
| 1 | Slewing gear holding brake | 1 | Lower pole claw (option) |
| 2 | Open pole claw (option) | 2 | Lift pole claw (option) |
| 3 | Slewing gear freewheeling | 3 | Option |
| 4 | Close pole claw (option) | 4 | Horn |
| 5 | Setting up the fly boom | 5 | Option |
| 6 | Slewing speed - uppercarriage | 6 | Winch movement indicator on/off |

| | | | | | |
|---|-----------------------------------|---|------------------------------|---|----------------------------------|
|  | | | |  | |
| I | Lower winch 2 Turn auger right | 1 | Slewing gear service brake | I | Lower winch 1 |
| II | Lift winch 2 Turn auger left | 2 | Drive pedal, left crawler | II | Lift winch 1 |
| III | Slew uppercarriage left | 3 | Drive pedal, right crawler | III | Lift boom Telescope boom in |
| IV | Slew uppercarriage right | 4 | Throttle pedal diesel engine | IV | Lower boom Telescope boom out |

Slewing speed - uppercarriage

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

Operation

Traveling > Uppercarriage locking mechanism

6.33 Traveling

6.33.1 Uppercarriage locking mechanism

NOTICE

Risk of damage to the uppercarriage locking mechanism if the uppercarriage is not completely unlocked.

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

After the uppercarriage has been unlocked in the SENCON, in some cases the locking bolt (1) will not completely move out of the locking mechanism. If the uppercarriage is slewed when not completely unlocked, the uppercarriage locking mechanism can be damaged.

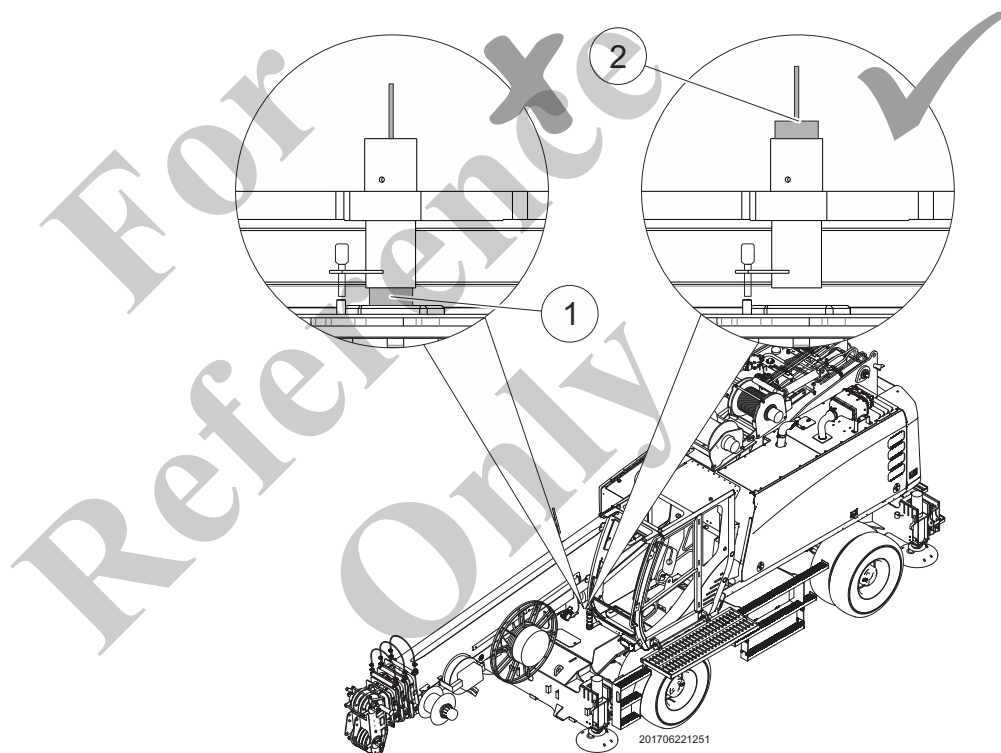


Fig. 123: Extended (2) and retracted (1) locking bolt (exemplary representation)

Lock and unlock the uppercarriage

1. → Start the diesel engine.
2. → Wait until the SENCON has booted.
3. → Configure and confirm the RCL operating mode.
4. → Press the HOME button on the SENCON.

5. ➤ Press the **Setup** menu button on the SENCON.
6. ➤ Move the SCROLL wheel one position to the right.
 - ⇒ The **Setup 2/2** window opens on the SENCON.
7. ➤ Push the safety lever forward.
8. ➤ Press the **Unlock/lock uppercarriage** menu button.
 - ⇒ The uppercarriage is unlocked once the status field appears.

The uppercarriage is unlocked once the status field appears.

6.33.2 Securing the bottom hook block to the undercarriage

NOTICE

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

- Secure the bottom hook block.

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

NOTICE

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

- Slowly and carefully tension the hoist rope.

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

Operation

Traveling > Steering the machine

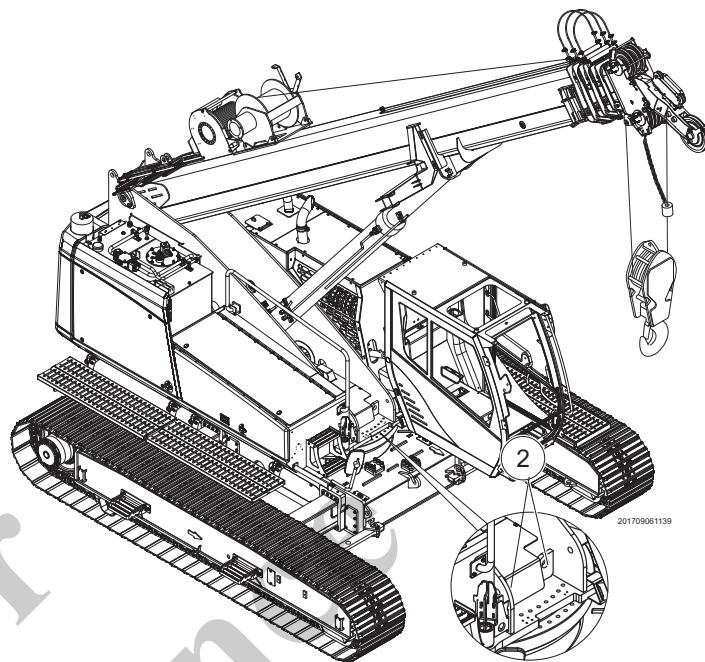


Fig. 124: Securing the bottom hook block to the undercarriage

1. ➤ Raise telescopic boom as far as possible.
2. ➤ Apply the slewing gear holding brake.
3. ➤ Lower winch 1 until the bottom hook block hangs near the cab.
4. ➤ Attach the included lifting tackle to the lifting eyelets on the uppercarriage and to the bottom hook block.
5. ➤ Lift winch 1 slowly and carefully until the hoist rope is slightly tensioned.
6. ➤ Move the boom to between 30° and 60°.
7. ➤ When necessary lift winch 1 slowly and carefully and increase the tension in the hoist rope.

6.33.3 Steering the machine

▲ WARNING

Starting in the wrong direction poses a risk for accidents!

- Always select the desired direction of travel before driving.
- Drive slowly and carefully.

When the preselected direction of travel is opposite to the position of the uppercarriage to the undercarriage, the direction of travel and the direction of rotation are reversed. If the machine is accidentally moved against the expected direction of travel, this can lead to accidents. Serious injuries and property damage can result.

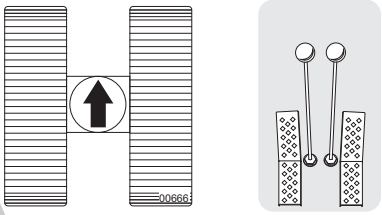
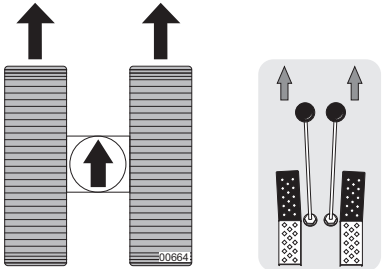
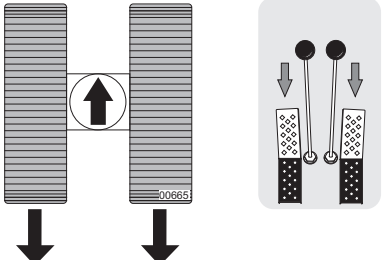
NOTICE

Risk of damage to crawler tracks and running gear components due to driving over elevations and depressions.

- Under no circumstances can you lower or raise obstacles.
- Only drive on level, smooth routes and roads.
- Observe the permissible floor load.

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

i On the front part of the undercarriage is a red control arrow. If this is seen through the right cab window, the boom is above the front axle.

| 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. |  |

Operation

Traveling > Steering the machine

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

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

6.33.4 Traveling with suspended load

Safety instructions

- Reduce pendulum movement of the load through careful driving.
- Carry the load as close to the ground as possible.
- Observe permissible wind speeds.
- Rotate 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 at the lowest gear and not faster than 0.4 m/s (0.8 mph).
- The ground must be sufficiently load-bearing.
- Do not drive on top bumps and ground shafts.

Driving on even ground

The machine may be operated with 100 % of the permissible payload under the following conditions:

- At speeds up to 0.1 m/s (0.2 mph).
- The travel distance must not exceed the permissible inclination of 0.3° in the direction of travel, and on the side.
- The road must be level and sufficiently load-bearing.
- Do not pass over tops and ground shafts and take account of occurring ground pressures.

Operation

Work mode > Safety instructions for operation

Reduced load capacity when traveling at a speed above 0,1 m/s (0.2 mph) over level ground

Reduced load capacity at speeds above 0.1 m/s (0.2 mph) over level ground is calculated from:

At least **0.5t (0.6 US t)** must be deducted from the permissible load **and** the reduced load capacity may not be more than 90% of the permissible load capacity.

6.33.5 Restrictions when traveling on slopes and inclined ground

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

| Incline | up to 2° | up to 4° | up to 6° | > 6° to 25° |
|---|-------------------------------|------------------|---|---|
| Max. boom length movable for the respective inclination | 25.2 m (82.7 ft) | 25.2 m (82.7 ft) | 13.8 m (45.3 ft) | <ul style="list-style-type: none"> ■ Moving with a load is not permitted. ■ Driving without load is only allowed, <ul style="list-style-type: none"> – if all removable counterweights are attached according to the manufacturer's instructions. – when the upper-carriage is in the direction of travel. – when the load hook is anchored against pendulum motion on the machine. |
| Load capacity (relates to the relevant load lift chart for the corresponding inclination) | 100% | 100% | 25% (The permissible load capacity is equal to 25% of the load capacity valid for the 0.3° table) | |
| Reeving | Same as at 100% load capacity | | | |

i *Load capacity at 6° incline:
The load capacity lessens to 25% of the corresponding 0.3° main boom table.*

6.34 Work mode

6.34.1 Safety instructions for operation

- Before startup carry out the checks in accordance with Chapter 2 SAFETY.
- Operation and control must only be carried out by trained personnel.
- Make sure no one is in the danger zone except the slinger and the banksman.
- Plaintiffs and referrers must be able to have visual contact or communicate with each other.
- Only operate the machine from the driver seat or with the optional remote radio control.
- Do not use the machine to transport persons.
- Maintain a safe distance from overhead power lines.

- Take note of environmental conditions such as poor visibility and wind speeds.
- If a storm is approaching, put the machine in parked position.
- Only use the specific load lift charts for the machine.
- Observe the performance specifications of the machine.
- Check whether or not attachment points and attachment ropes have adequate load-bearing capacity.
- Comply with the banksman's signals.
- Position the boom in the direction of travel for movement when longer traveling longer distances, hook in and secure the bottom hook block.
- Before leaving the cab:
 - Park the machine on secure ground. Move away from the edge of the embankment when necessary.
 - Lower attached loads.
 - Secure working equipment.
 - Pull back the safety lever.
 - Block slewing gear.
 - Switch off the diesel engine.

Lock the cab.

NOTICE

Risk of damage to the machine when freeing jammed loads.

- Select the corresponding operating mode on the SENCON.
- Never breach the RCL.

Improper pile driving or freeing of jammed loads can damage the machine.

6.34.2 Slewing the uppercarriage

⚠ WARNING

Risk of death due to moving parts in the work area of the machine.

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

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

NOTICE

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

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

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

Operation




Work mode > Slewing the uppercarriage

Uppercarriage slewing speed

The uppercarriage slewing speed depends on:

- Diesel engine speed
- How far the left joystick is moved

The uppercarriage rotation speed can be adjusted to the relevant working conditions using the SENCON:

| | | |
|--|--|---|
|  <p>Quick-select button on the SENCON</p> | <p>Reduction of the uppercarriage rotation speed for more accurate work</p> | <p>Reduced slewing speed. Normal slewing speed. Reduced slewing speed must be used when the fly boom is attached.</p> |
|   <p>Setting working speed on the SENCON</p> | <p>Individual adjustment of the upper carriage rotation speed</p> | <p>The procedure is described in the SENCON chapter on "Setting functions' working speed". Chapter 5.6 "Set speed of crane control functions" on page 96</p> |

Slewing gear holding brake

If the green icon **slewing gear holding brake engaged** is shown on SENCON, the slewing gear holding brake is engaged. The slewing gear holding brake engages once the ignition is turned on or the safety lever is pulled. The uppercarriage cannot be slewed as long as the slewing gear holding brake is engaged. 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.

Slewing gear holding brake statuses

| Icon | Explanation |
|------|--|
| | Slewing gear holding brake engaged. The slewing gear holding brake is engaged once the ignition is turned on. The uppercarriage cannot be slewed as long as the slewing gear holding brake is engaged. |
| | Slewing gear holding brake not applied. |

Unlock slewing gear holding brake

1. → Start the diesel engine.
2. → Press the button (1) on the left joystick.
 - ⇒ The slewing gear holding break is thereby unlocked.

Fig. 125: Unlock slewing gear holding brake

Slewing the uppercarriage

1. → Start the diesel engine.
2. → Unlock the slewing gear holding brake.

Fig. 126: Slewing the uppercarriage

3. → Press the left joystick to the left (I).
 - ⇒ The uppercarriage is slewed to the left.
4. → Press the left joystick to the right (II).
 - ⇒ The uppercarriage is slewed to the right.

Operation

Work mode > Slewing the uppercarriage



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. 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. To stop slewing, move the left joystick in the opposite direction or step on the slewing gear brake pedal.

Stop uppercarriage slewing

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.

1. Release the joysticks in middle position.

2. Step on the slewing gear brake pedal (1).

Fig. 127: Slewing gear service brake



Tactful steering in the opposite direction with the left joystick strengthens the breaking action.

Slewing gear freewheeling



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

When the slewing gear freewheel is engaged and the slewing uppercarriage of the left joystick is released, the uppercarriage slews itself again with uninterrupted speed.

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

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

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

When the **load moment limitation** of a uppercarriage incline is set at more than 0.3° in the SENCON window, the slewing gear free-wheel is not available.

Slewing gear freewheel statuses

| Icon | 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 free-wheel cannot be engaged. |

Powering the slewing gear free-wheel on and off

1. → Start the diesel engine.
2. → Disengage the slewing gear holding brake.

Fig. 128: Activating slewing gear freewheeling

3. → Press the slewing gear brake pedal (2) down and press the button (1) on the left joystick.
 - ⇒ The slewing gear freewheel is on. The green **Slewing gear freewheel engaged** icon appears on the SENCON.
4. → Press the button (1) again on the left joystick.
 - ⇒ The slewing gear freewheel is on. The gray **Slewing gear freewheel disengaged** icon appears on the SENCON.

Operation

Work mode > Lift and lower loads

6.34.3 Lift and lower loads

Safety instructions

⚠ DANGER

Risk of death or serious injury due to suspended loads.

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

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

NOTICE

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

- Do not shorten the lifting limit switch chain.
- Before operation, check that the lifting limit switch is correctly attached and functioning properly.

If the lifting limit switch chain is shortened, it can cause a delayed response in the lifting limit switch. This results in the rope not stopping in time and the bottom hook block colliding with the boom head.

- 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 permissible wind speeds.
- Pay attention to the correct RCL settings.
- Make sure the rope has no slack.
- At low temperatures under 0°C (32°F) run the hoisting gear slowly to ensure that the stiff rope coils properly.
- Operate the winch slowly when environmental temperatures are below 0 °C (32 °F) in order to reel the rope securely.

i

The lift speed of the winch depends on the

- speed of the drive engine,
- Deflection of the right joystick.

Switching joystick assignment for winch control

1. ➔ Unlock the **Changeover winch 1-2** switch and turn it to the left.

⇒ The left joystick drives the winch 2.

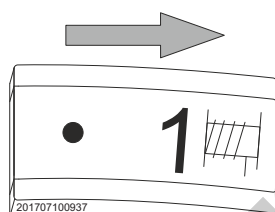
The right joystick drives the winch 1.

2. → Unlock the **Changeover winch 1-2** switch and turn it to the right.

⇒ The left joystick drives the winch 1.

The right joystick drives the winch 2.

Lift and bottom hook block with winch 1



1. → Press the **Activate winch 1** switch to the right.
2. → Push the joystick activated for winch 1 forward.
⇒ The bottom hook block lowers.
3. → Push the joystick activated for winch 1 backward.
⇒ The bottom hook block rises.

Lift and bottom hook block with winch 2



1. → Turn the **Equip winch 2** switch to the right.
⇒ Winch 2 is in working position.
2. → Press the **Activate winch 2** switch to the right.
⇒ The winch arrows do not glow red in the SENCON.
3. → Push the joystick activated for winch 2 forward.
⇒ The bottom hook block lowers.
4. → Push the joystick activated for winch 2 backward.
⇒ The bottom hook block rises.

Operation

Work mode > Operate with two winches

6.34.4 Operate with two winches

6.34.4.1 Safety instructions

▲ WARNING

Risk of death when permissible safe working loads and operating parameters of the load moment limitation are not observed!

- The weight of the load may not exceed the permitted load capacity for the boom extension.
- Always select the appropriate RCL program (auxiliary jib or fly boom).
- When adjusting the load, only a load moment reduction is permitted! This means that the center of gravity must move towards the machine. Permitted modes of operation, see [Chapter 6.34.4.3 “Lift with two winches” on page 197 \(A\) and \(B\)](#). Any other working methods are prohibited, see [Chapter 6.34.4.3 “Lift with two winches” on page 197 \(C\) and \(D\)](#).

If the permitted load capacities and operating parameters of the load moment limitation are not observed, serious material and personal damage, including death, is possible.

6.34.4.2 Tracking an unloaded hook

The tracking of an unloaded hook is necessary when the length of the telescopic boom is changed so that the hook is neither pulled into the lifting limit switch nor hits the ground.

In order to prevent the RCL from limiting the load capacity to the smaller number of strands and, if necessary, switching it off, the number of strands for the winch to which the unloaded hook hangs from can be set to "0" in the RCL

Once the ignition is switched off, the strand count is reset to the initial value.

6.34.4.3 Lift with two winches

For working with the fly boom (SA) and / or the heavy load tip (SLS) apply:

Permitted operating methods

In operating methods (A) and (B) the load moment reduces in that the load is brought closer to the machine. The danger of the machine becoming overloaded and tipping over is therefore reduced.

For Reference Only

Fig. 129: Permitted operation methods when working with 2 winches

Operating method A

The load is suspended vertically. The upper attachment point on the load is fastened to the rope of the boom extension. The rope of the boom extension carries the entire weight of the load.

The lower attachment point on the load is fastened to the rope of the telescopic boom. The rope of the telescopic boom is not bearing any weight. The rope of the telescopic boom must be lightly tensioned so that the rope does not drag.

1. → Bring up winch 2 until the load is horizontal.
⇒ The load moment is reduced and safe lifting is ensured.
2. → Drive off both winches at the same time in order to lower the load.

Operation

Work mode > Operate with two winches

Operating method B

The load is suspended horizontally. The weight of the load is equally distributed across the rope of the telescopic boom and the boom extension.

1. → Pull out winch 1 until the load hangs vertically. Make sure the rope has no slack on the boom extension when doing so.
 - ⇒ The load moment is reduced and safe lifting is ensured.
2. → Lower the load with winch 2. Follow the rope of winch 1.

Prohibited operation methods


For
Reference
Only

Fig. 130: Prohibited operation methods when working with 2 winches

In operating methods (C) and (D) the load moment increases in that the load is brought further from the machine. As a result, the machine can become overloaded and tip over.

6.34.4.4 Tilt-up panel lifting

Second hook (only on the auxiliary jib)

- Activation of the operating mode via the softkey  in the display. After activation, the load-bearing capacity of the machine is reduced to max. 2 strands (the RCL overwrites the previously chosen strand count and accepts no changes of the strand count).



Once the ignition is switched off, the strand count is reset to the initial value.

NOTICE

Further precautions and requirements follow to ensure secure operation.

Die Benutzung des betrachteten Krans für „Tilt-Up Panel Lifting“ mit zwei Seilzügen stellt neue und unterschiedliche Gefahren dar, als das normale Heben. Deswegen müssen die folgenden zusätzlichen Sicherheitsvorkehrungen getroffen werden, falls es notwendig ist, den Kran für „Tilt-Up Panel Lifting“ zu benutzen und der Kran mit zwei Seilzügen ausgestattet ist:

- Der Kran muss aufgestellt und betrieben werden in Übereinstimmung mit den Anweisungen von Grove in dem Betriebs- und Sicherheitshandbuch, der Traglasttabelle und den Aufklebern, die an dem Kran angebracht sind.
- Das Drahtseil der Hauptwinde muss über der Hauptausleger-nase eingesichert werden für zwei Teile des Seils (?)
- Das Drahtseil der Zusatzwinde muss über der Zusatzausleger-nase eingesichert werden für einen Teil des Seils (?)
- Die Ladung muss mit dem Hauptseilzug verbunden sein, welche mit ihrem Ende so nah wie möglich am Kran befestigt sein muss und der Zusatzseilzug muss so weit entfernt wie möglich vom Kran befestigt sein.
- Das Anti-Zwei Blockiersystem muss installiert und überprüft sein, um zu bestätigen, dass es aktiv ist, um beide Seilzüge zu überwachen.
- Die RCL Windenauswahl muss auf die Hauptwinde und zwei Teile des Seiles (?) eingestellt sein.
- Das Windenseil und die Laufrolle müssen vor und nach dem Hebeeinsatz auf Reibung und Scheuern überprüft werden.
- Das Gesamtzuggewicht darf 80% der Standardtraglasttabelle nicht überschreiten. Der Betreiber ist dafür selbst verantwortlich, da der RCL keine Funktion hat, verringerte Hebegrenzen einzustellen.
- Der Zusatzseilzug muss als Teil der Abzüge angesehen werden, um die erlaubte Netto-Ladung zu bestimmen.
- Das Paneel muss angehoben werden, sodass die Seilzüge in einer Linie mit dem Kran sind.
- Die Ladung muss kontrolliert werden, um eine Drehung der Ladung zu vermeiden und um sicherzustellen, dass die Ladung in einer Linie mit dem Ausleger bleibt.

Operation

Work mode > Lifting and lowering the telescopic boom

- Die Ladung muss mit dem Zusatzseilzug ausgeglichen werden, ohne dabei mehr als die Hälfte der Ladung zu jeder Zeit während des Anhebens aufzunehmen. Der RLC wird keine Absicherung für den Zug des Zusatzseilzugs bieten. - Der Einfluss von Wind auf den Kran und das Paneel muss berücksichtigt werden. Der Betrieb muss eingestellt werden, wenn Wind einen Kontrollverlust über die Ladung verursachen kann.
- Der Hauptseilzug muss dazu verwendet werden, das Paneel in die vertikale Position zu heben.

Gehen Sie sicher, dass das komplette Personal, das an und um den Kran herum arbeitet, ausreichend trainiert und vollständig mit den Betriebsfunktionen des Krans sowie den Sicherheits- und Arbeitsmethoden vertraut ist.

Das Personal sollte vollständig mit den Vorschriften und Normen der Steuerung eines Krans und dessen Betriebens vertraut sein.

Arbeitsmethoden können leicht zwischen staatlichen Vorschriften, lokalen Vorschriften und Baustellenvorschriften sowie Arbeitgeberrichtlinien abweichen, daher ist ein vollständiges Wissen und Verständnis über die relevanten Arbeitsregelungen notwendig

6.34.5 Lifting and lowering the telescopic boom

WARNING

Danger of personal injury and danger of machine damage due abruptly raising and lowering of the telescopic boom!

- **Raise and lower the telescopic boom slowly and in a controlled manner.**

Abrupt movements of the telescopic boom can result in component failure or cause the machine to tip.

The telescopic boom is raised and lowered using the right-hand joystick. The raising and lowering speed of the telescopic boom depends on the speed of the diesel engine and the deflection of the right-hand joystick.

In order to be able to raise and lower the telescopic boom, the switch "**Changeover luffing down-up/telescope in - out**" must be in the left position.

The raising speed and lowering speed of the telescopic boom can be adjusted to the relevant working conditions using the SENCON:



The procedure is described in the SENCON chapter on "**Setting functions' working speed**". ↪ Chapter 5.6 "Set speed of crane control functions" on page 96

Movement directions of the right-hand joystick for raising and lowering the boom

1. → Push the right-hand joystick to the left.
⇒ The telescopic boom is raised.
2. → Push the right-hand joystick to the right.
⇒ The telescopic boom is lowered.

i *If the RCL has reacted due to overloading, the function "Raise boom" is not operable. In order to bring the machine into a safe position, it can be necessary to bypass the "Raise boom" function. See Section ↗ Chapter 6.23.5 "Bypass RCL" on page 164*

6.34.6 Extending and retracting the telescopic boom

The telescopic boom is extended and retracted with the right joystick.

In order to be able to raise and lower the telescopic boom, the switch "**Changeover luffing down-up/telescope in - out**" must be in the right position.

Movement directions of the right-hand joystick for extending and retracting the boom

1. → Push the right joystick forward.
⇒ The telescopic boom is extended.
2. → Pull the right joystick back.
⇒ The telescopic boom is retracted.

6.34.7 Working range limitation

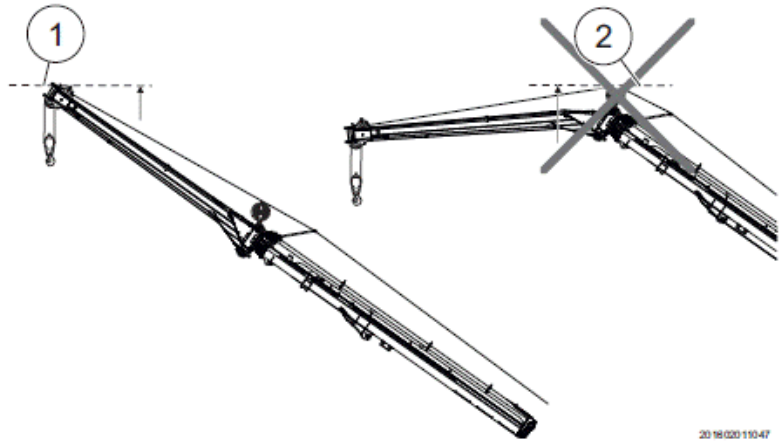
The working range limitation is controlled by a console in the cab and has the following functions:

- Boom angle limitation
- Tip height limitation
- Work radius limitation
- Uppercarriage-rotation angle limitation

i *Information*
See the operating manual of the bracket in the appendix.

Operation

Work mode > Normal operation with the elevating work platform



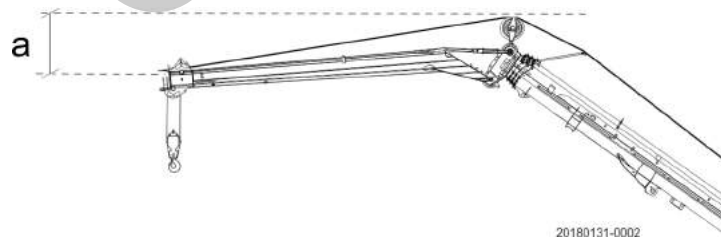
NOTICE

Risk of damage to machine and surroundings from failure to observe the maximum levels!
The maximum height of the machine can be greater than the set value of the height limitation for certain boom configurations (2).
If the highest point of the machine exceeds the configured height limit value, the machine may collide with objects in the work area. This can cause serious property damage. Always use the height of the foremost pulley head (1) for the height limitation.

During operation with an angled tip

NOTICE

Risk of damage to machine and surroundings from failure to observe the maximum levels!
When operating with an angled tip, the height limit is at a safe distance of 1 m (3.3 ft) lower than the actual obstacle.



a Safe distance: 1 m (3.3 ft)

6.34.8 Normal operation with the elevating work platform



See the corresponding operating manual.

6.34.9 Normal operations as a carrier for the driving / removing of pile driving equipment

⚠ WARNING

Improper operation of the machine when driving and removing pile elements can lead to death or injury and may cause severe material damage to the machine!

- **Observe all safety precautions before and during operation of the pile driving equipment.**
- **Avoid slack rope.**

Safety precautions to be observed before commencing work

- Follow the respective manufacturer's instructions for the pile driving equipment and the instructions in this operating manual.
- The operator must have been instructed in the operation and maintenance of pile driving equipment and in all safety precautions associated with the subject.
- Operation as a carrier device for inserting and removing piling equipment is only allowed,
 - with the maximum wheel track width.
 - with the maximum counterweight.
 - if the total weight of the piling machine, piling equipment, ducts and other attachments is a maximum 80% of the published load capacity values for maximum track width and maximum counterweight.
 - Over the main boom. Operation as carrier over the jib or fly boom is not permitted.
 - If driving or removing pile elements using pile driving equipment is only successful in the vertical direction. Hoisting at an angle or lateral loads on the boom is not permissible.
 - when used for the removal of piling equipment that prevent the transmission of vibrations and impact loads on the crane. In addition, all precautions are to be taken that prevent the transmission of vibrations and impact loads on the crane, or at least minimize them. The removal of piling equipment only with the winch is not permitted.
- The winches must be equipped with a rope guide to guarantee the safe winding and decoiling of the cable.
- All lock pins of the rope holder and the rope guide / bracket must be positioned.
- Operation as carrier over the jib or fly boom is not permitted.
- All load hooks must be equipped with a positive locking latch.

Safety precautions to be observed during work

- The driving or removing of pile elements using pile driving equipment is only carried out in the vertical direction. Hoisting at an angle or lateral loads on the boom are not permissible.
- The RCL must be enabled to its full functionality. Working with deactivated or bypassed load moment limitation is not permitted.
- Avoid rope slack between carrier and pile driving equipment.

Operation

Work mode > Normal operations as a carrier for the driving / removing of pile driving equipment

- Keep the piling equipment and attachments away from the boom head at all times.
- During operation, as a carrier for inserting and removing piling equipment – daily inspections should be carried out and recorded in addition to regular and periodic inspections.
 - Inspect all the lifting limit switches and the RCL daily and check their functionality.
 - Inspect the boom daily to make sure all sliders are in place. For booms that use a bolting system, check the bolting mechanism daily for functionality and wear.
 - Check the hoist rope daily for damage or wear.
 - Inspect all strength-relevant areas on a monthly basis and additionally before the crane goes back to lifting mode.

Avoiding rope slack

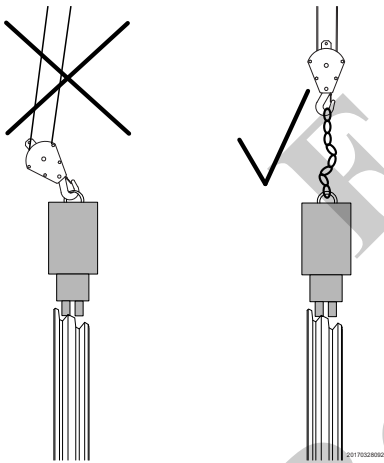


Fig. 131: Avoiding rope slack when driving pile elements

NOTICE

Rope slack

- There is a risk of the rope becoming slack as soon as the load hook / bottom hook block - as minimum weight - is no longer freely suspended by the hoisting rope.
- If the hoisting rope is slack, it is no longer ensured that it is wound tightly onto the rope drum.
- If the hoisting rope is not wound tightly, it may be subject to load jerks and uncontrolled load when being led out, causing damage to the rope.
- Do not let the load hook rest on the load / pile driving equipment.
- Fit hoisting equipment (chain) between the load hook of the carrier and the pile driving equipment for length adjustment in order to avoid rope slack as well as tensile force on the pile driving equipment during driving operation.
- Never suspend the full weight of the pile from the load hook while driving or removing piles.
- The load suspension device must not be subject to tensile force when driving piles by means of vibrator implement.

Avoiding rope slack when driving pile elements

6.35 Parking the machine

1. → Park the machine on level, solid ground.
2. → Align the uppercarriage with the undercarriage.
3. → Lower attached loads.
4. → If necessary, fully lower the cab.
 - i* Machines with inclinable cabs Set inclinable cab to 0°.
5. → Apply the slewing gear holding brake.
6. → Let the diesel engine idle for 5 - 10 minutes.
7. → Turn the ignition key to position 0.
8. → Pull the safety lever.
9. → Lock the cab and windows.
10. → Wait 3–minutes.
11. → Turn off the battery disconnect switch.
12. → Secure the work tool.
13. → Lock undercarriage.

Operation

Depressurizing the hydraulic system

6.36 Depressurizing the hydraulic system

▲ WARNING

Risk of severe burns from hot parts and hydraulic oil.

- **Avoid contact with hot parts.**
- **Wear protective clothing and protective gloves.**
- **Shut down the leaking hydraulic system immediately.**

Contact with hot hydraulic system parts or hot hydraulic oil can cause severe burns.

Protective equipment: ■ Protective clothing
■ Hygiene protection gloves
■ Safety shoes

1. ▶ Lower the attached loads to the ground.
2. ▶ Switch off the diesel engine.
3. ▶ Turn the ignition key to position I.
4. ▶ Push the safety lever forward.
5. ▶ Slowly activate the steering lever and the pedals several times in all directions.
6. ▶ Activate all buttons and switches for hydraulic functions several times.
7. ▶ Open the aeration filter on the hydraulic oil tank.
8. ▶ Close the aeration filter.
9. ▶ Turn the ignition key to position 0.

7 Setup

7.1 Safety instructions regarding setup

- Protective equipment:
- Protective gloves
 - Safety shoes
 - Hearing protection
 - Protective clothing
 - Fall arrest safety harness
 - Hard hat
-
- When disassembling components or equipment, always use load suspension equipment with a sufficient load 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.
 - Perform all setup tasks in order.
 - Do not climb on equipment parts or the machine.
 - Keep the necessary suspension gear, wooden planks and tools at hand.
 - Only use the suspension gear that came with the machine for lifting work.

7.2 Walkways

7.2.1 Mounting/dismounting walkways

From the beginning of working with the machines, the walkways at the cab entrance and on the right side of the uppercarriage must be monitored. Installing a walkway is described below.

Install walkways with the undercarriage retracted.

⚠ WARNING

Risk of death from falling walkways!

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

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

Setup

Walkways > Flaps

Fig. 132: Installing the 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). Observe the specified tightening torque of the screws.
4. Make sure the walkway is fastened securely.

i *Removal is the reverse of installation. For transport, remove walkways and step grid holder.*

7.2.2 Flaps

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

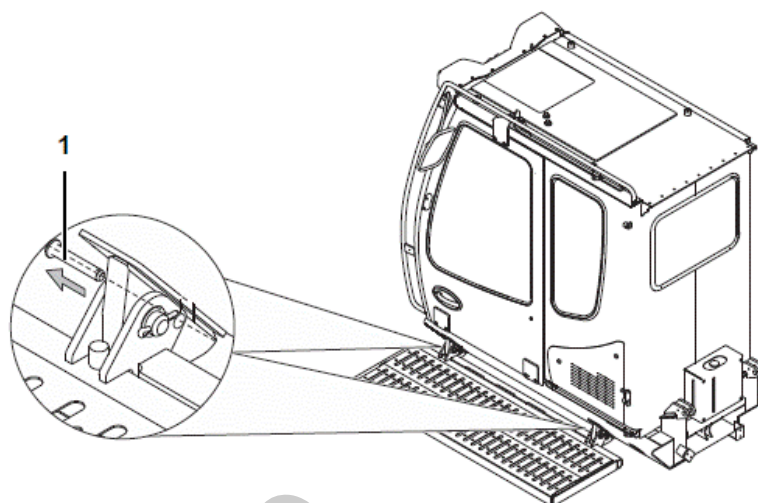


Fig. 133: Fold the walkway (Model Presentation)

1. → Unfasten and pull out the rear bolts (1).

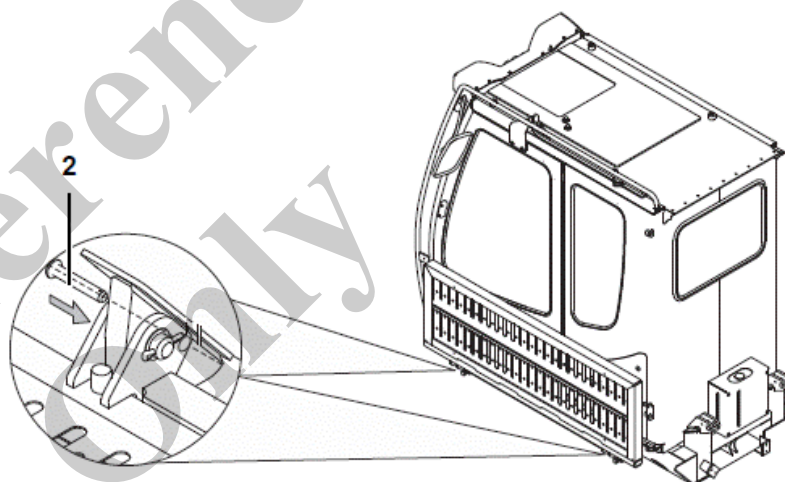


Fig. 134: Stow the walkway (Model Presentation)

2. → Stow the walkway.
 3. → Reinsert the rear bolts (2) and secure them.
 ⇒ The walkway is now secured.

7.3 Track widths

7.3.1 General information

You can change the track width of the machine.

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

Setup

Track widths > Increasing the track width

Safety instructions

- Before extending, align the uppercarriage with the undercarriage and apply the slewing gear brake to prevent twisting.
- Do not slew the uppercarriage while retracting.

7.3.2 Track width markings

The undercarriage has arrows at the positions shown. 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 | 3.8 m (12.5 ft) |
| B | 3.05 m (10.0 ft) |
| Undercarriage fully retracted | 2.3 m (7.6 ft) |

Fig. 135: Track width marking with fully extended undercarriage

7.3.3 Increasing the track width

NOTICE

Risk of damage to the machine.

- **Never drive in obstructed bolts with hammers or mallets.**

Undercarriage and bolts will be damaged due to improper bolt insertion.

1. → Remove the spring cotter pins (2) and the bolts (1) 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.

***i** 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. 136: Unbolting the undercarriage for telescoping

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

Fig. 137: Bolt the undercarriage

7.3.4 Decreasing the track width

NOTICE

Risk of damage to the machine.

- **Never drive in obstructed bolts with hammers or mallets.**

Undercarriage and bolts will be damaged due to improper bolt insertion.

Setup

Track widths > Decreasing the track width

Fig. 138: Unbolting the undercarriage for telescoping

1. ➤ Remove the spring cotter pins (2) and the bolts (1) on the locking rods at the positions shown.
2. ➤ Enter the cab.
3. ➤ Push the safety lever forward.
4. ➤ Start the diesel engine.

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

5. ➤ Press the **Release undercarriage telescoping** switch to the left and hold it until the running gear retracts.
6. ➤ Switch off the diesel engine.
7. ➤ Pull the safety lever back.
8. ➤ Exit the cab.

Fig. 139: Bolting the retracted undercarriage

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

7.4 Steps

⚠ WARNING

Danger of crushing due to moving machine parts!

- 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 drive mode.

Persons will be caught and injured by extending track wheel carriers.

⚠ WARNING

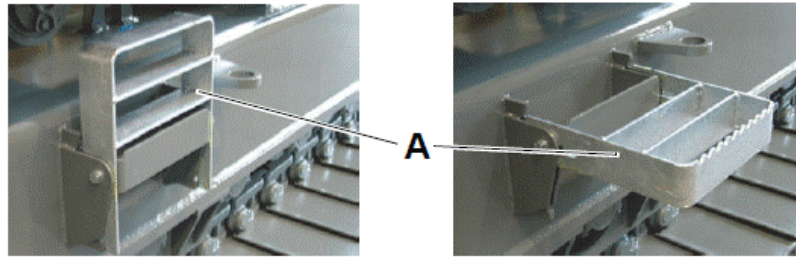
Risk of injury due to slippery surface.

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

Risk of personal injury due to slipping on soiled access ladders.

Setup

Setup mode



There are access ladders (A) on both sides of the machine. These must be folded out while working.

Folding out a step

1. → Pull step (A) upward.
2. → Slowly lower step (A) until it rests in horizontal position.

Stowing a step

1. → Lift the lowered step (A) until it is completely against the side wall.
2. → Pull step (A) upward and then lower it.

7.5 Setup mode

Operating modes are selected on the SENCON.

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

- Reeving.
- Setting up the auxiliary jib.
- Setting up the (SA 6,5 / SA 13) fly boom.
- Setting up the elevating work platform.

Certain operating parameters must be configured on the SENCON in order to use operating mode **Setup 1**.

Once setup is complete, the operating parameters must be set according to the machine configuration.

The operating mode is outlined at [linktarget](#)

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Bridged lifting limit switch

When the boom angle is less than 25°, the lifting limit switch is bridged.

NOTICE

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

- When the lifting limit switch is bypassed, lift the load hook slowly.
- Maintain the safety distance of 1 m (3.3 ft) between load hook and boom head.
- Once the load hook has been lowered, do not use the function *Lower hook* any longer.

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 lower hook function is continued when the load hook has been lowered, the rope can be damaged.

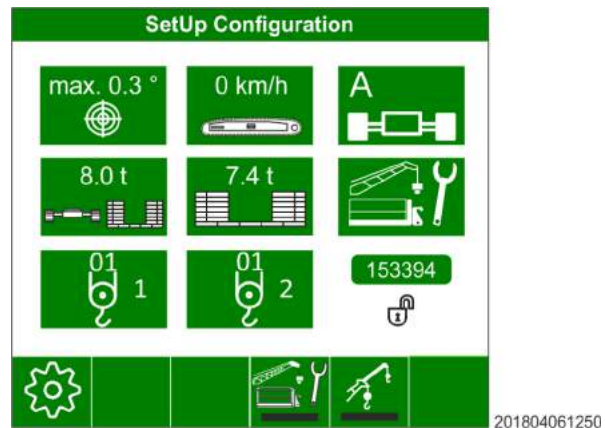
Required operation parameters for Setup 1

| Name | Value to be applied | Icon display in SENCON |
|---------------------------|---------------------|------------------------|
| Uppercarriage inclination | 0.3 ° | |
| Track width | C (2.3 m / 7.55 ft) | |
| Undercarriage ballast | 0 t (0 lbs) | |
| Counterweight | 5 t (11023.1 lbs) | |
| Select operating mode | Setup 1 | |

Setup

Softkeys - quick-action icon setup

7.6 Softkeys - quick-action icon setup



The softkey icon provides the possibility for an immediate change in the setup mode without needing to further change RCL parameters.

The control prevents a currently invalid set-up program from being selected.

Pressing the "Setup attachment" softkey immediately switches to the respective setup mode.

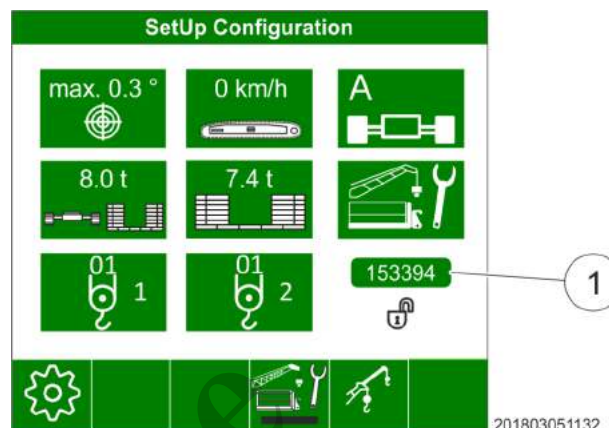
Disabling this menu icon changes the setting back to the previously set up state.

The following set-up work can be carried out with the "Setup attachment" softkey:

- Reeving
- Attaching the undercarriage ballast
- Setting up the auxiliary jib
- Setting up the fly boom

Only install the “setup attachment” if the following conditions apply:

- Maximum track width
- Maximum counterweight



1. → Press the softkey in the “setup state” window.

- ⇒ ■ The “Setup attachment” mode is activated.
- The RCL code (1) in the display changes to corresponds with the “setup” load lift chart.
- The previous machine configuration (setup state) changes only in the display of the boom settings (setup attachment symbol), all other symbols (track width, UC ballast, rear ballast, etc.) remain in the default state on the display.



2. → Press the “Setup attachment” softkey again.

- ⇒ The softkey is deactivated and the setting switches back the previously set setup state.



Once the ignition is switched off, the executed function is cleared.

Track width monitoring is active for the setup attachment.

The lifting limit switch is automatically bridged from a boom angle below 20°.


Setup

Set up the swing barrier protection (option)

Tilt-up panel lifting softkey



Second hook (only on the auxiliary jib)

- Activation of the operating mode via the softkey  in the display. After activation, the load-bearing capacity of the machine is reduced to max. 2 strands (the RCL overwrites the previously chosen strand count and accepts no changes of the strand count).



Once the ignition is switched off, the strand count is reset to the initial value.

NOTICE

Further precautions and requirements follow to ensure secure operation.

7.7 Set up the swing barrier protection (option)

The swing barrier protection indicates the swing range of the uppercarriage in work mode. When in work mode, all persons must stay clear of the swing range.

Fig. 140: Unlocking the swing barrier protection


1.  Pull the locking bolt (1) in out of the swing barrier protection.

Fig. 141: Folding out the swing barrier protection

- 2.** → Completely fold out the swing barrier protection.
- 3.** → Insert and secure the locking bolt (1) in at the position shown.

Fig. 142: Pulling out the swing barrier protection

- 4.** → Pull out the bolt (1). Pull out the swing barrier protection to its full length. Insert the bolt (1) in at the position shown.
- 5.** → Unfold and pull out the swing barrier protection on the second track wheel carrier.

Setup

Attaching the hoist rope

Fig. 143: Applying barrier tape

- ▶ Apply barrier tape (1).

7.8 Attaching the hoist rope

Reeving the hoist rope

- ▶ In SENCON, select the operating mode equip 1.
- ▶ Select according to the operating mode.

Fig. 144: Pull out rope jump off protection

- ▶ Completely lower telescopic boom.
- ▶ Shut down winch and pull hoist rope above the telescopic boom up to the pulley head. Make sure the hoist rope remains taut.
- ▶ Pull the hoist rope out so that enough rope is available for reeving between the pulley head and bottom hook block.
- ▶ Release and remove rope jump off guard (1) and (2).
- ▶ Reeve the hoist rope according to the reeving plan.
- ▶ Plug in and secure the rope jump off guard.

Anchoring the hoisting rope

Fig. 145: Releasing and unscrewing the bolt on the pouch socket

1. → Loosen retaining spring (1).
2. → Unscrew bolt (2) from the pouch socket.

Fig. 146: Inserting hoist rope into pouch socket

3. → Insert hoist rope connecting bolt (1) into the pouch socket.

Setup

Attaching the hoist rope

Fig. 147: Secure pouch socket to the rope anchorage

4. → Secure the pouch socket (1) to the rope anchorage (2) with the bolt (3).

i *The rope anchorage is located on the pulley head or bottom hook block, depending on the reeving.*

5. → Secure the bolt (3) with the retaining spring (4).

Mounting the lifting limit switch weight

NOTICE! Damage due to improperly mounted lifting limit switch weight!

- Do not shorten the chain for the lifting limit switch weight.
- Attach the lifting limit switch weight to the part of the hoist rope that is attached to the rope anchorage.

If the lifting limit switch weight is mounted improperly, the bottom hook block can be pulled against the pulley head. This can cause material damage.

Fig. 148: Securing the hoist end limit switch to the rope

1. → Place both halves (1) and (2) of the lifting limit switch weight around the strand of the hoist rope that is attached to the rope anchorage.
2. → Secure the two halves of the lifting limit switch weight with spring cotter pins (3).

Fig. 149: Connecting weight with lifting limit switch

3. → Attach the chain of the lifting limit switch weight (1) to the rope of the lifting limit switch (2).

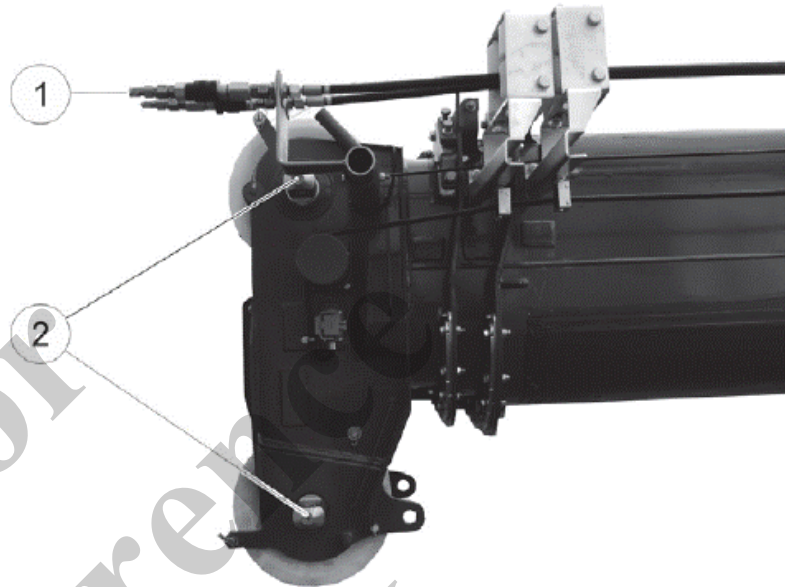
Setup

Slewing the soil drill (option) into working position

7.9 Connections for the pole claw and the supplemental hydraulic systems on the boom head (option)

Safety instructions

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



1. Hydraulic connections
2. Retaining points

7.10 Attaching pole claw (option)

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

7.11 Slewing the soil drill (option) into working position

1. ➤ Enter the cab.
2. ➤ Start the diesel engine and push the safety lever forward.

3. ➤ Select the **Setup** operating mode on the SENCON.
4. ➤ Retract the boom almost completely.
5. ➤ Raise the bottom hook block. Leave 0.5 m (1.6 ft) distance between bottom hook block and lifting limit switch.
6. ➤ Sink the boom about 45 ° until the auger can be pivoted into working position.
7. ➤ Release the **Soil drill on** switch and push it toward the symbol.
 - The soil drill is ready for operation.
8. ➤ Push and hold the **Open soil drill lock** switch.
 - ⇒ The transport tab is unlocked.
9. ➤ Push the left joystick forward until the soil drill has slewed out the transport tab.
10. ➤ Release the **Open soil drill lock** switch.
11. ➤ Push the left joystick forward until the soil drill points downward.
12. ➤ Detach the rope and stow it away.

7.12 Slewing the soil drill into transport position (option)

1. ➤ Enter the cab.
2. ➤ Start the diesel engine and push the safety lever forward.
3. ➤ Select the **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 about 45 ° so that the auger can be pivoted 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.
 - ⇒ The transport tab is unlocked.
9. ➤ Pull the left joystick backward until the soil drill has gone as far as it will go.
 - ⇒ When it reaches the stop, the soil drill is shut down.
10. ➤ Release the **Open soil drill lock** switch.
11. ➤ Push the **Soil drill on** switch away from the symbol.

Setup

Attaching the fly boom (6.5 m)

7.13 Attaching the fly boom (6.5 m)

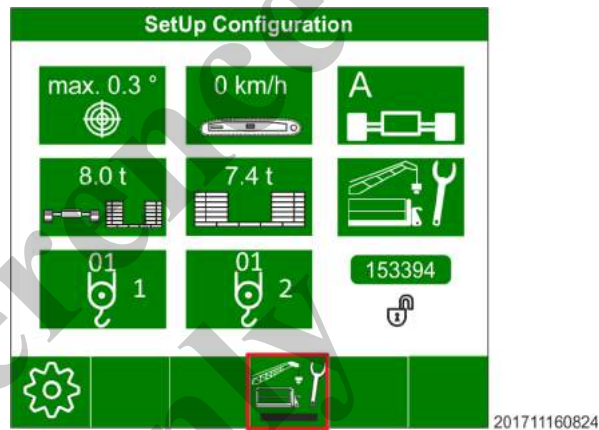
⚠ WARNING

Risk of falling.

- Use a ladder with a minimum height of 1.40 m (4.6 ft) to insert/remove the bolts.
- Do not climb onto the boom.

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

1. Enter the cab.
2. Start the diesel engine.
3. Fully extend the undercarriage.
4. Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



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.

Fig. 150: Lifting the fly boom to the telescopic boom

- 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) and the telescopic boom (1) must be in line.

For
Reference
Only

Fig. 151: Bolting the fly boom

- 13.** ▶ Remove the bolts (1) from the retainers (2).
- 14.** ▶ Bolt the fly boom into the telescopic boom at the bolting positions (1).
- 15.** ▶ Secure the bolts (1) with retaining springs.
- 16.** ▶ Remove the lifting gear from the fly boom and move the auxiliary crane out of the work area.

Setup

Attaching the fly boom (6.5 m)

Fig. 152: Folding up the deflection sheave

- 17.** ▶ Remove the bolt (2) from the retainer (1).
- 18.** ▶ Fold up the deflection sheave (3).
- 19.** ▶ Bolt down and secure the deflection sheave with the bolt (2).
- 20.** ▶ Run the hoist rope over the deflection sheave and the head pulley sheave on the fly boom.

Fig. 153: Inserting the bypass plug on the telescopic boom

- 21.** ▶ Remove the bypass plug (1) from the lower bush (2) and insert it into the upper bush (3).

Fig. 154: Attaching the bypass flag to the telescopic boom

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

Setup

Attaching the fly boom (6.5 m)

Fig. 155: Fly boom lifting limit switch cable

- 23.** ▶ Remove the lifting limit switch cable of the fly boom (1) from the bush.

For
Reference
Only

Fig. 156: Inserting the fly boom lifting limit switch cable into the telescopic boom

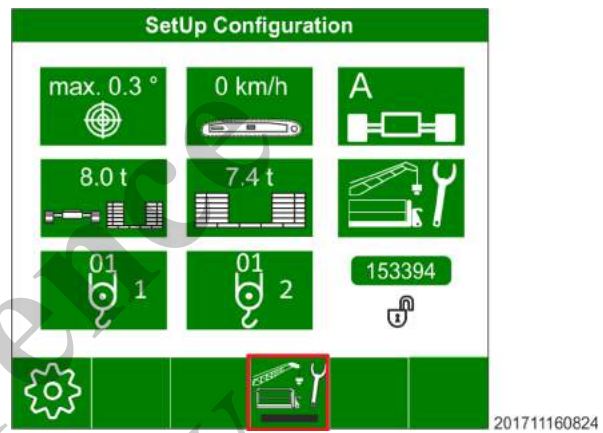
- 24.** ▶ Insert the lifting limit switch cable of the fly boom (1) into the lower bush (2) on the telescopic boom.
- 25.** ▶ Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom.
- 26.** ▶ Secure the bottom hook block in accordance with the reeving plan.

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

Ensure that the fly boom is correctly bolted to the basic body and secured.

This procedure requires a space of at least 10 m (32.8 ft) to the right of the machine. The fly boom must be bolted to the telescopic boom at 0°.

1. → Enter the cab.
2. → Start the diesel engine.
3. → Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



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.
7. → Unreeve the hoist rope.
8. → Lower the telescopic boom to 0° and retract it.

Fig. 157: Attaching a rope for pulling the fly boom

9. → Attach a rope (1) to the fly boom.

Setup

Folding the fly boom (6.5 m) into working position

Fig. 158: Unbolting the ramp

10. ▶ Release and remove the bolt (1) on the ramp.

Fig. 159: Bolting the ramp in setup position

11. ▶ Fold out the ramp (1). Insert the bolt (2) at the position shown and secure it with the retaining spring (3).

Folding the fly boom (6.5 m) into working position

⚠ WARNING! Risk of death from swinging fly boom.

- Observe the deadweight of the fly boom.
- Ensure that no one is in the danger zone. The pivot radius must be at least 10 m (32.8 ft).

The fly boom can swing off its support at high speed and severely injure anybody in its swing range.

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

Fig. 160: Unbolting the ramp

13. ➤ Release and remove the bolt (1) on the ramp.

Fig. 161: Pulling the fly boom around

14. ➤ Use the rope to move the fly boom (1) around until the bolt openings on the right of the fly boom align with those of the telescopic boom.

Setup

Folding the fly boom (6.5 m) into working position

Fig. 162: Pulling out the bolt on the fly boom

- 15.** ▶ Release and remove the bolts (1) on the fly boom.

Fig. 163: Bolting the fly boom to the boom head

- 16.** ▶ Bolt the fly boom to the telescopic boom at the bolting positions (1) and secure with retaining springs (2).

Fig. 164: Releasing the fly boom lock

17. ▶ Release and remove the vertical bolt (1) on the basic body.

Fig. 165: Pulling the fly boom into working position

18. ▶ Use the rope to pull the fly boom into working position.

Fig. 166: Folding the fly boom into working position

19. ▶ Bolt and secure the fly boom to the main boom (1).

Setup

Folding the fly boom (6.5 m) into working position

20. ▶ Insert and secure the vertical bolt (1) into the fly boom lock on the basic body.

Fig. 167: Unbolting the ramp

21. ▶ Release and remove the bolt (1) on the ramp.

Fig. 168: Folding in and bolting the ramp

22. ▶ Fold in the ramp (1) and secure it with the bolt (2) at the position shown.

Fig. 169: Folding up the deflection sheave

- 23.** ▶ Remove the bolt (2) from the retainer (1).
- 24.** ▶ Fold up the deflection sheave (3).
- 25.** ▶ Bolt down and secure the deflection sheave with the bolt (2).

Fig. 170: Inserting the bypass plug on the telescopic boom

- 26.** ▶ Remove the bypass plug (1) from the lower bush (2) and insert it into the upper bush (3).

Setup

Folding the fly boom (6.5 m) into working position

Fig. 171: Attaching the bypass flag on the telescopic boom head

- 27.** ▶ Attach the bypass flag of the lifting limit switch to the telescopic boom head.

Fig. 172: Fly boom lifting limit switch cable

- 28.** ▶ Pull the lifting limit switch cable (1) of the fly boom out of the bush.

Fig. 173: Inserting the fly boom lifting limit switch cable into the telescopic boom

29. → Insert the lifting limit switch cable of the fly boom (1) into the lower bush (2) on the telescopic boom.
30. → Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom.
31. → Secure the bottom hook block in accordance with the reeving plan.

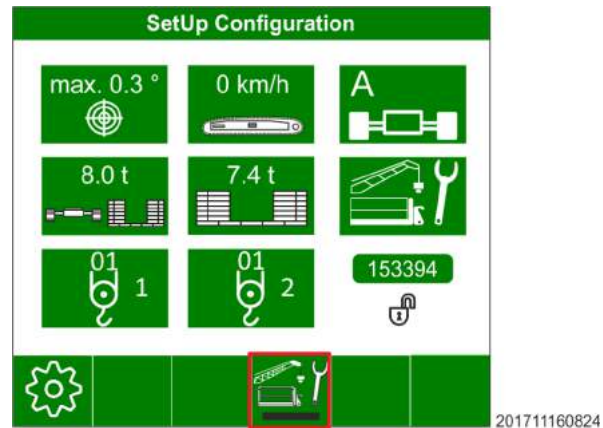
7.15 Folding the fly boom, (6.5 m) into transport position

Safety instructions

- Ensure that the fly boom is correctly bolted to the basic body and secured.
 - In order to perform the operation there must be at least 10 m(32.8 ft) space to the right of the machine for disposal.
1. → Enter the cab.
 2. → Start the diesel engine.
 3. → Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.

Setup

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



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.

Fig. 174: Inserting the lifting limit switch cable of the fly boom into the storage socket

9. → Remove the lifting limit switch cable of the fly boom from the telescopic boom and insert it into the storage socket (1) on the fly boom.

Fig. 175: Removing the bypass flag from the telescopic boom head

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

Fig. 176: Inserting the bypass plug on the telescopic boom

- 11.** ▶ Remove the bypass plug (1) from the upper socket (3) and insert it into the lower socket (2).

Setup

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

Fig. 177: Folding down the deflection sheave

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

Fig. 178: Releasing and unfolding the ramp

- 15.** ▶ Release the bolt (2) on the ramp. Fold out the ramp on the basic body (1).

Fig. 179: Bolting the ramp

16. ▶ Insert and secure the bolt (1) on the ramp.

Fig. 180: Attaching a rope for pulling the fly boom

17. ▶ Attach a rope (1) to the fly boom.

Setup

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

Fig. 181: Releasing the fly boom safeguard

- 18.** ▶ Release and remove the vertical bolt (1) on the basic body.

Fig. 182: Unbolting the ramp

- 19.** ▶ Release and remove the bolt (1) on the ramp.

▲ WARNING! Risk of death from swinging fly boom.

- **Observe the deadweight of the fly boom.**
- **Ensure that no one is in the danger zone. The pivot radius must be at least 10 m (32.8 ft).**

The fly boom can swing off its support at high speed and severely injure anybody in its swing range.

- 20.** ▶ Check the boom angle. The angle of the boom must be 0°.

Fig. 183: Unbolting the fly boom for folding

- 21.** ▶ Release and drive out the bolts (1) on the left side of the boom.

Fig. 184: Pulling the fly boom around

- 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).
- 23.** ▶ Insert and secure the vertical bolt (1) into the fly boom lock on the basic body.

Setup

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

Fig. 185: Unbolting the fly boom on the boom head

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

Fig. 186: Folding the fly boom into transport position

- 26.** ▶ Use the rope to move the fly boom (1) around until the fly boom can be secured to the ramp.

Fig. 187: Secure the fly boom to the ramp

27. ▶ Secure the fly boom to the ramp with the bolt (1).

Fig. 188: Folding the ramp into transport position

28. ▶ Release and remove the pin (1).

29. ▶ Fold in the ramp (2).

Setup

Folding the fly boom from 0° to 40°

Fig. 189: Bolting the ramp in transport position

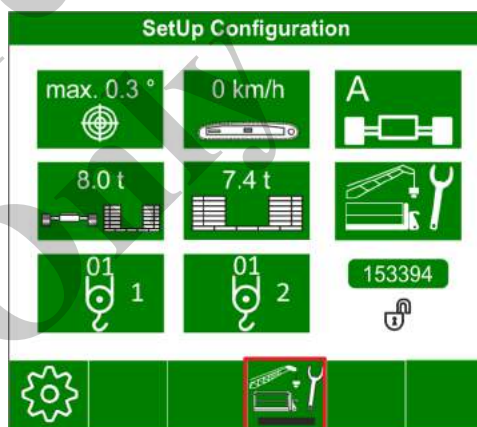
- 30.** ▶ Insert and secure the bolt (1) on the ramp.
- 31.** ▶ Release the rope from the fly boom.
- 32.** ▶ Reeve the hoist rope on the telescopic boom.
- 33.** ▶ Attach and secure the lifting limit switch to the telescopic boom.
- 34.** ▶ Reeve the bottom hook block.

7.16 Folding the fly boom from 0° to 40°

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

Fig. 190: Folding the fly boom from 0° to 40°

1. Enter the cab.
2. Start the diesel engine.
3. Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



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.

Setup

Folding the fly boom from 40° to 0°

Fig. 191: Removing the bolts from the fly boom

7. → Release and remove both bolts (1) from the fly boom.

Fig. 192: Placing bolts in parking position

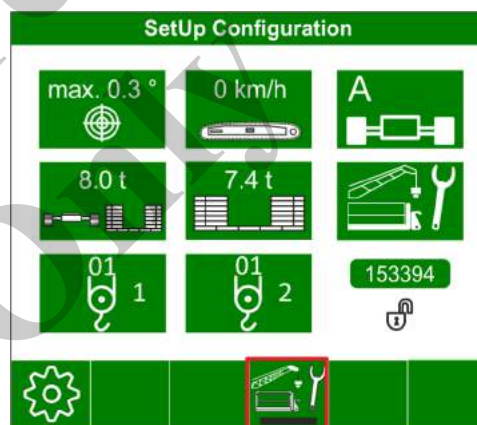
8. → Insert and secure both bolts at the positions shown (1) on the fly boom. Do not push the fly boom into the ground.
9. → Carefully lift the telescopic boom until the fly boom is no longer touching the ground.
 - ⇒ Fold the fly boom downward by 40°.

7.17 Folding the fly boom from 40° to 0°

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

Fig. 193: Folding the fly boom from 40° to 0°

1. → Enter the cab.
2. → Start the diesel engine.
3. → Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



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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.

Setup

Dismantling the fly boom (6.5 m)

Fig. 194: Removing the bolts from the fly boom

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

Fig. 195: Bolting the fly boom in the 0° position

8. → Insert and secure both bolts (1) on the fly boom at the positions shown.
9. → Carefully lift the telescopic boom until the fly boom is no longer touching the ground.

7.18 Dismantling the fly boom (6.5 m)

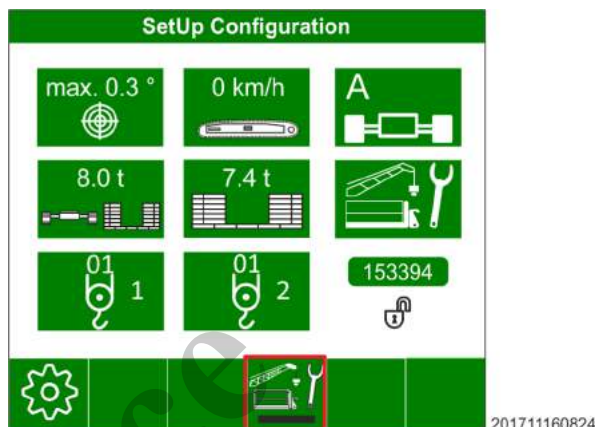
▲ WARNING

Risk of falling.

- Use a ladder with a minimum height of 1.40 m (4.6 ft) to insert/remove the bolts.
- Do not climb onto the boom.

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

1. → Start the diesel engine.
2. → Fully extend the undercarriage.
3. → Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



4. → Push the safety lever forward.
5. → Completely retract the telescopic boom and fold it to 0°.
6. → Place the bottom hook block on the ground.
7. → Unreeve the hoisting cable and wind it onto the winch.
8. → Switch off the diesel engine and pull the safety lever towards you.

Fig. 196: Placing the lifting limit switch on the fly boom in parking position

9. → Remove the lifting limit switch cable of the fly boom from the telescopic boom and insert it into the storage socket (1) on the fly boom.

Setup

Dismantling the fly boom (6.5 m)

Fig. 197: Attaching the bypass flag to the telescopic boom

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

Fig. 198: Inserting the bypass plug on the telescopic boom

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

Fig. 199: Folding down the deflection sheave

- 12.** ▶ Release and remove the bolt (2) on the deflection sheave (3).
- 13.** ▶ Fold the deflection sheave down.
- 14.** ▶ Insert and secure the bolt in the retainer (1).
- 15.** ▶ Attach the fly boom to an auxiliary crane with suitable lifting gear.

Fig. 200: Unbolting the fly boom head

- 16.** ▶ Unscrew the bolts (1) on the fly boom and secure into the parking bushes (2).
- 17.** ▶ Lift the fly boom away from the telescopic boom.

Setup

Attaching the fly boom extension (6.5 m) (optional)

18. ▶ Remove the lifting gear from the fly boom and move the auxiliary crane out of the work area.
19. ▶ Reeve the hoist rope from Winch 1 onto the telescopic boom head and onto the bottom hook block.
20. ▶ Attach the lifting limit switch weight to the hoist rope and the chain to the lifting limit switch of the telescopic boom.

7.19 Attaching the fly boom extension (6.5 m) (optional)

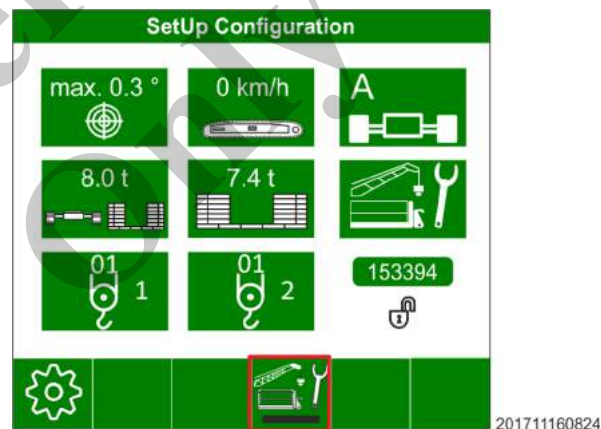
▲ WARNING

Risk of falling.

- Use a ladder with a minimum height of 1.40 m (4.6 ft) to insert/remove the bolts.
- Do not climb onto the boom.

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

1. ▶ Enter the cab.
2. ▶ Start the diesel engine.
3. ▶ Fully extend the undercarriage.
4. ▶ Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



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.

Fig. 201: Removing the bolts from the fly boom extension

- 10.** ▶ Release and remove the bolts (1) on the fly boom extension.
- 11.** ▶ Attach the fly boom extension to an auxiliary crane (min. load capacity: 2,000 kg (4409 lbs)) with suitable lifting gear.
- 12.** ▶ Hoist the fly boom extension to the fly boom head.

Fig. 202: Hoisting the fly boom extension to the fly boom

- 13.** ▶ Align the fly boom extension with the fly boom head. The holes on the fly boom extension (2) must be aligned with those of the fly boom (1).

Setup

Attaching the fly boom extension (6.5 m) (optional)

Fig. 203: Bolting the fly boom extension to the fly boom

- 14.** ▶ Bolt the fly boom extension to the fly boom at the bolting positions (1) and secure with retaining springs.
- 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.

Fig. 204: Fly boom extension lifting limit switch cable

- 17.** ▶ Remove the lifting limit switch cable of the fly boom extension (1) in from the bush.

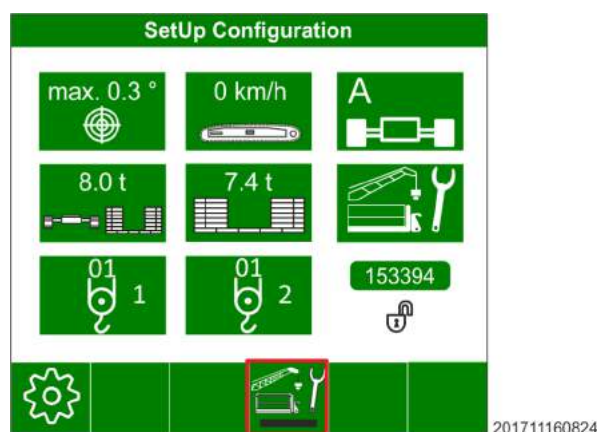
Folding the fly boom extension (6.5 m) into transport position (optional)

Fig. 205: Inserting the fly boom extension lifting limit switch cable into the fly boom head

18. ▶ Insert the lifting limit switch cable of the fly boom extension (1) into the bush on the fly boom head.
19. ▶ Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom extension.
20. ▶ Secure the bottom hook block in accordance with the reeving plan.

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

1. ▶ Enter the cab.
2. ▶ Start the diesel engine.
3. ▶ Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



4. ▶ Push the safety lever forward.
5. ▶ Place the bottom hook block on the ground.

Setup

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

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.

Fig. 206: Releasing the bolt on the fly boom extension

10. ▶ Release and remove the bolt (1) on the fly boom extension.

Fig. 207: Attaching a rope for pulling the fly boom extension around

11. ▶ Attach a rope (1) to the boom head of the fly boom extension.

⚠ WARNING! Risk of death from swinging fly boom.

- **Observe the deadweight of the fly boom.**
- **Ensure that no one is in the danger zone. The pivot radius must be at least 10 m (32.8 ft).**

The fly boom can swing off its support at high speed and severely injure anybody in its swing range.

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

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

Fig. 208: Unbolting the fly boom head

- 13.** ▶ Release and drive out the bolts (1) on the right between the fly boom and the fly boom extension.

Fig. 209: Pulling the fly boom extension to the fly boom

- 14.** ▶ Use the rope to pull the fly boom extension (1) to the fly boom.

Fig. 210: Bolting the fly boom extension in transport position

- 15.** ▶ Insert the fly boom extension to the fly boom with the bolt (1) and secure with a spring cotter pin (2).
- 16.** ▶ Reeve the hoist rope over the fly boom head.

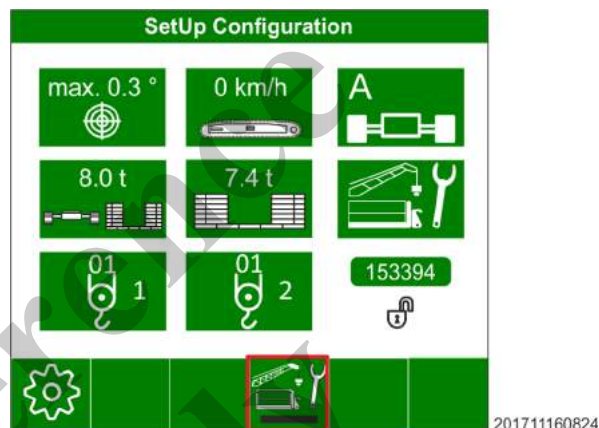
Setup

Folding the fly boom extension to working position

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.

7.21 Folding the fly boom extension to working position

1. ▶ Enter the cab.
2. ▶ Start the diesel engine.
3. ▶ Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



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.

Fig. 211: Attaching a rope for pulling the fly boom extension around

8. ▶ Attach a rope (1) to the boom head of the fly boom extension.

9. → Release and remove the bolts (1) on the left side of the fly boom extension.

▲ WARNING! Risk of death from swinging fly boom.

- Observe the deadweight of the fly boom.
- Ensure that no one is in the danger zone. The pivot radius must be at least 10 m (32.8 ft).

The fly boom can swing off its support at high speed and severely injure anybody in its swing range.

10. → Check the boom angle. The angle of the boom must be 0°.

Fig. 212: Removing the bolts from the fly boom extension

Fig. 213: Unbolting the fly boom extension

11. → Release and remove the bolt (1) on the fly boom.

Fig. 214: Pulling the fly boom extension into working position

12. → Use the rope to pull the fly boom extension (1) into working position.

Setup

Folding the fly boom extension to working position

Fig. 215: Bolting 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. 216: Fly boom extension lifting limit switch cable

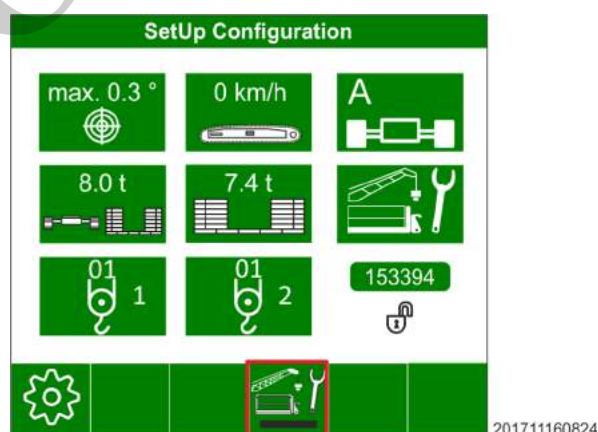
- 14.** ▶ Remove the lifting limit switch cable of the fly boom extension (1) in from the bush.

Fig. 217: Inserting the fly boom extension lifting limit switch cable into the fly boom head

15. Insert the lifting limit switch cable of the fly boom extension (1) into the bush on 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.

7.22 Installing the auxiliary jib

1. Start the diesel engine.
2. Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.



3. Retract the telescopic boom to the stop and lower it to installation height.
4. Place the bottom hook block on the ground.
5. Reeve out the hoist rope.

Setup

Installing the auxiliary jib

Fig. 218: Lifting the auxiliary jib to the telescopic boom head

6. → Using a suitable hoist, lift the auxiliary jib (1) onto the telescopic boom head (2) and hook it in.

Fig. 219: Bolting in the auxiliary jib

7. → Insert bolt (1) and secure with retaining springs (2).
8. → Secure the hoist rope in accordance with the reeving plan and mount the lifting limit switch.

Fig. 220: Connecting the lifting limit switch

9. → Remove the bypass plug (1) from the lower socket on the telescopic boom and insert it into the upper power socket. Insert the plug (2) into the lower bush.

Fig. 221: Attach the rope jump off guard to the sheave of the auxiliary jib.

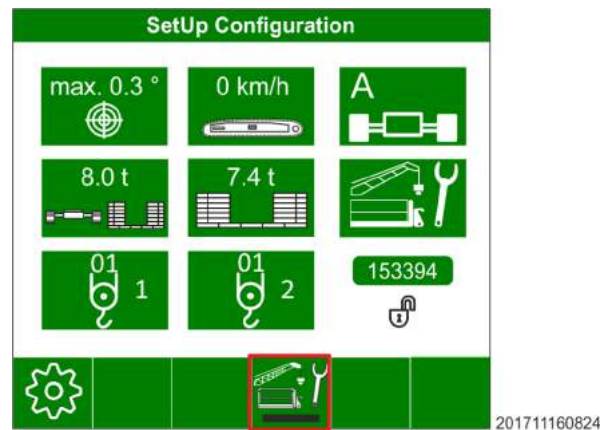
10. → Insert the rope jump off guard (1) into the auxiliary jib sheave and secure it with spring cotter pins (2).

7.23 Dismantling the auxiliary jib

1. → Start the diesel engine.
2. → Adjust **Setup** operating mode on the SENCON using the "Setup Attachment" quick-action symbol.

Setup

Dismantling the auxiliary jib



3. → Retract the telescopic boom to the stop and lower it to installation height.
4. → Place the bottom hook block on the ground.
5. → Remove the lifting limit switch weight and chain from the lifting limit switch.
6. → Un-reeve hoisting cable and wind it onto the winch.

Fig. 222: Placing bypass plug in parking position

7. → Remove the bypass plug from the upper bush and insert it into the lower bush.
8. → Fasten the auxiliary jib to a suitable lifting tool.

Fig. 223: Unfastening the auxiliary jib

- 9.** → Loosen the spring cotter pins (2) and pull out the bolts (1) from the auxiliary jib.
- 10.** → Lift the auxiliary jib away from the telescopic boom.
- 11.** → Mount the hoist rope and the bottom hook block onto the telescopic boom.

Transport

Instructions for safety in transport

8 Transport

8.1 Instructions for safety in transport

⚠ WARNING

Risk of serious injury due to improper driving or unloading of the transport vehicle!

- Only drive and unload transport vehicles with the help of a busman.
- Only drive straight on the loading area and ramps of the transport vehicle and do not swivel the uppercarriage.
- Lock the uppercarriage at 0°.

If the transport vehicle is driven incorrectly, this can lead to uncontrolled machine movements or the machine tipping over. This can cause serious injury.



Dimensions and weights, see Chapter 3 "Technical data" on page 43.

- Keep loading area and ramps of the transport vehicle, as well as, in particular, the undercarriage of the machine, free from mud, snow, and ice.
- Select a suitable transport vehicle. Observe the machine's loading dimensions.
- If needed, remove or unfold the fly boom, completely secure.
- Secure the bottom hook block against swinging.
- Take note of the transport vehicle's load capacity.
- Secure machine and work tools to the transport vehicle.
- Secure the machine, work equipment, and required auxiliary equipment, such as ramp parts and wooden planks, against unplanned movement during loading and transportation.
- Completely lower cab.
- Only load the machine on flat and sufficiently load-bearing ground.
- Only transport the machine on the designated lashing points and lifting points.
- Before transporting, ensure that the route is suitable for the weight and size of the machine to be transported.
- Adjust the minimum track width of the undercarriage.
- Stow or remove the walkways and deploy the railings.
- Only have authorized personnel execute loading and transport tasks.
- Observe the applicable regulations on securing loads.



The respective transport company is always responsible for the transport of machine and accessories. In every case, ensure that the machine does not pose any hazards to other traffic participants.

8.2 Switching on the battery disconnect switch



1. → Open service access door.
2. → Press the battery disconnect switch.
⇒ The switch is illuminated yellow.
3. → Close the service door.

Fig. 224: Battery disconnect switch

8.3 Unloading the machine

8.3.1 Setup mode



See Section Setup.

Transport

Unloading the machine > Moving the machine off the transport vehicle

8.3.2 Moving the machine off the transport vehicle

Safety precautions

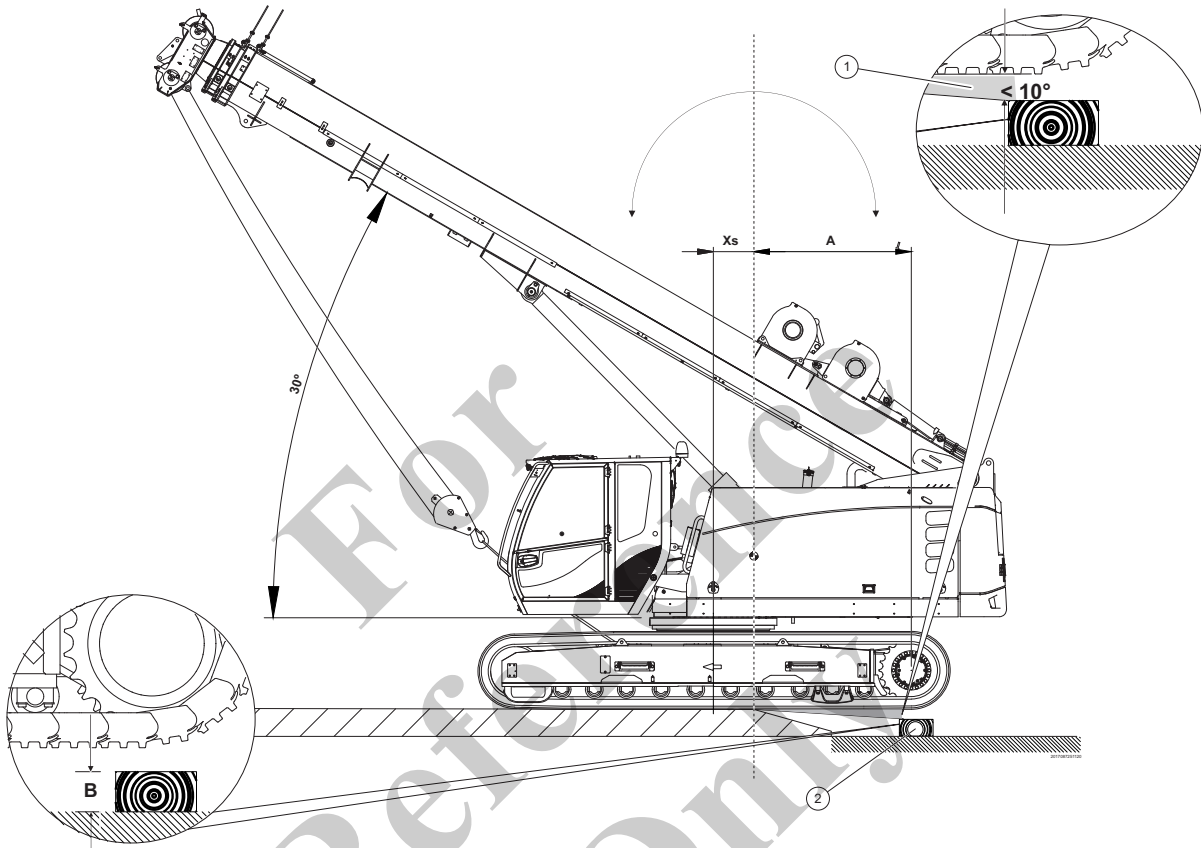


Fig. 225: Safety precautions: Moving the machine off the transport vehicle

- 1 Ramp angle <math>< 10^\circ</math>
- 2 Support (wood, rubber mat)
- B Support height (wood, rubber mat): 4-5 cm (1.6-2 inch)

| Machine, trim levels | Counterweight [t] | Counterweight [US t] | Xs [mm] | Xs ["] | A [mm] | A ["] |
|--|-------------------|----------------------|---------|--------|--------|-------|
| Machine with full counterweight | 5.0 | 5.5 | 455 | 17.9 | 1765 | 69.5 |
| Machine with counterweight without depositor | 4.2 | 4.6 | 390 | 15.4 | 1830 | 72.1 |

Drive machine onto the flatbed trailer

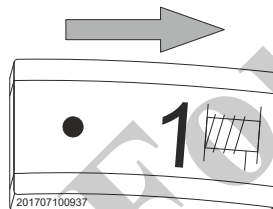
1. Turn the ignition key to position II.
 ⇨ The diesel engine is started.

Transport

Unloading the machine > Moving the machine off the transport vehicle

2. → Unlock the **Luff/telescope boom** switch and press it to the left.

3. → Unlock the **Changeover winch 1-2** switch and turn it to the left.



4. → Turn the **Activate winch** switch to the right.

5. → Unlock the **Activate travel mode** switch and turn it to the right.

6. → Press the **Preselection, travel slow/fast** switch to the left.

7. → Turn the hand throttle slightly to the right.

Transport

Unloading the machine > Moving the machine off the transport vehicle

Fig. 226: Horn button

- 8.** ▶ Push the button (1) on the right joystick.
 - ⇒ The horn must sound.
- 9.** ▶ Push the safety lever forward.

Fig. 227: Push the safety lever forward.

Fig. 228: Working diagram

- 10.** ▶ Lift the boom into the 30° position.
 - ⇒ The boom position is displayed on the SENCON (3).
- 11.** ▶ Move the machine off of the lowbed trailer.

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

- When the lifting limit switch is bypassed, lift the load hook slowly.
- Maintain the safety distance of 1 m (3 ft) between load hook and boom head.
- Once the load hook has been lowered, stop using the Lower hook function.

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 lower hook function is continued when the load hook has been lowered, the cable can be damaged.

Fig. 229: Safety distance between load hook and boom head

12. Lower the boom.
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.

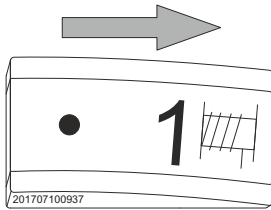
Drive machine off the flatbed trailer

1. Turn the ignition key to position II.
⇒ The diesel engine is started.
2. Unlock the **Luff/telescope boom** switch and press it to the left.

Transport

Unloading the machine > Moving the machine off the transport vehicle

3. → Unlock the **Changeover winch 1-2** switch and turn it to the left.



4. → Turn the **Activate winch** switch to the right.

5. → Unlock the **Activate travel mode** switch and turn it to the right.

6. → Press the **Preselection, travel slow/fast** switch to the left.

7. → Turn the hand throttle slightly to the right.

Fig. 230: Horn button

8. → Push the button (1) on the right joystick.
⇒ The horn must sound.

Fig. 231: Push the safety lever forward.

9. → Push the safety lever forward.

Fig. 232: Working diagram

10. → Lift the boom into the 30° position.

⇒ The boom position is displayed on the SENCON (3).

11. → Move the machine off of the lowbed trailer.

Transport

Lashing the machine

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

- When the lifting limit switch is bypassed, lift the load hook slowly.
- Maintain a safety distance of 1 m (3 ft) between the load hook and the boom head.
- Once the load hook has been lowered, stop using the Lower hook function.

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 Lower hook function is continued when the load hook has been lowered, the rope can be damaged.

Fig. 233: Safety distance between load hook and boom head

12. ▶ Lower the boom.
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.

8.4 Lashing the machine

Safety instructions

- Ensure that the sling gear has sufficient load-bearing capacity and is undamaged.
- Ensure that the machine does not become damaged if additional securing is necessary.
- The respective transport company is always responsible for the transport of machine and accessories.
- Only attach the machine on the lashing points intended for this purpose.

Lashing points

The lashing points on the machine are marked with a green symbol on a white background. The lashing points are located both in the front and rear, as well as on the left and right of the undercarriage. The load hook must be lashed during transport. The lashing points on the load hook are not marked.

Fig. 234: Lashing point label

8.5 Lifting the machine

8.5.1 Lifting the machine

⚠ WARNING

Danger of serious injury or death by a ruptured engine!

- Ensure that the lifting harness and the lifting crane exhibit adequate sustainability and secure stability.
- Make sure that, in the area of the raised machine, nobody is on or under the machine while it is being lowered.
- Ensure that the sling gear has sufficient load-bearing capacity and is undamaged.

The ruptured engine can rock and crash. This can result in serious injury.

Sling gear

The following items are suitable sling gear:

- Chain suspension
- Cable suspension
- Round slings / strap suspension.

NOTICE

When lifting, keep in mind the machine's weight and the focus of the machine



The lifting points are marked green and have a green load hook symbol.

Transport

Lifting the machine > Lifting the machine

1. ➤ Select suitable lifting crane and sling gear.
2. ➤ Lower attached loads.
3. ➤ Position the uppercarriage in the direction of travel.
4. ➤ Lash the bottom hook block to the undercarriage.
5. ➤ Park the machine.
6. ➤ Fasten the lifting gear to the lifting point (1).

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Reference
Only

Fig. 235: Lifting point (Model Presentation)

7. ➤ Lift up the machine carefully.

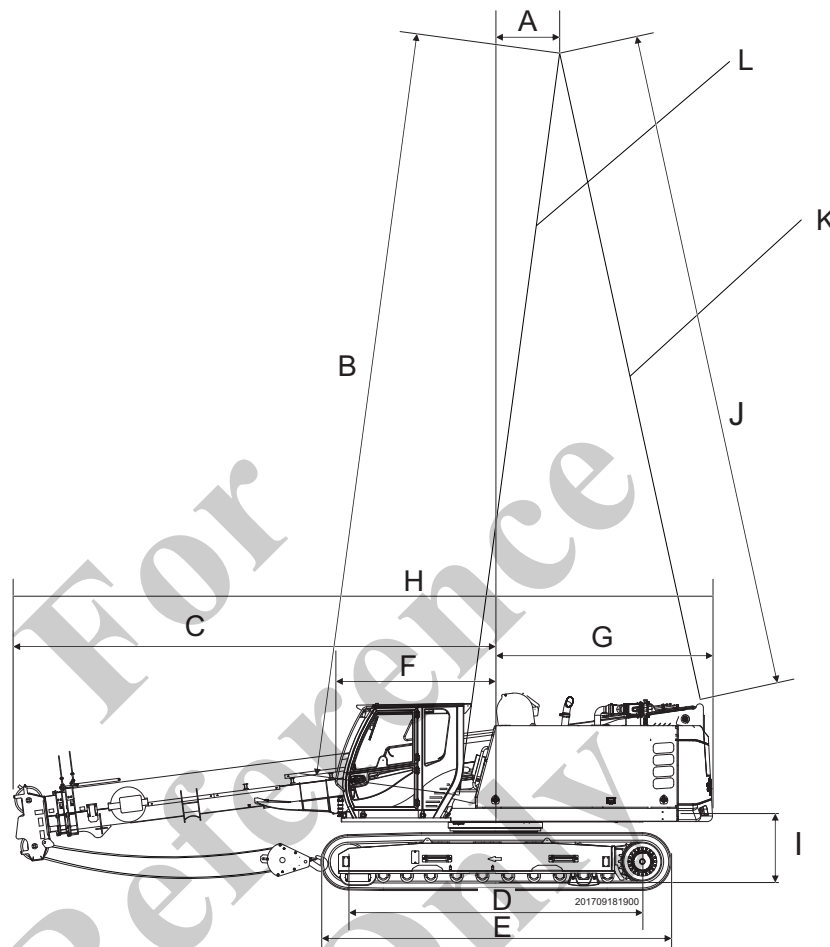


Fig. 236: Lifting data

- | | | | |
|---|------------------|---|----------------------------|
| A | 3.2 ft (0.98 m) | G | 10.8 ft (3.3 m) |
| B | 37.1 ft (11.3 m) | H | 34.7 ft (10.6 m) |
| C | 24 ft (7.3 m) | I | 3.4 ft (1.0 m) |
| D | 14.6 ft (4.5 m) | J | 32.8 ft (10.0 m) |
| E | 17.4 ft (5.3 m) | K | 2 x 15432.4 lbs (2 x 7 t) |
| F | 7.9 ft (2.4 m) | L | 2 x 22046.2 lbs (2 x 10 t) |

The lifting specifications apply without attachments and the additional 2 x 400 kg (2 x 881.8 lbs) for the following machine configuration:

| Machine configuration | Measure |
|-----------------------|----------------------|
| Counterweight | 4.2 t (9259 lbs) |
| Weight of the machine | 31.750 t (69996 lbs) |
| Track width | 700 mm (27.6") |
| Load hook | 25 t (55115.6 lbs) |

Maintenance schedule

9 Maintenance schedule

| Interval | Maintenance work | Personnel |
|--|--|--|
| Particular interval: during hydraulic oil change | Change the hydraulic tank's oil leakage filter | Service Technician |
| Particular interval: after the 5th Change the air filter's primary element | Change the filter element (secondary element) of the air filter | Service Technician |
| Particular interval: in accordance with the display | Change the air filter's filter element (main element) | Service Technician |
| | Check water separator (fuel) and drain if necessary | Service Technician The machine operator |
| Particular interval: as required | clean the DEF tanks filling filter | Service Technician The machine operator |
| Particular interval: before/after long usage periods, | check the pressure roller on the winch | Service Technician The machine operator |
| | change the DEF supply module return filter | Service Technician |
| | change the DEF supply module inlet filter | Service Technician |
| Every 10 OH / daily | Check winch gear oil | The machine operator |
| | Lubricate the track and gears of the slewing ring. | The machine operator |
| | Carry out a visual and functional check of the entire machine (in accordance with the manual): In particular, visually check the safety-relevant bolts, screw connections, rope, and cylinder, for general damage to the steelwork | The machine operator |
| | Check diesel fuel level | The machine operator |
| | Check fill level of the windshield washer system | The machine operator |
| | Checking the diesel engine oil level | The machine operator |
| | Checking the coolant level | The machine operator |
| | Check DEF fill level | The machine operator |
| | Check the hydraulic oil level | The machine operator |

Maintenance schedule

| Interval | Maintenance work | Personnel |
|--|--|----------------------|
| | Check the fat fill level of the central lubrication pump | The machine operator |
| | Check the fat fill level of the slewing ring lubrication pump | The machine operator |
| Every 50 operating hours / daily | Clean the sliding surfaces of the pushbeams, carry out a visual check, and lubricate. | The machine operator |
| | Visually check the slewing ring connection for damage to threaded union, gears, seal, and grease collar | The machine operator |
| | Deep clean of the entire machine | The machine operator |
| | Check and lubricate the manual lubrication stations | The machine operator |
| Particular interval: every 100 OH | Completely unwind ropes and then wind up under adequate pre-tension | Service Technician |
| | Check the limit switch on the winch | Service Technician |
| Particular interval: 150 operating hours / bi-annually | Drain the water from the fuel prefilter | Service Technician |
| | Drain the water from the fuel tank | Service Technician |
| every 250 OH / approx. 4-6 weeks after commissioning | Track the fastening screws on the track rollers and sprockets | Service Technician |
| | Check chain tension of the crawler chassis | |
| | Clean the sliding surfaces of the pushbeams, carry out a visual check, and lubricate. | Service Technician |
| | Track screw connections of the base plates on the chain | Service Technician |
| | Clean or change the circulating air and fresh air filters in the climate control system | Service Technician |
| | Visual check and lubrication of the sliding blocks / sliding surfaces. | The machine operator |
| | Clean and visually check the dust ejector valve in the air filter | The machine operator |
| | Carry out a visual and functional check of the entire machine (in accordance with the manual): In particular, visually check the safety-relevant bolts, screw connections, rope, and cylinder, for general damage to the steelwork | The machine operator |
| | Check the hydraulic oil level | The machine operator |
| | Check the fat fill level of the central lubrication pump | The machine operator |
| | Check the fat fill level of the slewing ring lubrication pump | The machine operator |

Maintenance schedule

| Interval | Maintenance work | Personnel |
|----------|---|---|
| | Check DEF fill level | The machine operator |
| | Checking the coolant level | The machine operator |
| | Checking the diesel engine oil level | The machine operator |
| | Check fill level of the windshield washer system | The machine operator |
| | Check winch gear oil | The machine operator |
| | Check diesel fuel level | The machine operator |
| | Change crawler travel drive gear oil | Service Technician |
| | Change winch gear oil | Service Technician |
| | Check securing of the winch load foot | Service Technician |
| | Change HydroClean or auxiliary control filter filter element | Service Technician |
| | Change hydraulic filter (main filter) filter element | Service Technician |
| | Check pressure accumulator | Service Technician (company specialist) Service Technician |
| | Check slewing ring mounting nuts for proper seating | Service Technician |
| | Measure slewing ring backlash | Service Technician |
| | Read SENCON error memory | Service Technician |
| | Check frost and corrosion protection of the coolant (diesel engine) | Service Technician |
| | Lubricate rope | The machine operator Service Technician |
| | Visual check of the exhaust system for damage, leaks | Service Technician The machine operator |

Maintenance schedule

| Interval | Maintenance work | Personnel |
|----------------------|---|--|
| | Remove hydraulic oil sample for Shell LubeAnalyst | Service Technician The machine operator |
| | Visually check hose and pipe connections for damage, leaks | The machine operator |
| | Check and lubricate the manual lubrication stations | The machine operator |
| | Check dust ejector valve in the air filter, clean if necessary | The machine operator |
| | Function check of the climate control system | The machine operator |
| every 250 OH/monthly | Check chain tension of the crawler chassis | |
| | Check crawler track for sufficient tension | The machine operator |
| | Clean and visually check the dust ejector valve in the air filter | The machine operator |
| | Clean or change the circulating air and fresh air filters in the climate control system | Service Technician |
| | Clean cab ventilation filter element, change if necessary | The machine operator |
| | Visually check hose and pipe connections for damage, leaks | The machine operator |
| | Check dust ejector valve in the air filter, clean if necessary | The machine operator |
| | Function check of the climate control system | The machine operator |
| | Check batteries, battery cables, and connections for secure placing/corrosion | The machine operator |
| | Change hydraulic system filter element | Service Technician |
| Every 6 months | Lubricate winch bearings | The machine operator |
| Every 500 OH | Test freezing point and additive concentration of the diesel engine coolant and refill if necessary, add additive via SCA filter change or liquid | Service Technician |
| | Change diesel engine fuel filter | Service Technician |
| | Read SENCON error memory | Service Technician |
| | Lubricate rope | The machine operator Service Technician |

Maintenance schedule

| Interval | Maintenance work | Personnel |
|--|---|--|
| | Change diesel engine oil filter | Service Technician |
| | Change diesel engine oil | Service Technician |
| | Check frost and corrosion protection of the coolant (diesel engine) | Service Technician |
| | Change diesel engine prefilter | Service Technician |
| | Check diesel engine V-belt for tension and damage | Service Technician |
| | Clean the DEF supply module prefilter | Service Technician |
| | From 2000 OH: Remove hydraulic oil sample for Shell LubeAnalyst | Service Technician The machine operator |
| | Visual check of the exhaust system for damage, leaks | Service Technician The machine operator |
| Particular interval: every 2 years/1000 OH | Visually check diesel engine turbocharger for damage | Service Technician |
| | Remove hydraulic oil sample for Shell LubeAnalyst | Service Technician The machine operator |
| Particular interval 2000 OH | Remove hydraulic oil sample for Shell LubeAnalyst | Service Technician The machine operator |
| annually / every 2000 OH | Track the fastening screws on the track rollers and sprockets | |
| | Check the lock of the axle-brake. | Service Technician |
| | Track screw connections of the base plates on the chain | Service Technician |
| | Clean or change the circulating air and fresh air filters in the climate control system | Service Technician |
| | Change hydraulic oil tank aeration filter | Service Technician |
| | Change HydroClean or auxiliary control filter filter element | Service Technician |
| | Change crawler travel drive gear oil | Service Technician |

Maintenance schedule

| Interval | Maintenance work | Personnel |
|-----------------------|---|---|
| | Change hydraulic oil (or in accordance with the result of the Shell Lube Analysis) | Service Technician |
| | Check the splined shaft connection on the winch | Service Technician |
| | Change winch gear oil | Service Technician |
| | Check the winch brake wear | Service Technician |
| | Check securing of the winch load foot | Service Technician |
| | Check the lock of the gear teeth lubrication sliding block | Service Technician |
| | Change fuel tank aeration filter | Service Technician |
| | Change hydraulic filter (main filter) filter element | Service Technician |
| | Check pressure accumulator | Service Technician (company specialist) Service Technician |
| | Check slewing ring mounting nuts for proper seating | Service Technician |
| | Clean coolant cooler | The machine operator Service Technician |
| | Change diesel engine V-belt | Service Technician |
| | Set diesel engine valve clearance | Service Technician |
| | Check the threaded union on the slewing gear for tightness. | Service Technician |
| | Measure slewing ring backlash | Service Technician |
| every 2 years/4000 OH | Change climate control system collection dryer | |
| | Test the contamination level of the diesel engine coolant with Fleetguard® Quik-Chek test strips and change if necessary. | Service Technician |
| | Change the DEF supply module main filter. | Service Technician |
| | Change the filter element (secondary element) of the air filter. | Service Technician |
| Every 4 years | Change diesel engine coolant | Service Technician |

Maintenance schedule

| Interval | Maintenance work | Personnel |
|---|---|---|
| Particular interval: every 5000 OH / 5 years | carry out a material check of 4 representative screws from the slewing ring connection. | Service Technician (company specialist) |
| Particular interval: 12,000 OH / 3 years | Change climate control system oil | Service Technician (company specialist) |
| Particular interval: every 12000 OH / 6 years | Change hydraulic hoses | Service Technician |
| Particular interval: every 10 years | general winch overhaul | Service Technician (company specialist) |

For
Reference
Only

10 Tightening torques

10.1 General information

If screws or nuts are changed, only use new or reconditioned parts.
Screws, nuts and all threads must be clean, dry and free of grease.

There are 2 different tables for tightening torques:

- Standard connections
- Rotary connection

10.2 Standard connections

In order to avoid a screw connection failure, only phosphate black screws may be used in the following applications:

- Sprocket
- Slewing ring
- Track rollers
- Slewing gear, travel drives and travel gears
- Winch installations
- All the screws for the following connections:
 - Cab console - Cab
 - Base frame - Cab adjustment
 - Base frame - Engine

| Bolt | | Tightening torque | |
|------------|----------------|----------------------------|--------------------------|
| Dimensions | Strength class | Zinc flake coating [Nm] | Black phosphated [Nm] |
| M6 | 8.8 | 6.4 | 9.4 |
| | 10.9 | 9.4 | 13.8 |
| | 12.9 | 11 | 16.1 |
| M8 | 8.8 | 15.4 | 22.8 |
| | 10.9 | 22.7 | 33.4 |
| | 12.9 | 26.5 | 39.1 |
| M10 | 8.8 | 30 | 45 |
| | 10.9 | 44.2 | 65.8 |
| | 12.9 | 51.7 | 77.5 |
| M12 | 8.8 | 52.5 | 77.5 |
| | 10.9 | 76.7 | 114.2 |
| | 12.9 | 90 | 133.3 |
| M14 | 8.8 | 83.3 | 123.3 |

Tightening torques

Standard connections

| Bolt | | Tightening torque | |
|------------|----------------|----------------------------|--------------------------|
| Dimensions | Strength class | Zinc flake coating [Nm] | Black phosphated [Nm] |
| | 10.9 | 121.7 | 181.7 |
| | 12.9 | 142.5 | 212.5 |
| M16 | 8.8 | 127.5 | 191.7 |
| | 10.9 | 186.7 | 281.7 |
| | 12.9 | 218.3 | 329.2 |
| M18 | 8.8 | 183 | 274 |
| | 10.9 | 262 | 391 |
| | 12.9 | 306 | 458 |
| M20 | 8.8 | 257 | 387 |
| | 10.9 | 365 | 551 |
| | 12.9 | 428 | 644 |
| M22 | 8.8 | 348 | 528 |
| | 10.9 | 496 | 753 |
| | 12.9 | 580 | 881 |
| M24 | 8.8 | 441 | 665 |
| | 10.9 | 628 | 947 |
| | 12.9 | 735 | 1108 |
| M27 | 8.8 | 643 | 980 |
| | 10.9 | 917 | 1395 |
| | 12.9 | 1073 | 1633 |
| M30 | 8.8 | 878 | 1331 |
| | 10.9 | 1250 | 1895 |
| | 12.9 | 1463 | 2218 |
| M33 | 8.8 | 1179 | 1801 |
| | 10.9 | 1679 | 2565 |
| | 12.9 | 1965 | 3001 |
| M36 | 8.8 | 1521 | 2315 |
| | 10.9 | 2167 | 3298 |
| | 12.9 | 2535 | 3859 |
| M39 | 8.8 | 1957 | 2998 |
| | 10.9 | 2788 | 4269 |
| | 12.9 | 3262 | 4995 |

10.3 Rotary connection

| Bolt | | Tightening torque | |
|------------|----------------|----------------------------|--------------------------|
| Dimensions | Strength class | Zinc flake coating [Nm] | Black phosphated [Nm] |
| M33 | 10.9 | <i>Not permissible</i> | 2600 |

For
Reference
Only

Fault search

Machine motion

11 Fault search

11.1 Safety instructions for troubleshooting

⚠ WARNING

Risk of serious injury due to unforeseen fault!

- Personnel for maintenance, inspection and fault correction must have the appropriate qualifications for these tasks.
- For activities not described in detail, please notify the manufacturer's customer service.
- Park and secure machine as soon as possible.
- Immediately resolve the cause of the fault.
- Take note of the instructions and notes in the manufacturer's operating manual in the case of faults in the diesel engine.

A fault can lead to uncontrollable machine behavior. This can cause serious injury.

11.2 Machine motion

| No. | Fault description | Cause | Remedy |
|-----|--|---|--|
| 001 | Joysticks not working. | Safety lever is active. | <ul style="list-style-type: none"> ■ Release safety lever. |
| | | Pilot pressure is too low or non-existent. | <ul style="list-style-type: none"> ■ Check safeguards, replace defective safeguards. ■ Check pilot pressure with a manometer at measuring point 35. The set value is 40 bar. ■ Inform the manufacturer service partner. |
| 002 | Crawler track is grinding on the track guide. | Track tension is too low. | <ul style="list-style-type: none"> ■ Check track tension. ■ Tension crawler track. |
| | | Oil is leaking from the track rollers or carrier rollers. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| 003 | Operation movements are reduced or not possible. | The safety lever has been pulled back. | <ul style="list-style-type: none"> ■ Release safety lever. |
| | | The maximum load capacity has been exceeded. | <ul style="list-style-type: none"> ■ Check the status of the load moment limitation on the SENCON. ■ If required, reduced machine load moment. |
| | | The work area limitation is active. | <ul style="list-style-type: none"> ■ Shut off work area limitation or adjust work area limitation settings. |
| | | Hydraulic system working with reduced power. | <ul style="list-style-type: none"> ■ Check SENCON for fault messages. ■ Increase diesel engine speed. |

Fault search

Machine motion

| No. | Fault description | Cause | Remedy |
|-----|--|--|--|
| | | | <ul style="list-style-type: none"> ■ Open hydraulic stopcock. ■ Check function of the diesel engine. |
| | | Malfunction in the hydraulic system. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | | Hydraulic pump not working. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | | The load moment limitation has a fault. | <ul style="list-style-type: none"> ■ Check SENCON for fault messages. ■ Check proximity switch cable and reel on the telescopic boom for damage. ■ Inform the manufacturer service partner. |
| 004 | Cab cannot be raised. | Emergency tap is open. | <ul style="list-style-type: none"> ■ Close emergency tap. |
| | | Hydraulic system defect. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| 005 | Increased shaking or rocking of cab: | 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. ■ Inform the manufacturer service partner. |
| 006 | Cab lowers by itself. | Emergency tap is open. | <ul style="list-style-type: none"> ■ Close emergency tap. |
| 007 | Machine does not start. | Engine speed set too low. | <ul style="list-style-type: none"> ■ Increase engine speed. |
| | | Safety lever engaged. | <ul style="list-style-type: none"> ■ Push the safety lever forward. |
| | | Leakage in hydraulic system circuit. | <ul style="list-style-type: none"> ■ Check hydraulic connections. Secure loose connections. ■ Have leaking hydraulic hoses replaced by manufacturer service partners. |
| | | Hydraulic system defect. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| 008 | Machine only moves at one speed or too slowly. | Operating temperature too low. | <ul style="list-style-type: none"> ■ Run the machine until warm. |
| | | The diesel filter is dirty. | <ul style="list-style-type: none"> ■ Change diesel filter. ■ Vent the fuel system. |
| | | Defect in the diesel engine or hydraulic system. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| 009 | The brake power of the travel brake is too weak or uneven. | Hydraulic oil level too low. | <ul style="list-style-type: none"> ■ Add hydraulic oil. ■ Check hydraulic system for leakage points. |
| | | The hydraulic pressure of the travel brake is too low. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| 010 | Oil leaks on the slewing gear drive | Loose connections | Tighten connections. |
| 011 | Rotary feedthrough leaking. | Seals damaged. | Replace seals. |

Fault search

Diesel engine



Fault number 002 is only for machines with a crawler undercarriage.

11.3 Diesel engine

| Fault description | Cause | Remedy |
|--|--|--|
| Diesel engine does not start. | Battery capacity is too low. | <ul style="list-style-type: none"> ■ Check charge level of batteries. ■ Recharge or replace batteries. ■ Start machine using auxiliary battery. |
| | No contact between terminals and battery clamps. | <ul style="list-style-type: none"> ■ Remove oxidation from battery terminal and clamps with a copper wire brush. ■ Treat battery terminal with terminal grease. |
| | Fuel tank is empty. | <ul style="list-style-type: none"> ■ Refuel machine. |
| | Filter is contaminated. | <ul style="list-style-type: none"> ■ Open diesel filter and air filter and check for contamination. ■ Have contaminated filters replaced by manufacturer service partners. |
| | Starter not working. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | Hydraulic oil level is too low. | <ul style="list-style-type: none"> ■ Check SENCON for fault messages. ■ Add hydraulic oil as needed. |
| | A diesel engine error has occurred. | <ul style="list-style-type: none"> ■ Read the error code on SENCON. ■ Inform the manufacturer service partner. |
| | DEF tank is empty. | <ul style="list-style-type: none"> ■ Check DEF level on SENCON. ■ Add DEF as needed. |
| | Safeguards or relays not working. | <ul style="list-style-type: none"> ■ Check safeguards or relays for defects. ■ Replace defective safeguards or relays. |
| | Fuel tap is closed. | <ul style="list-style-type: none"> ■ Open fuel tap. |
| | Defect on ignition switch. | <ul style="list-style-type: none"> ■ Check ignition. ■ Check starter actuation (click noise). |
| | Emergency stop switch is active. | Check emergency stop switch, release if necessary. |
| | Hydraulic tank shut-off flap closed. | Open hydraulic tank shut-off flap. |
| Diesel engine not starting or immediately switching back off | Remote radio control in the cab is active | Turn off remote radio control in the cab. |
| Diesel engine losing power. | Fuel suction resistance is too high. | <ul style="list-style-type: none"> ■ Replace the filter element of the water separator. ■ Use fuel pre-warming at temperatures below 0 °C (32 °F). |

| Fault description | Cause | Remedy |
|--|---|--|
| | DEF tank is empty. | <ul style="list-style-type: none"> ■ Check DEF level on SENCON. ■ Add DEF as needed. |
| | Air filter is clogged. | <ul style="list-style-type: none"> ■ Check SENCON for fault messages. ■ Inform the manufacturer service partner. |
| | Exhaust aftertreatment is defective. | <ul style="list-style-type: none"> ■ Read the error code on SENCON. ■ Inform the manufacturer service partner. |
| | Diesel filter is clogged. | <ul style="list-style-type: none"> ■ Change diesel filter. |
| | There are errors on SENCON. | <ul style="list-style-type: none"> ■ Read the error code on SENCON. ■ Inform the manufacturer service partner. |
| Machine does not move. | Travel brake is activated. | <ul style="list-style-type: none"> ■ Release travel brake. |
| | Drive is defective. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | Pilot control device defective. | <ul style="list-style-type: none"> ■ Troubleshoot via SENCON diagnostics, check input/output vectors. |
| Oil or fuel leakage points on diesel engine. | Hose clampings are loose. | <ul style="list-style-type: none"> ■ Fasten hose clampings. |
| | Hoses or seals are damaged. | <ul style="list-style-type: none"> ■ Have hoses or seals replaced by your manufacturer service partner. |
| Strong smell of exhaust fumes. | Diesel engine not at operating temperature. | <ul style="list-style-type: none"> ■ Bring diesel engine to operating temperature. |
| | Wrong fuel used. | <ul style="list-style-type: none"> ■ Fill with correct fuel. |
| | Air filter, fuel filter or water separator clogged. | <ul style="list-style-type: none"> ■ Clean air filter. ■ Replace fuel filter. ■ Clean water separator. |
| | Damage to diesel engine or exhaust system. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |

11.4 Unusual machine noises

| Fault description | Cause | Remedy |
|-----------------------------------|--|--|
| Noise from the slewing gear. | Gear rim lubrication insufficient. | <ul style="list-style-type: none"> ■ Lubricate gear rim according to lubrication plan. |
| Fan constantly runs at top speed. | Fan control is not working. | <ul style="list-style-type: none"> ■ Check that the plug for the fan control is secure. ■ Inform the manufacturer service partner. |
| Noises in the hydraulic system. | Hydraulic pump delivers insufficient oil. | <ul style="list-style-type: none"> ■ Check hydraulic oil level and refill oil. |
| | Hydraulic pump draws in air. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | Overpressure valve is defective. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | Hydraulic pump suction line is not sealed. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |

Fault search

Climate control system

| Fault description | Cause | Remedy |
|-----------------------|------------------------------------|--|
| Winch emitting noise. | Winch oil level too low. | <ul style="list-style-type: none"> ■ Check winch oil level. ■ If necessary, fill with oil. |
| | Winch pressure roller not working. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |

11.5 Climate control system

| Fault description | Cause | Remedy |
|--|---|---|
| Climate control system is not working. | V-belt defective, loose or has come free. | <ul style="list-style-type: none"> ■ Check V-belt for correct positioning and tension. ■ Have defective or worn-out V-belt replaced by the relevant service. |
| | Air conditioning compressor not working. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| Blower is not working. | Fuse blown or loose. | <p>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. Inform the manufacturer service partner.</p> <ul style="list-style-type: none"> ■ Replace fuse. |
| | Contact is loose. | <ul style="list-style-type: none"> ■ Check plug is secure. |
| | Fan motor defective. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| Defective control element | Power supply interrupted. | Check the control element. Inform the manufacturer service partner. |
| Blower cannot be shut off. | Control element defective. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| | Short-circuit in cable. | <ul style="list-style-type: none"> ■ Inform the manufacturer service partner. |
| Cooling capacity too low. | Air filter is clogged or worn-out. | <ul style="list-style-type: none"> ■ Contact air-conditioning technicians. |
| | Heat exchanger is contaminated. | <ul style="list-style-type: none"> ■ Clean the heat exchanger's cooling fins with pressurized air. |
| | Refrigerant level too low. | <ul style="list-style-type: none"> ■ Contact air-conditioning technicians. |
| No or insufficient heat output. | Heat exchanger contaminated. | <ul style="list-style-type: none"> ■ Clean the heat exchanger's cooling fins with pressurized air. |
| | Thermostat not working. | <ul style="list-style-type: none"> ■ Contact air-conditioning technicians. |
| Coolant feed temperature too low | Wait until the diesel engine has warmed up. Vehicle thermostat defective. | Inform the manufacturer service partner. |
| Heat exchanger lamellas are contaminated | Check the heat exchanger and clean if necessary. Water lines kinked or crushed. | Check the heat exchanger and clean if necessary. Water lines kinked or crushed - contact your manufacturer service partner. |

| Fault description | Cause | Remedy |
|---------------------------------------|--------------------------------------|--|
| Air filter clogged | Clean or replace the filter element. | |
| Resistor defective | Resistor broken. | Replace the resistor. |
| Air-conditioning control not working. | Air-conditioning control defective. | Inform the manufacturer service partner. |

11.6 Lighting

| Fault description | Cause | Remedy |
|--|---------------------------------------|--|
| Turn signal system, hazard signal system, or machine lighting not working. | Bulb not working. | ■ Change bulb. |
| | Fuse blown. | ■ Change fuse. |
| | Plug connection loose. | ■ Check plug connection is secure and tighten. |
| | Cable or plug connection not working. | ■ Inform the manufacturer service partner. |
| | Switch not working. | ■ Inform the manufacturer service partner. |

11.7 Remote radio control

| Fault description | Cause | Remedy |
|-----------------------------------|--|--|
| Remote radio control not working. | Remote radio control battery charge too low. | ■ Charge batteries. |
| | The safety lever has been pulled back. | ■ Release safety lever. |
| | Interfering frequencies are disrupting the remote radio control. | ■ Resolve the source of the disruption. ■ Restart the remote radio control. |
| | The uppercarriage cannot be slewed. | ■ Loosen the slewing gear holding brake. |
| | Remote radio control in the cab is not active. | ■ Activate remote radio control in the cab. |

12 Removal and disposal

⚠ CAUTION

Risk of injury and environmental damage due to improper disposal.

- Only have a suitable disposal company dispose of the machine.

Failure to properly dispose of the machine at the end of its service life can result in injury or environmental harm.

For
Reference
Only

13 Signage

Cab



Signage







Signage



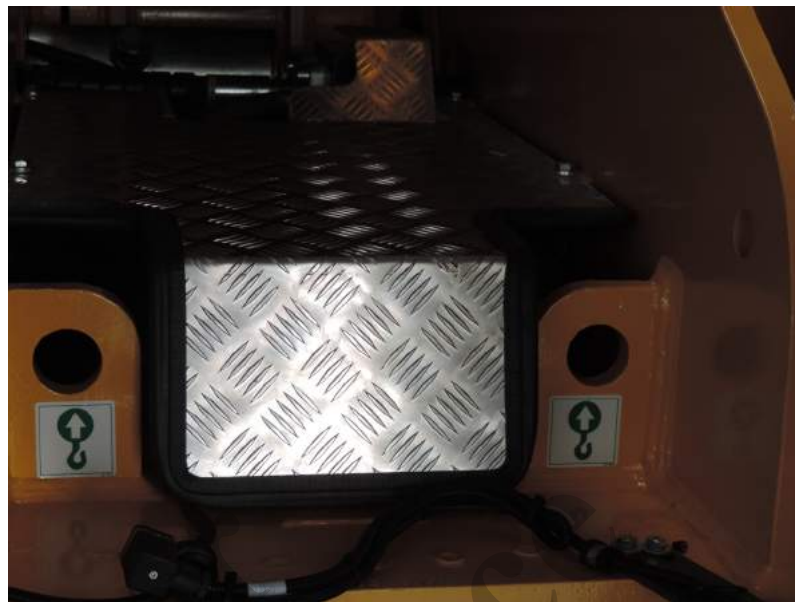
Uppercarriage



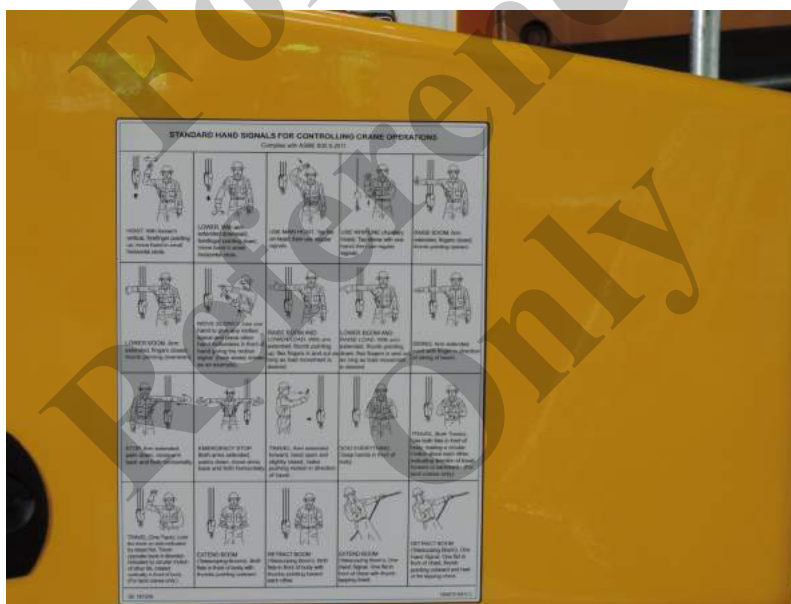


Signage





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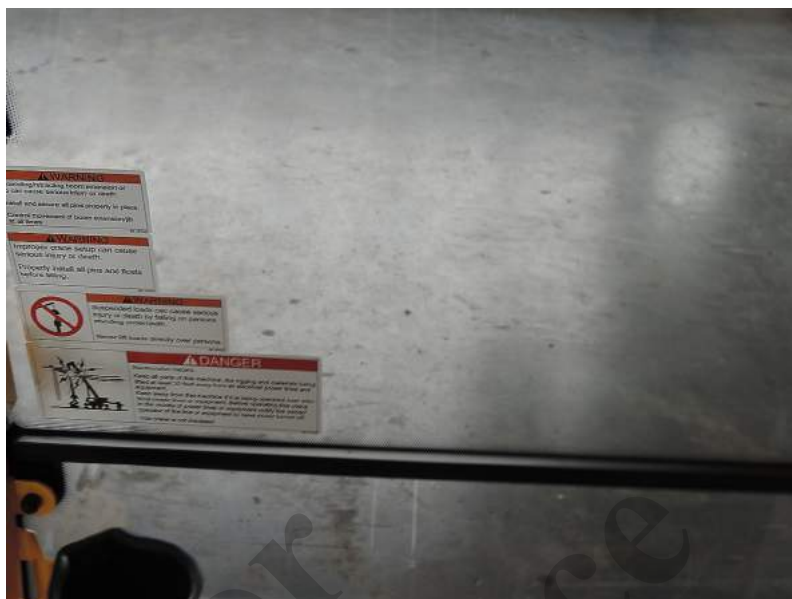


Signage





Signage



Undercarriage





Signage





For
Reference
Only

Appendix

A Supplemental documentation

A.1 Elevating work platform

| Name | Data |
|----------------|------------------------|
| Designation | Personnel basket |
| Type | Yoke |
| Number | 557-01 |
| Type of manual | Operation instructions |
| Manufacturer | Manitowoc |

For Reference Only



OPERATOR MANUAL

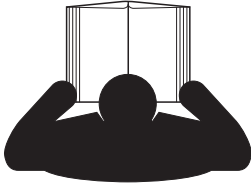
This manual has been prepared for and is considered part of the

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.

| | |
|---|---|
|  | <p style="text-align: center;">⚠ DANGER</p> <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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OPTION

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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 Electrocution 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.

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22. Precautions such as but not limited to the following shall be taken:
- a. When welding is to be accomplished from the personnel platform, suitable electrode holders shall be provided to protect them from contact with any conducting components of the platform.
 - b. When personnel lifts are conducted over water, personal flotation devices shall be provided and required to be worn. Personal fall protection devices with quick release features shall be provided, and required to be worn. The fall protection device shall be appropriately attached while personnel are lifted over land and detached while personnel are lifted over water.
 - c. A boat with appropriate rescue personnel shall be available at all times during a personnel lift over water.
 - d. Appropriate personnel protective equipment shall be provided and required to be used around toxic, flammable or hazardous substances or fumes.
23. Review any concentrated loading of the platform to preclude the over stressing of any component or the impairing of the platform stability.

Equipment Operator

Equipment Operator shall:

1. Comply with any applicable qualification criteria. As a minimum the qualification requirements shall include, but not be limited to:
 - a. Qualification to operate the specific type hoisting equipment used in the personnel lift.
 - b. Successfully meeting the physical qualification criteria as established in the applicable hoisting equipment ASME B30 volume. Additionally, the operator shall have been tested for substance abuse. Testing shall be in accordance with applicable government regulations and the policies of the employer.
 - c. Successfully meeting the training and qualification criteria established in the applicable hoisting equipment ASME B30.5 volume for telescoping cranes.
2. Be qualified to operate the platform controls of a platform with controls.
3. Not engage in a personnel lift when physically or mentally unfit. The operator has the right to refuse any personnel lift under the following circumstances:
 - a. The operator does not feel physically or mentally fit to perform the operation.
4. Not engage in any practice that will divert their attention while actually engaged in operating the hoisting equipment.
5. Only respond to signals from the Personnel Lift Supervisor or a designated signal person. The operator shall obey a stop signal at any time, no matter who gives it.
6. Consult with the Personnel Lift Supervisor before commencing or continuing the lift whenever the operator has any doubt as to the safety of the lift.
7. When involved with a boom mounted platform without controls, remain at the hoisting equipment controls whenever personnel are in the platform.
8. When involved with a boom mounted platform with boom motion controls and a means of lowering, retracting and rotating in the event the primary power source becomes inoperative, be free not to remain at the hoisting equipment controls.
9. Consult the Safety and Operation sections in the Operator Manual for specific instruction on the equipment operation.
10. Inspect the hoist equipment setup area before the personnel lift and report his observations to the Personnel Lift Supervisor. The operator shall inspect the area for potential hazards such as, but not limited to:
 - a. Excessive load or radius.
 - b. Overhead obstructions and electrical transmission lines.
 - c. Hazardous locations.
 - d. Inadequate surface and support to withstand all forces imposed.
 - e. Wind, weather and other unstable conditions.
 - f. Any potentially hazardous conditions.
11. Inspect the hoist equipment immediately prior to starting a personnel lift operation. The criteria for a frequent inspection as specified in the appropriate hoisting equipment ASME B30 volume shall be used.
12. Operate hoisting equipment with tracks at full extension and pinned and crane equipped with full counterweight configuration. Handling of personnel is not permitted with mid span or zero span positions.

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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 Electrocutation 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 Electrocutation 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.

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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).

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Lifting Personnel Near Power Lines



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FIGURE 1-1

| Required Clearance for Lifting Personnel Near High Voltage Power Lines | |
|--|-----------------------------------|
| Kilovolts (kV) | Minimum Radial Distance ft (m) |
| to 50 | 10 (3) |
| over 50 to 200 | 15 (4.6) |
| over 200 to 350 | 20 (6.1) |
| over 350 to 500 | 25 (7.6) |
| over 500 to 750 | 35 (10.7) |
| over 750 to 1000 | 45 (13.7) |

Lifting personnel where the crane equipment or platform can become electrified from electric power lines is an extremely hazardous practice. It is advisable to perform the lift so there is no possibility of any of the crane equipment, load line or personnel platform becoming a conductive path. This hoisting equipment shall not be used to lift personnel under, beside, or over electric power lines if any combination of boom, personnel platform, load line and machine component will enter the prohibited zone as specified in the required clearance table or the 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 to be 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.

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Condition B

The following steps shall be taken when lifting personnel in a Condition B situation:

1. A meeting, on the job site, between the job site management and either a qualified representative of the owner of the power lines or the electric utility shall take place. Procedures to safely complete the lift shall be established.
2. The clearance specified in the Required Clearance Table or in the Electrocution Hazard decal (Figure 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.



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.

Supplemental documentation

OPTION

PERSONNEL BASKET

OPTION

| PERSONNEL LIFT PLATFORM PRE-LIFT INSPECTING | | |
|--|---------------------|-----------------------|
| Inspector | Date | Platform ID |
| | 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 BASKET

OPTION

| PERSONNEL PLATFORM LIFT PLANNING AND AUTHORIZATION FORM | | |
|--|--|--------------------|
| 1. Location | Date | |
| 2. Purpose of Lift _____ _____ _____ | | |
| 3. Hoisting Equipment Mfg. | Model# | Serial # |
| 4. Expected radius | (max) | (at work location) |
| 5. (A) Rated load at radius | (B) Maximum lift load (50% of 5A) | |
| 6. Platform ID | | |
| 7. Platform Weight | | |
| 8. (A) Number of platform occupants | (B) Approximate weight with equipment. | |
| 9. Total Lift Weight | | |
| 10. Personnel Lift Supervisor | | |
| 11. What are the alternatives to this personnel lift? _____ _____ _____ | | |
| 12. Why are they not being used? _____ _____ _____ | | |
| 13. Prelift briefing held | AM/PM | |
| Attendees | | |
| 14. Anticipated hazards (wind, weather visibility, power lines) | | |
| 15. Lift accomplished date | Time | |
| 16. Remarks _____ _____ _____ _____ | | |
| <i>Name</i> | <i>Signature</i> | <i>Date</i> |

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Lift Testing

All equipment used in lifting of personnel should be tested and inspected to protect against failure during lifting operations. Trial Lift and Proof Lift are the two test lifts that must be used for the Yoke Basket Platforms. Perform these test lifts using the following information and criteria.

Contact Crane Care with any questions concerning Basket Test Failure, Inspection, Trial or Proof Lift, Basket Repairs or any other questions concerning this procedure.

Proof Lift

At each new job site, prior to hoisting people in the basket platform, the basket and rigging shall be proof tested to 125% of the basket platform's rating.

- The test load shall be evenly distributed.
- The weight used for the Proof Lift is identified in the *Basket Type and Test Weights* table in parentheses ().
- The platform shall be lifted and held in a raised position for not less than five minutes.
- After the Proof Lift test is completed, a qualified person shall inspect the platform and fill out the *Personnel Lift Platform Pre-Lift Inspection* form on page 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.

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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).

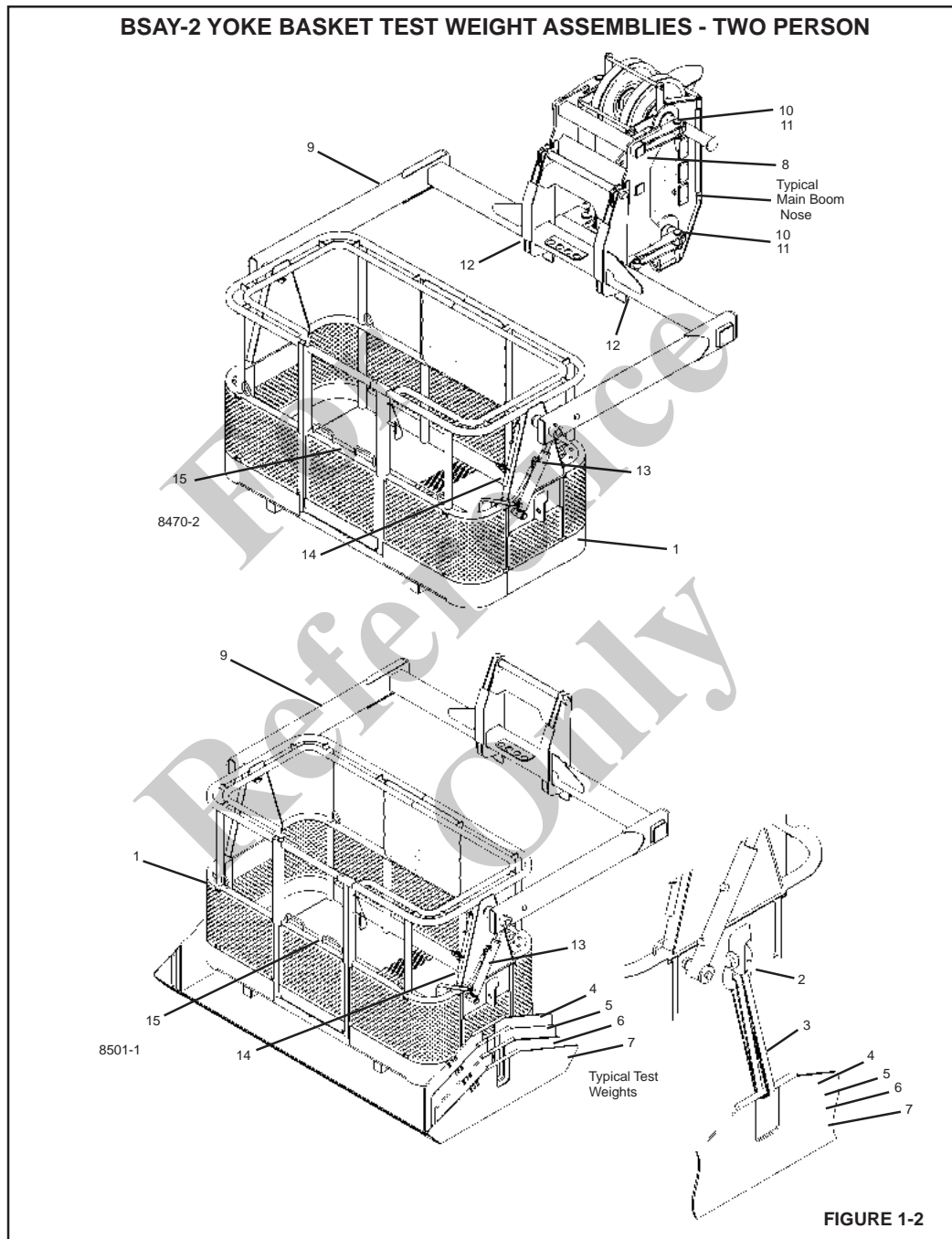
BSAY Yoke Basket Assembly Parts List (Figure 1-2)

| 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 |

OPTION

PERSONNEL BASKET

OPTION



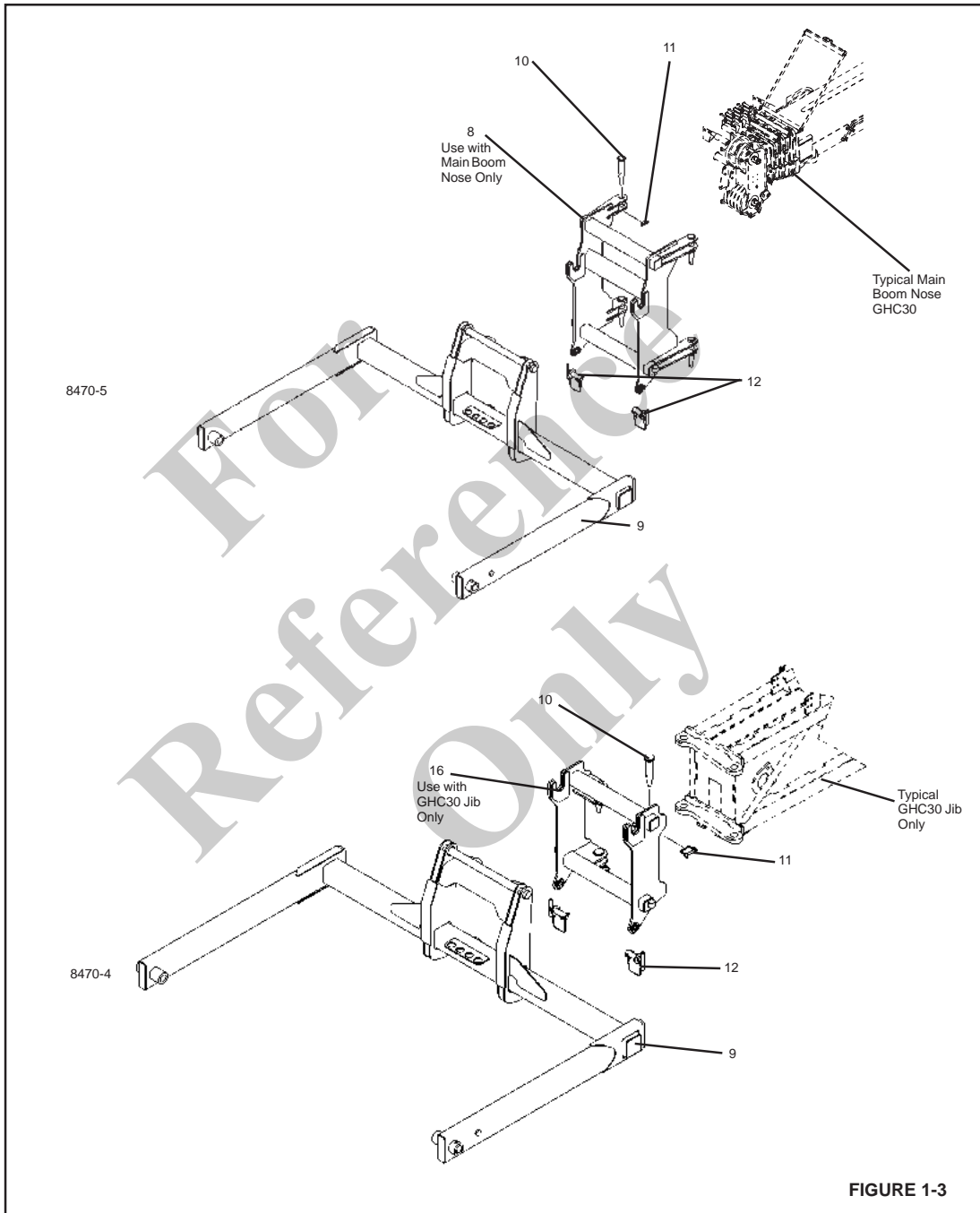
Grove

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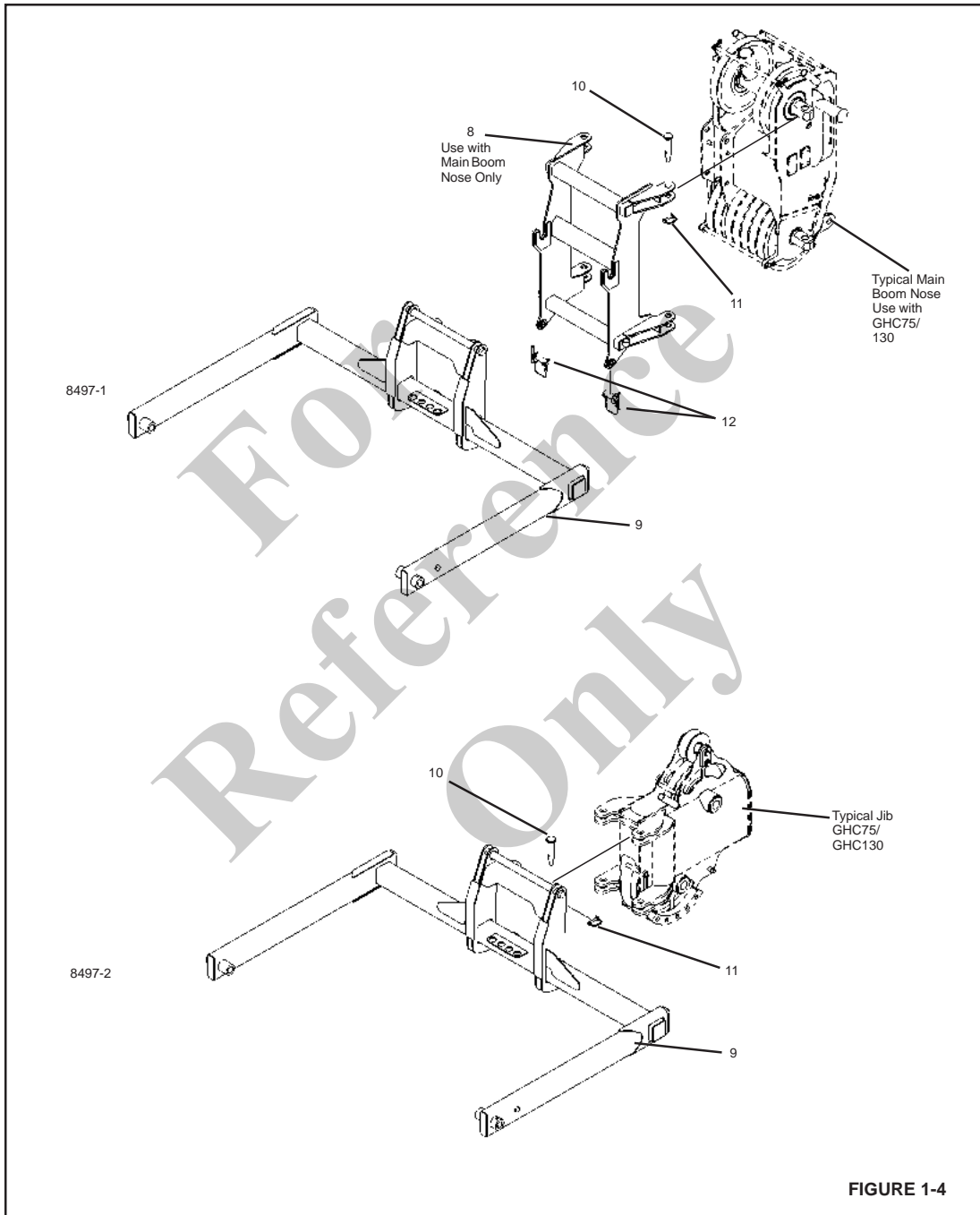
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OPTION

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OPTION



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OPTION

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

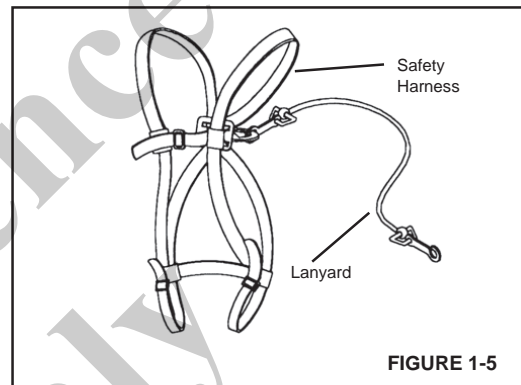
Safety harnesses are required for basket occupants and should be secured to the harness attachment links located near the basket corners See (Figure 1-5).

⚠ 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.



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.

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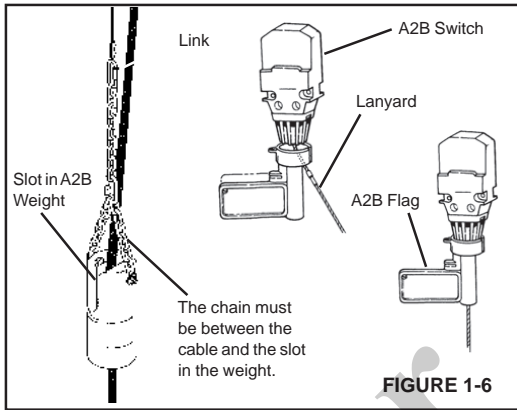


FIGURE 1-6

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.

PERSONNEL BASKET

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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.

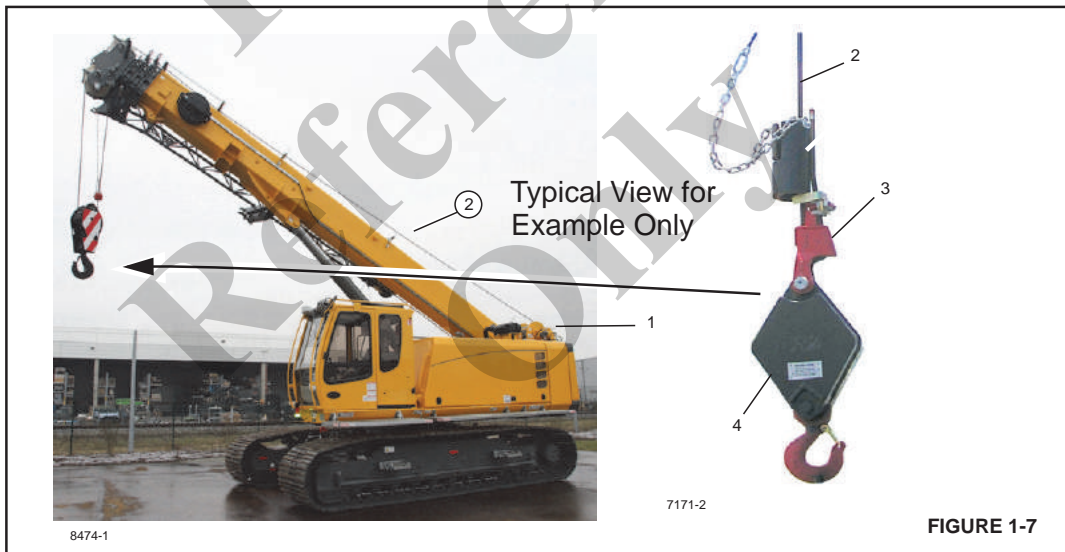
If your crane has the hoist mounted to the turret (as shown in Figure 1-7) - DO NOT connect the hoist cable to any place on the boom.

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

1. Remove the hook block (4) from the wedge socket (3, Figure 1-7) and feed the cable back through the boom nose until the wedge socket (3) has cleared the boom nose. Note that a typical single reeved hook block (4) is shown in Figure 1-7, your machine may appear to be reeved differently.
2. Slowly re-wind the hoist cable until the wedge socket (3) is within several feet of the stowing point.
3. Slowly rewind the hoist cable (2) until any remaining slack is removed and the cable is snug.



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.

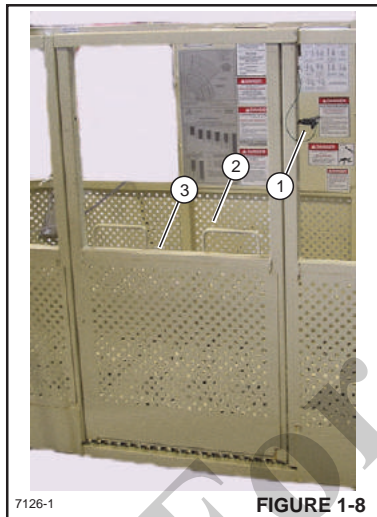
Perform the Installation instructions beginning on page 14 before starting these operating instructions.

1. 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.

OPTION

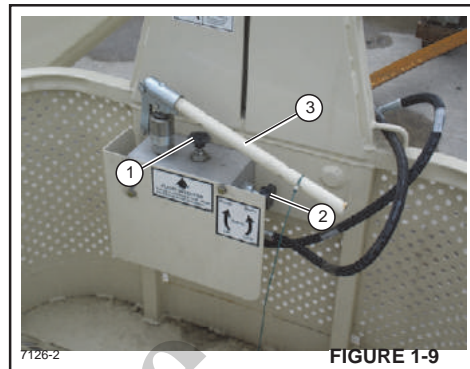
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7126-1 **FIGURE 1-8**

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 platform 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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Supplemental documentation

A.2 Pile gripper

| Name | Data |
|----------------|------------------------|
| Designation | Pole claw |
| Type | Pole claw |
| Number | 564-01 |
| Type of manual | Operation instructions |
| Manufacturer | Manitowoc |

For Reference Only



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.

| | |
|---|---|
|  | <p>⚠ DANGER</p> <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

**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, 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.

⚠ 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 powers 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.

POLE CLAW

OPTIONS

- 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.

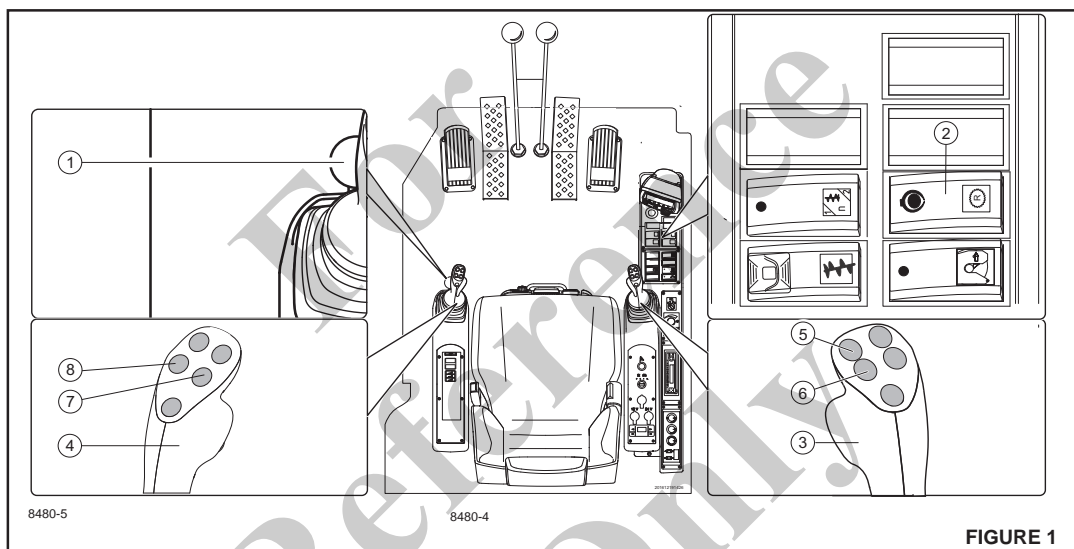


Figure 1 Item Numbers

| 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.

OPTIONS

POLE CLAW

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.

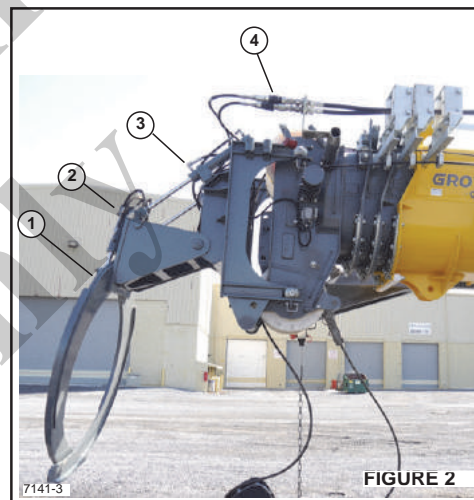


Figure 2 Item Numbers

| Item | Description |
|------|------------------------------|
| 1 | Clamping Tongs |
| 2 | Cylinders - Open/Close Tongs |
| 3 | Cylinders - Tilt Clamp |
| 4 | Couplings - Quick Change |

POLE CLAW

OPTIONS

For
Reference
Only

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A.3 Wire ropes

| Name | Data |
|----------------|---|
| Designation | Wire ropes |
| Type | Wire ropes |
| Number | . |
| Type of manual | Operation, installation, maintenance instructions |
| Manufacturer | . |

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Reference
Only



Handhabung, Montage und Wartung von Drahtseilen /

*Handling, assembly and
maintenance of wire ropes*



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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1 Handhabung, Montage und Wartung von Drahtseilen / *Handling, assembly and maintenance of wire ropes*

1.1 Die Seilauswahl / *Rope selection*

Die Fa. Grove liefert ihre Krane und Bagger in der Erstbeseilung mit hochwertigen Drahtseilen aus. Bei Erreichen der Ablegereife sollte die Beseilung durch neue Drahtseile der gleichen Machart, des gleichen Nenndurchmessers, der gleichen Drahtfestigkeit sowie der gleichen Schlagart und Schlagrichtung ersetzt werden. Diese für die Bestellung der Seile erforderlichen Angaben finden sich im Kranbuch Ihres Gerätes.

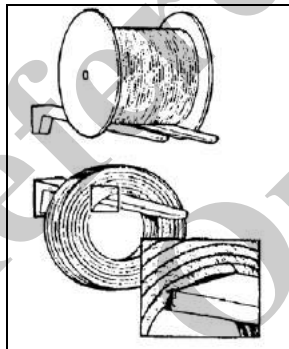
Im Umgang mit Drahtseilen sollten die folgenden Punkte beachtet werden:

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.

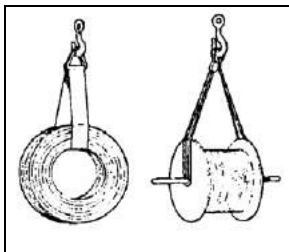
The following points should be noted when handling wire ropes:

1.2 Wie sollten Drahtseile entladen werden? / *How should wire ropes be unloaded?*

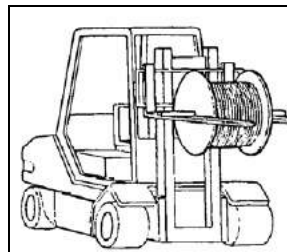


Die ersten Probleme im Umgang mit Drahtseilen treten häufig bereits bei der Anlieferung auf: die Gabel des Staplers fährt unter den Haspel oder in den Seilring hinein und beschädigt die Drahtseiloberfläche.

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.



Der Schaden wird vielleicht erst erheblich später entdeckt und eventuell sogar dem Drahtseilhersteller angelastet.



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 prefe-



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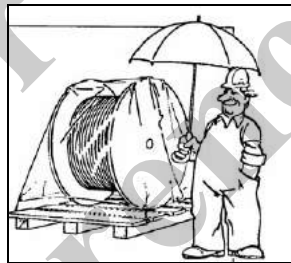
Das auf Ringen oder Haspeln angelieferte Drahtseil sollte nach Möglichkeit überhaupt nicht direkt mit einem Lasthaken oder der Gabel eines Staplers in Berührung kommen, sondern beispielsweise mit Hilfe von breiten textilen Hebebändern angehoben werden.

Ein Haspel wird zweckmäßigerweise an einer durch seine Achsbohrung gesteckten Stange angehoben. Wenn die Gabel des Staplers länger ist als die Haspelbreite, kann der Haspel auch an den Flanschen angehoben werden.

rably 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.

1.3 Wie sollten Drahtseile gelagert werden? /
How should wire ropes be stored?



Drahtseile sollten sauber, kühl und trocken überdacht gelagert werden. Ein Bodenkontakt ist zu vermeiden, beispielsweise durch Lagerung auf Paletten.

Wenn eine Lagerung im Freien unumgänglich ist, müssen die Seile so abgedeckt werden, daß sie mit Regenwasser nicht in Kontakt kommen. Diese Abdeckung schützt zwar gegen Regenwasser, jedoch nicht vor Kondenswasser, welches nicht entweichen kann und das Drahtseil eventuell nachhaltig schädigt. Abhilfe schafft hier beispielsweise eine Zwischenablage aus Sackleinen.

Bei der Lagerung einer größeren Zahl von Ersatzseilen sollte der Grundsatz gelten: first in - first out. Dies bedeutet, daß die Drahtseile in der Reihenfolge ihrer Anlieferung aufgelegt werden sollten. Auf diese Weise wird vermieden, daß einzelne Drahtseile erst nach vielen Jahren Lagerzeit zum Einsatz kommen.

Es versteht sich von selbst, daß bei Verwechslungsgefahr (zum Beispiel bei gleichen Drahtseilen unterschiedlicher Drahtfestigkeiten) die verschiedenen Lagerpositionen deutlich gekennzeichnet werden müssen. Außerdem muß eine ordentliche Dokumentation geführt werden, die anhand von Lagernummern, Spezifikation, Auftrag- und Lieferdatum für jedes der gelagerten und aufgelegten Drahtseile eine Rückverfolgung bis zum Lieferanten ermöglicht.

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.



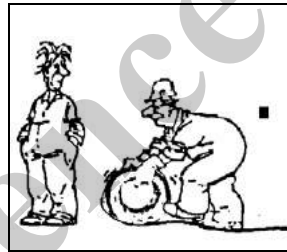
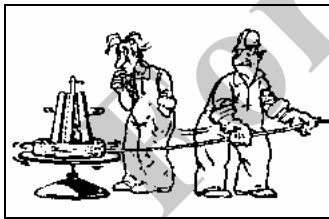
Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

2 Die Montage von Drahtseilen / *Assembly of wire ropes*

Bei der Montage von Drahtseilen ist generell darauf zu achten, daß die Seile ohne Verdrehung und ohne äußere Beschädigung vom Ring oder Haspel abgewickelt und auf die Anlage aufgelegt werden.

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.

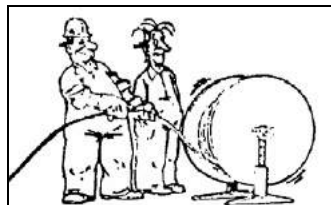
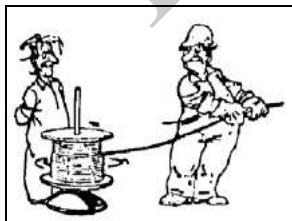
2.1 Das Abwickeln vom Ring / *Unwinding from the coil*



Ein auf einem Ring angeliefertes Drahtseil wird entweder von einem Drehteller abgewickelt oder am Boden ausgerollt. In letzterem Fall sollte der Boden möglichst sauber sein, da beispielsweise Sand, der am Schmiermittel des Drahtseiles haften bliebe, auf der Anlage zwischen Drahtseil und Seilrolle zu Drahtbeschädigungen führen könnte.

*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.*

2.2 Das Abwickeln vom Haspel / *Unwinding from the reel*

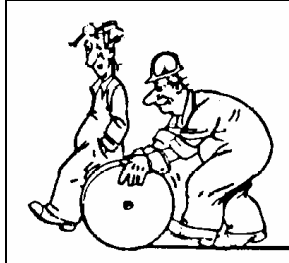


Ein auf einem Haspel aufgewickelter Drahtseil wird ebenfalls vorzugsweise von einem Drehteller oder aber von einem Bock abgewickelt.

A wire rope wound on a reel is likewise preferably unwound by a turntable or a payoff stand.

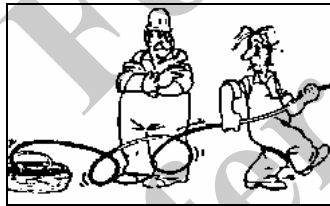


Handhabung, Montage und Wartung von Drahtseilen /
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Ein Ausrollen am Boden, welches in der einschlägigen Literatur immer wieder empfohlen wird, funktioniert in der Praxis nicht sehr gut, da hierbei der Haspel immer weniger Drahtseil abwickelt als die Wegstrecke, die er zurücklegt, so daß man bei diesem Vorgehen das Drahtseil hinter sich herziehen muß.

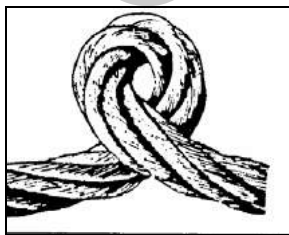
Unreeing on the ground, which is repeatedly recommended in the pertinent literature, is not very satisfactory in practice because the reel unwinds an increasingly smaller amount of rope than the distance it covers, i.e. with this approach you are forced to pull the wire rope along behind you.



In keinem Fall aber darf das Drahtseil seitlich vom Ring oder Haspel abgezogen werden, da auf diese Weise für jede abgezogene Windung eine Torsion in das Drahtseil eingebracht wird. Jede Seilverdrehung aber verändert die Schlaglängen von Litzen und Drahtseil, damit auch die Längenverhältnisse der Seilelemente zueinander und somit letztendlich die Lastverteilungen im Seil.



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.



Ein seitlich vom Ring oder Haspel abgezogenes Drahtseil sperrt sich gegen die aufgezogene Verdrehung und legt sich in Schlaufen. Bei Belastung eines solchen Seiles ziehen sich die Schlaufen zusammen und erzeugen eine Klanke, eine irreparable Verformung.

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.

Drahtseile mit Klankenbildung sind nicht mehr betriebsicher und müssen abgelegt werden.

Wire ropes with kink formation are no longer reliable and must be discarded.



2.3 Der Montagevorgang / Assembly

Die vorteilhafteste Art der Drahtseilmontage ist von Anlage zu Anlage verschieden. In jedem Fall ist die Art zu wählen, die bei vertretbarem Aufwand die geringste Gefahr der Seilverdrehung und der Beschädigung des Drahtseiles durch Kontakt mit Konstruktionsteilen gewährleistet.

Bei einigen Geräten kann es empfehlenswert sein, zuerst das alte Drahtseil abzulegen und dann das neue Seil zu montieren, bei anderen, insbesondere größeren Geräten empfiehlt es sich, das neue Drahtseil mit dem alten Seil einzuziehen. Eine weitere Möglichkeit, insbesondere bei der Erstbeseilung, ist die Verwendung eines dünneren Vorseiles, mit dessen Hilfe dann das eigentliche Drahtseil eingezogen wird.

In allen Fällen ist abzuwägen, ob das Drahtseil durch die gesamte Seileinsicherung eingezogen werden soll oder zunächst direkt vom Ring oder Haspel auf die Seiltrommel umgespult und anschließend von Hand oder mittels Hilfsseil eingesichert werden soll.

Wenn ein Seilende mit einer nicht lösbaren Seilendverbindung versehen ist, bleibt immer nur die Möglichkeit, das freie Seilende durch die gesamte Einsicherung zu ziehen.

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.

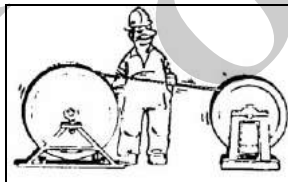
With some equipment it may be advisable first to discard the old wire rope and then assemble the new one; with other equipment, in particular larger units, it is advisable to draw in the new wire rope with the old one.

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.

2.4 Das Umspulen vom Haspel auf die Seiltrommel / Rewinding from the reel to the rope drum



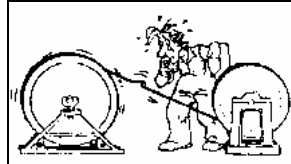
Jedes Drahtseil erhält schon bei der Fertigung, wo es mittels Abzugscheiben aus dem Verseilkorb gezogen wird, eine bevorzugte Biegerichtung. In dieser Richtung gebogen wird es beim Kunden ausgeliefert. Beim Umspulen vom Haspel auf die Seiltrommel ist darauf zu achten, daß das Seil diese bevorzugte Biegerichtung beibehält. Wenn der Seilstrang unterhalb der Seiltrommel aufläuft, sollte der Montagehaspel so aufgestellt werden, daß der von ihm ablaufende Seilstrang, ebenfalls unterhalb des Haspels abläuft, und umgekehrt.

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.



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Handling, assembly and maintenance of wire ropes



Beim Umspulen entgegengesetzt zur bevorzugten Biegerichtung des Drahtseiles wird dieses entweder versuchen, sich auf der Strecke zwischen Haspel und Seiltrommel zu verdrehen oder später im Einsatz durch Verdrehen die bevorzugte Lage einzunehmen. In beiden Fällen können Strukturveränderungen des Drahtseiles auftreten.

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.

**2.5 Das Einziehen des neuen Seiles mit Hilfe des alten Seiles oder eines Vorseiles/
*Drawing in the new rope with the aid of the old rope or a leader rope***

Wenn das neue Drahtseil durch das abzulegende Seil oder ein Vorseil eingezogen wird, ist auf eine sichere Verbindung dieser Seile zu achten. Weiterhin muß gewährleistet sein, daß das Vorseil nicht verdrehen kann. Als Vorseil empfehlen sich zum Beispiel drehungsfreie Drahtseilmacharten oder dreilitzige Faserseile. Bei Verwendung konventioneller Drahtseile ist darauf zu achten, daß sie zumindest die gleiche Schlagrichtung wie das einzuziehende Drahtseil haben.

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 fibre 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.

Wenn das neue Drahtseil mit Hilfe des alten Seiles eingezogen wird, werden die beiden Seilenden oft stumpf gegeneinander geschweißt. Eine derartige Verbindung kann den im Seiltrieb aufgebauten Drall vom alten auf das neue Seil übertragen und dieses schon bei der Montage extrem vorschädigen.

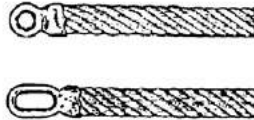
If the new wire rope is drawn in with the aid of the old rope, the two rope ends are often butt-welded to each other. A joint of this type can transmit the twist built up in the rope drive from the old rope to the new one and already severely damage the latter during assembly.

Dieses Verfahren ist aber auch aus anderen Gründen sehr problematisch: Die Schweißverbindung erzielt zwar bei Verwendung spezieller Elektroden im Zerreißversuch im geraden Strang zufriedenstellende Werte, kann aber dennoch wegen der großen Länge der starren Verbindungszone infolge der Biegebeanspruchung beim Lauf über Rollen brechen

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.

Wenn diese Verbindung Anwendung findet, sollte sie zusätzlich durch einen Seilstrumpf gesichert werden.

If this joint is used, it should be secured in addition by a rope stocking.



Unproblematischer ist die Verbindung der Drahtseile durch zwei an den Enden angeschweißte Ringe oder Kettenstücke, die mittels Litzen oder dünnen Seilen verbunden werden.

Diese Verbindung besitzt eine zufriedenstellende Tragkraft, ist biegsam und verhindert die Übertragung von Drall vom alten zum neuen Seil. Bei Verwendung von zwei Litzen kann anhand der Zahl der Verdrehungen nach der Montage festgestellt werden, ob das alte Seil auf der Anlage stark verdreht worden ist.

Eine weitere Möglichkeit stellt die Verbindung mittels Seilstrümpfen dar. Seilstrümpfe sind Geflechte aus Litzen, die über die Seilenden geschoben und an den Enden mit Klebeband gesichert werden. Bei Belastung ziehen sich die Seilstrümpfe zusammen und Halten die Seilenden mittels Reibung.

Beim Einziehen eines Gleichschlagseils ist zu beachten, daß die Seilstrümpfe sich trotz der Schnürspannungen wie eine Mutter auf einer Schraube auf dem Seil abdrehen können. Hier schafft ein vorheriges Umwickeln der Seilstrecken, die von den Seilstrümpfen gehalten werden sollen, mit einem starken Klebeband Abhilfe.

2.6 Das Auftrommeln unter Last / Winding on to drums under load

Für ein einwandfreies Spulen des Drahtseiles auf der Trommel ist es im Falle von Mehrlagenspülung, und hier besonders bei Verwendung der sogenannten Lebussspülung, von großer Wichtigkeit, daß die Drahtseile unter Vorspannung auf die Trommel gebracht werden.

Wenn die unteren Lagen zu locker sind, können sich die höheren Lagen unter Last zwischen tieferliegende Seilstränge einziehen. Dies kann zu gravierenden Seilschäden führen.

Da der ablaufende Seilstrang an dieser Stelle vielleicht sogar festgeklemmt wird, kann dies beim Abtrommeln des Seiles plötzlich zu einer Spulrichtungsumkehr und somit zu einem schlagartigen Anheben der abwärts bewegten Last führen.

Die Vorspannung sollte in der Größenordnung von etwa 1 bis 2% der Mindestbruchkraft der Drahtseile liegen.

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.

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 pre-tension.

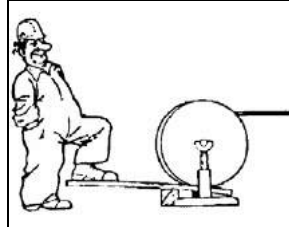
If the lower layers are too loose, the higher ones may be drawn in between lower rope sections under load. This may lead to serious rope damage.

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 pre-tension should be in the order of magnitude of about 1 to 2% of the minimum breaking force of the wire ropes.

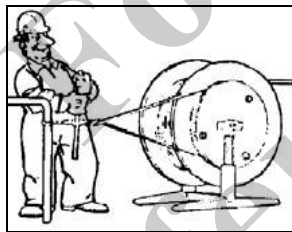


Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

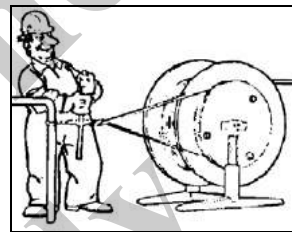


Während es in vielen Fällen ausreicht, das Drahtseil normal aufzulegen, um es dann abzutrommeln und mit Hilfe einer äußeren Last wieder aufzutrommeln, ist dies in anderen Fällen, zum Beispiel im Falle eines Turmdrehkranes, der seine höchste Kletterhöhe noch nicht erreicht hat, nicht möglich. In diesen Fällen muß die Vorspannung bereits bei der Montage aufgebracht werden.

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 pre-tension must already be supplied during assembly.



Dies kann beispielsweise durch ein Abbremsen des Haspelflansches mit Hilfe eines Brettes erfolgen oder durch eine am Haspel angebrachte Bremsscheibe. Die Bremsschnüre (Hanfseile mit Stahlkern) liefert der Drahtseilhersteller.



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.

In keinem Fall sollte man versuchen, die Vorspannung durch Klemmkräfte, zum Beispiel durch Einklemmen des Drahtseiles zwischen zwei Holzbohlen, zu erzeugen. Das Seil würde durch Strukturveränderungen irreparabel verformt.

You should never attempt to produce the pre-tension by clamping forces, e.g. by clamping the wire rope between two wooden planks. The rope would be irreparably deformed by structural changes.

2.7 Das Einfahren des Drahtseiles /
„Running in” the wire rope

Bevor ein Drahtseil nach seiner Montage die eigentliche Arbeit übernimmt, sollte es eine gewisse Zahl von Lastspielen mit geringen Teillasten durchführen. Es sollte „eingefahren“ werden, damit sich die Seilelemente setzen und der neuen Umgebung anpassen können. Leider wird in der Praxis genau das Gegenteil dieser Empfehlung getan: nach der Seilmontage erfolgt oft zunächst einmal die Überlastprüfung mit Lasten oberhalb der zulässigen Tragkraft der Anlage.

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.



2.8 Das Ablängen von Drahtseilen / Cutting wire ropes to length

Oft müssen Drahtseile vom Anwender selbst abgelängt oder gekürzt werden. Das Durchtrennen der Seile kann auf verschiedene Arten erfolgen. Bis zu einem Durchmesser von etwa 8 mm kann eine Drahtseilschere benutzt werden, mechanische oder hydraulische Cutter werden auch für größere Seildurchmesser angeboten. Wenn allerdings eine entsprechende Energiequelle in der Nähe ist, empfiehlt sich immer die Benutzung eines druckluftbetriebenen oder elektrischen Winkelschleifers.

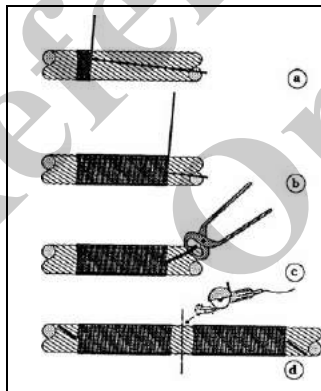
In allen Fällen müssen die Drahtseile neben der Trennstelle sorgfältig abgebunden werden, um ein Aufspringen der Seilenden oder eine Veränderung der Seil- und Litzenschlaglängen zu verhindern. Dies gilt ganz besonders beim Ablängen von drehungsarmen oder drehungsfreien Drahtseilen, deren Litzen oft bewußt vom Seilhersteller nicht vorgeformt worden sind.

Das Abbinden muß mit Eisendraht erfolgen, Isolierbänder können Strukturveränderungen der Drahtseile nicht verhindern.

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.



Zunächst wird die Trennstelle mit Kreide oder Isolierband markiert. Dann legt man das eine Ende des Bindendrahtes auf einer Länge von etwa 4 mal dem Seildurchmesser längs auf das Seil und beginnt, das Drahtseil und dieses Drahtstück von der Trennstelle wegführend zu umwickeln. Das Seil wird nun auf einer Länge von etwa 3 mal dem Seildurchmesser stramm umwickelt. Dann wird das überwickelte Drahtstück mit Hilfe einer Zange strammgezogen und gemeinsam mit dem zweiten Drahtende verdreht.

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.



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Die Länge der umeinander verdrehten Drahtenden wird mit der Zange auf etwa einen Seildurchmesser gekürzt. Die Drahtenden werden dann mit leichten Schlägen in ein Tal zwischen zwei Außenlitzen des Drahtseiles geschlagen, um der Gefahr einer Verletzung vorzubeugen.

Nach entsprechender Vorbereitung der anderen Seite der Trennstelle kann das Drahtseil nun durchgetrennt werden.

Anstelle eines langen Abbundes können auch auf jeder Seite der Trennstelle drei Abbunde von etwa einem Seildurchmesser Breite angebracht werden.

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.

For Reference Only



3 Die Wartung von Drahtseilen / Maintenance of wire ropes

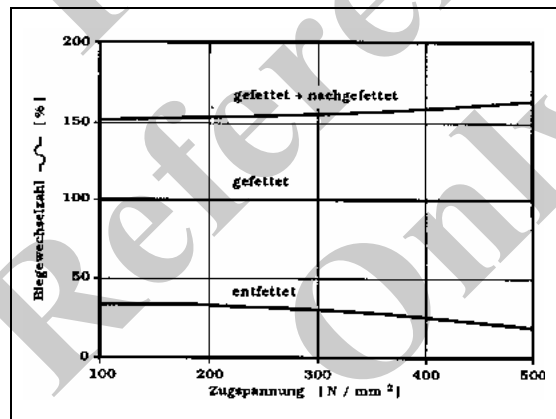
Drahtseile müssen nach DIN 15020 „regelmäßig gewartet werden, wobei die auszuführenden Arbeiten abhängen von der Art des Hebezeuges, dessen Benutzung und der Seilart.“ Durch eine regelmäßige Wartung kann die Lebensdauer eines Drahtseiles erheblich vergrößert werden.

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.

3.1 Die Nachschmierung von Drahtseilen / Relubrication of wire ropes

Während seiner Herstellung erhält ein Drahtseil eine intensive Schmierung, die einen Schutz gegen Korrosion und eine Verbesserung der Reibwerte zwischen den Seilelementen untereinander sowie zwischen Drahtseil und Seilrolle oder Trommel erreichen soll. Dieser Vorrat reicht jedoch nur für eine begrenzte Zeit und sollte regelmäßig ergänzt werden.

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.



Die DIN 15020 schreibt: „Drahtseile müssen in regelmäßigen Abständen, die von den Betriebsverhältnissen abhängen, nachgeschmiert werden, insbesondere im Bereich der Biegezone.“ Weiter heißt es: „Wenn aus betrieblichen Gründen das Nachschmieren des Seiles unterbleiben muß, ist mit einer kürzeren Auflagezeit zu rechnen und die Überwachung entsprechend einzurichten.“ Der Einfluß von Schmierung und Nachschmierung auf die Seillebensdauer wird im vorigen Bild gezeigt.

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.

Bei der Wahl des Nachschmiermittels ist darauf zu achten, daß es mit dem Fabrikat des Drahtseilherstellers verträglich ist. Drahtseilwerk Saar gibt hierüber gerne Auskunft.

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.

Schmierstoffempfehlung

- **Fett:** Aral Aralub LFZ 1

Lubricant recommendation

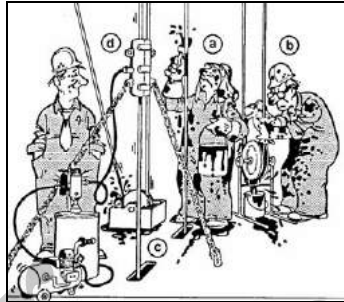
- **grease:** Aral Aralub LFZ 1



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- **Haftschmierstoff (Sprühdose):**
Seilfett F 315 L

- **adhesive lubricant (spray):**
Seilfett F 315 L



Das Aufbringen des Schmiermittels kann auf verschiedene Art erfolgen:

Die wohl gebräuchlichsten Methoden sind das Aufbringen mittels Pinsel oder Handschuh.

Auch das Aufbringen von Schmiermittel im Bereich einer Seilrolle wird häufig praktiziert.

Manchmal wird das Schmiermittel kontinuierlich an einer Seilrolle als Tropfschmierung aufgebracht. Bei geringerem Schmiermittelbedarf finden häufig Sprühdosen Anwendung.

Verschiedene Anlagen erlauben das Durchlaufen einer Schmiermittelwanne.

Ein vollständiges Eindringen des Schmiermittels in alle Hohlräume des Drahtseiles garantiert allerdings nur eine Hochdruckschmierung mittels Druckmanschette. Hierbei werden die mit Gummidichtungen versehenen Halbschalen um das Drahtseil geklappt und verschraubt. Während das Drahtseil die Manschette durchläuft, wird mit Drücken um 30 bar Schmiermittel in die Manschette gepreßt. Wichtig bei jeder Drahtseilnachschiemierung ist, daß sie von Anfang an regelmäßig erfolgt und nicht erst aufgenommen wird, wenn bereits die ersten Schäden festgestellt wurden.

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.

**3.2 Das Reinigen von Drahtseilen /
Cleaning of wire ropes**

Die DIN 15020 schreibt: „Sehr stark verschmutzte Drahtseile sollten von Zeit zu Zeit äußerlich gereinigt werden.“ Dies gilt besonders für Drahtseile, die in stark abrasiver Umgebung arbeiten oder aber im Betrieb chemisch wirksame Stoffe anlagern.

Eine wirksame Reinigung ist allerdings ohne die richtigen Hilfsmittel sehr mühsam. Das kanadische Rigging Manual empfiehlt zur Seilreinigung eine Vorrichtung mit drei rotierenden Bürsten und nachgeschalteter Druckluft. Ein amerikanischer

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",

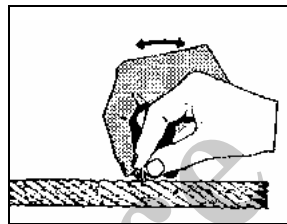
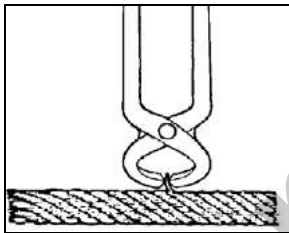


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Hersteller bietet einen „Seiligel“ an, eine mit Bürsten versehene rotierende Manschette, die über das Drahtseil gezogen wird.

a rotating sleeve with brushes, which is pulled over the wire rope.

3.3 Das Entfernen von gebrochenen Drähten / Removal of broken wires



Wenn bei einer Drahtseilinspektion Drahtbrüchen gefunden werden, die sich möglicherweise über benachbarte Drähte legen und diese dann bei Lauf über Rollen ebenfalls zerstören könnten, müssen diese Brüchenden entfernt werden. Auf keinen Fall sollten die Drähte mit einer Zange abgekniffen werden. Die beste Methode ist, die Drähte solange hin- und herzubiegen, bis sie an der letzten Stelle, an der sie in Litzenverband gehalten werden, brechen.

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.

Bei einem dickeren Draht empfiehlt es sich hier, ein Werkzeug hin und her über das Seil zu bewegen und so den Draht zu biegen, bis er bricht.

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.

3.4 Das Kürzen oder Rücken von Drahtseilen / Shortening or relocation of wire ropes

Sehr häufig müssen Drahtseile abgelegt werden, weil kurze Seilzonen, beispielsweise das Seilstück, welches auf der Trommel von der ersten in die zweite Lage klettern muß, stark beschädigt sind, während die restliche Seillänge noch in einwandfreiem Zustand ist.

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 derartigen Fällen kann die Auftriegszeit von Drahtseilen zum Teil dadurch drastisch erhöht werden, daß die Seile am Festpunkt um eine Strecke gedrückt oder gekürzt werden, die das am stärksten beanspruchte Seilstück aus der Hauptbeanspruchungszone herausführt. Nach diesem Vorgang wird nun eine benachbarte Zone den stärkeren Beanspruchungen ausgesetzt sein.

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.

Eine weitere typische lokale Beschädigung tritt auf der Seiltrommel an den Stellen auf, wo der Seilstrang gegen die benachbarte Windung läuft (crossover point) und zur Seite abgelenkt werden muß. Wenn die hier entstehenden Beschädigungen die Hauptursache für das Ablegen des Drahtseiles darstellen, kann durch mehrfaches Rücken des Seiles und Verschieben der Beanspruchungszone die Seillebensdauer eventuell vervielfacht werden.

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.



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Handling, assembly and maintenance of wire ropes

3.5 Das Wenden von Drahtseilen /
Reversal of wire ropes

Auf einigen Anlagen werden die Drahtseile auf verschiedenen Zonen völlig unterschiedlichen Beanspruchungen ausgesetzt. So wird zum Beispiel das Zugseil eines Schürfkübelbaggers (dragline) am Trommelende im wesentlichen auf Biegewechsel beansprucht, das Kübelende wird durch den Boden gezogen und starkem Verschleiß ausgesetzt.

Hier ist es, besonders im Ausland, eine gängige Praxis, das Drahtseil nach einer gewissen Laufzeit zu wenden (end-for-ending), so daß nun das in der Regel noch besser erhaltene Trommelende dem starken Verschleiß ausgesetzt werden kann.

Der Erfolg derartiger Maßnahmen ist allerdings umstritten. In jedem Fall kann sich der Aufwand nur dort lohnen, wo der Seilwert ein Vielfaches der Montagekosten darstellt.

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.



4 Die Inspektion von Drahtseilen / Inspection of wire ropes

4.1 Warum muß ein Drahtseil inspiziert werden? / Why must a wire rope be inspected?

Ein Drahtseil ist ein Gebrauchsartikel mit einer begrenzten Lebensdauer. Viele Eigenschaften eines Drahtseiles verändern sich im Laufe seiner Einsatzzeit. So steigt beispielsweise seine Bruchkraft zunächst mit zunehmender Laufzeit leicht an, um dann aber nach Überschreiten eines Maximums rapide abzufallen.

Dieser Bruchkraftabfall erklärt sich durch einen zunehmenden Verlust an Metallquerschnitt infolge von Abrieb und Korrosion, durch das Auftreten von Drahtbrüchen und durch Strukturveränderungen des Drahtseiles. Die Zahl der Drahtbrüche nimmt in der Regel stetig zu.

Eines der Ziele der Drahtseilinspektion ist es, diesen natürlichen Verlauf zu überwachen, damit das Drahtseil rechtzeitig vor Erreichen eines unsicheren Betriebszustandes abgelegt werden kann.

Ein weiteres Ziel der Inspektion ist es, außergewöhnliche Seilbeschädigungen zu erkennen, die in der Regel durch äußere Einflüsse erzeugt werden. Hierdurch wird einerseits ein rechtzeitiges Ablegen der Drahtseile ermöglicht, andererseits hilft das Erkennen von Schwachstellen im Seiltrieb, Maßnahmen zu ergreifen, die ein wiederholtes Auftreten derartiger Beschädigungen zu vermeiden helfen.

4.2 Wann muß ein Drahtseil inspiziert werden? / When must a wire rope be inspected?

Die DIN 15020, Blatt 2, empfiehlt in Punkt 3.4 „Überwachung“ eine tägliche Sichtprüfung von Drahtseilen und Seilendbefestigungen auf etwaige Schäden.

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.

15020 Part 2 recommends in point 3.4 "Monitoring" a daily visual inspection of wire ropes and rope end fastenings for any damage DIN.



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In regelmäßigen Zeitabständen sollen ferner die Drahtseile durch ausgebildetes Fachpersonal auf ihren betriebssicheren Zustand hin untersucht werden. Der zeitliche Abstand der Prüfungen ist nach DIN so festzulegen, „daß Schäden rechtzeitig erkannt werden. Deswegen sind die Abstände in den ersten Wochen nach dem Auflegen eines neuen Drahtseiles und nach dem Auftreten der ersten Drahtbrüche kürzer zu wählen als während der übrigen Aufliegezeit des Drahtseiles. Nach außergewöhnlichen Belastungen oder bei vermuteten nicht sichtbaren Schäden ist der zeitliche Abstand entsprechend zu kürzen (ggf. auf Stunden). Außerdem ist eine solche Prüfung durchzuführen bei der Inbetriebnahme nach längeren Stillstandszeiten, bei zum Ortswechsel demontierten Hebezeugen vor jeder Inbetriebnahme an einer neuen Arbeitsstelle und nach jedem Unfall oder Schadensfall, der in Zusammenhang mit dem Seiltrieb aufgetreten ist.

Seilrollen, Seiltrommeln und Ausgleichsrollen sind nach DIN 15020 „bei Bedarf, jedoch mindestens einmal jährlich und bei jedem Auflegen eines neuen Drahtseiles“ zu überprüfen.

Regelmäßige Inspektionen des Seiltriebes dienen der Sicherheit des Betreibers in zweifacher Hinsicht; Zunächst einmal wird das Unfallrisiko vermindert. Sollte aber durch einen unglücklichen Zufall dennoch einmal ein Schaden eintreten, helfen lückenlose Dokumente regelmäßiger Überwachungen, einen Vorwurf der Fahrlässigkeit zurückzuweisen.

4.3 Übersicht über die Ablegekriterien / *Survey of discard criteria*

Nach DIN 15020 muß ein Drahtseil abgelegt werden, wenn eines oder mehrere der folgenden Kriterien erfüllt sind:

1) Drahtbrüche. Ein Drahtseil muß abgelegt werden, wenn die zulässige Drahtbruchzahl gemäß DIN 15020 erreicht oder überschritten wurde (siehe Kapitel 5). Bei Auftreten von Drahtbruchnestern ist das Drahtseil ebenfalls abzulegen.

2) Durchmesserverringering. Ein Drahtseil muß abgelegt werden, wenn es seinen Durchmesser durch Strukturveränderungen auf längere Strecken um 15% oder mehr gegenüber dem Nennmaß verkleinert hat.

3) Korrosion. Ein Drahtseil muß abgelegt werden, wenn seine Tragkraft oder seine Betriebsfestigkeit durch Korrosion übermäßig herabgesetzt wurde. Hier muß das Drahtseil bei einer Durchmesserverringering von 10% gegenüber dem Nennmaß abgelegt werden, auch wenn keine Drahtbrüche festgestellt werden.

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.

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.

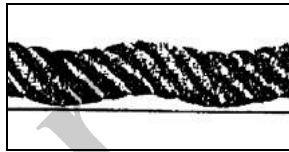


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4) Abrieb. Ein Drahtseil muß abgelegt werden, wenn seine statische Bruchkraft oder seine Betriebsfestigkeit durch metallischen Abrieb übermäßig herabgesetzt wurde. Hier muß das Drahtseil bei einer Durchmesser verringering von 10 % gegenüber dem Nennmaß abgelegt werden, auch wenn keine Drahtbrücke festgestellt werden.

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) Seilverformungen
Rope deformations



a) Korkezieherartige Verformungen. Ein Drahtseil muß abgelegt werden, wenn eine korkezieherartige Verformung eine Wellenhöhe von 1/3 des Seildurchmessers erreicht.

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) Korbbildungen. Bei Auftreten einer Korbbildung muß ein Drahtseil abgelegt werden.

b) Basket formations. If a basket formation occurs, a wire rope must be discarded.



c) Schlaufenbildungen. Bei erheblicher Veränderung des Seilverbandes durch Schlaufenbildungen von Drähten muß ein Drahtseil abgelegt werden.

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.



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d) Drahtlockerungen. Bei durch Rost oder Abrieb verursachten Drahtlockerungen muß ein Drahtseil abgelegt werden. Bei anderer Ursache sind die Folgeschäden für das Ablegen entscheidend.

e) Knotenbildungen. Bei starker Knotenbildung (Bildung von lokalen Verdickungen im Seil) muß ein Drahtseil abgelegt werden.

f) Einschnürungen. Drahtseile mit starken Einschnürungen sind abzulegen.

g) Lockenartige Verformungen. Drahtseile, die bleibende Verformungen erlitten haben, weil sie über eine Kante gezogen wurden, sind abzulegen.

h) Klanken. Drahtseile mit Klanken (zugezogene Seilschlinge) sind abzulegen.

i) Knicke. Drahtseile, die durch gewaltsame äußere Einwirkung Knicke erhalten haben sind abzulegen.

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.

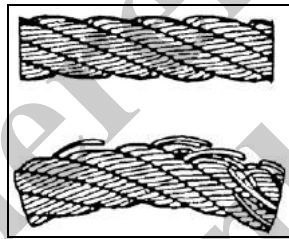
e) Knot formations. In the case of prominent knot formation (local thickening in the rope) a wire rope must be discarded.

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) Hitzeeinwirkung. Drahtseile, die übermäßiger Hitzeeinwirkung ausgesetzt waren, sind abzulegen. Eine Erwärmung von Seildrähten auf Temperaturen über etwa 300 Grad Celsius führen zu einem starken Abfall der Drahtfestigkeit

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.



4.4 Wo muß das Drahtseil inspiziert werden? / Where must a wire rope be inspected?

Eine optische Begutachtung hat generell auf der gesamten Seillänge zu erfolgen, wobei kritischen Stellen natürlich eine erhöhte Aufmerksamkeit gezollt werden sollte. Kritische Stellen sind:

a) die Seilzonen, die die größte Zahl von Biege-
wechseln ausführen. Hier ist mit erhöhtem Abtrieb
und Drahtbrüchen zu rechnen.

b) die Lastaufnahmepunkte. Wenn ein Hebezeug
bevorzugt an einer Stelle eine Last aufnimmt oder
abgibt, sind alle Seilzonen, die in dieser Stellung
auf Seilrollen liegen oder auf die Trommel auf-
oder von ihr ablaufen, besonderen Beanspru-
chungen unterworfen.

c) die Seilendbefestigungen. An den Seilendbefestigun-
gen ist das Drahtseil in seiner Elastizität be-
einträchtigt, die Seilgeometrie ist hier eingefroren.
Die Befestigung übt oft zusätzliche Pressungen
auf das Drahtseil aus, die Übergangszonen sind
häufig zusätzlichen Spannungen durch Seil-
schwingungen ausgesetzt. Oft kann sich in den
Endbefestigungen Feuchtigkeit festsetzen. Daher
ist hier mit Drahtbrüchen und Korrosion zu rech-
nen.

d) Seilzonen auf Ausgleichsrollen. Im Gegensatz
zu einer Einschätzung nach DIN 15020, die für
Ausgleichsrollen kleinere Durchmesser gestattet
als für die übrigen Rollen im Seiltrieb, sind die
Seilzonen auf Ausgleichsrollen durch Schwingun-
gen der Last oder ungleichmäßiges Spulen zweier
Seiltrommeln z. T. sehr hohen Biege-
wechselzahlen unterworfen.
Oft kann sich hier auch Feuchtigkeit zwischen Seil
und Rolle festsetzen und örtlich verstärkte Korro-
sion bewirken.

e) Seilzonen auf Seiltrommeln. Lastaufnahme-
punkte und Überkreuzungsstellen auf Seiltrom-
meln sind verstärktem Verschleiß unterworfen und
daher besonders auf Abtrieb, Drahtbrüche und
Strukturveränderung zu prüfen. Bei Mehrlagen-
spulung können sich die unteren Lagen lockern
und zu Hindernissen für die auflaufenden Seil-
stränge werden, auch können sich höhere Lagen
in lockere untenliegende Lagen hineinziehen.
Berührungsstellen mit den Trommelflanschen und
Steigungszonen sind außerdem besonders zu
begutachten, da sie starkem Verschleiß aus-
gesetzt sein können.

*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.
The fastening often exerts additional pressures on the
wire rope and the transition zones are frequently expo-
sed to additional stresses by rope vibrations. Moisture
may often deposit in the end fastenings. Hence wire
breaks and corrosion are to be anticipated here.*

*d) 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 winding of two rope drums.
Moisture may also deposit between rope and pulley and
cause locally increased corrosion.*

*e) 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 loo-
sen 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 be-
cause they may be exposed to heavy wear.*



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f) Seilscheiben. Seilscheiben sind, sofern dies möglich ist, auf ihre Gängigkeit hin zu prüfen. Der Rillengrund der Scheiben, der im Durchmesser etwa Seilennendurchmesser plus 6% bis plus 8% betragen sollte, ist mit Hilfe einer Lehre zu überprüfen.

Eine zu enge Seilrille führt zu einem starkem Abfall der Seillebensdauer infolge von Strukturveränderungen. Eine zu weite Rille bewirkt wegen der ungenügenden Unterstützung des Drahtseiles einen Abfall der Seillebensdauer infolge vorzeitiger Seilermüdung.

Die verbleibende Wandstärke von Rollen sollte gemessen werden, eventuell vorgefundenes seitliches Einarbeiten ist zu vermerken. Rollen mit Negativabdrücken der Seiloberfläche im Rillengrund sollten ausgetauscht werden.

g) Seilzonen, die aggressiven Medien oder Hitze ausgesetzt sind. Chemikalieneinfluß oder Hitze können die Tragkraft von Drahtseilen deutlich herabsetzen. Dauertemperaturen von etwa 200 Grad Celsius sind für das Drahtmaterial noch unkritisch, jedoch können bereits Temperaturen von 250 Grad Celsius zum vollständigen Schmiermittelverlust des Drahtseiles und somit zu einer deutlichen Verschlechterung der Arbeitsbedingungen führen.

4.5 Die Ablegedrahtbruchzahl / *Number of wire breaks for discard*

Die Ablegedrahtbruchzahl stellt das wichtigste Ablegekriterium dar. Als Ablegedrahtbruchzahl gilt die größte Zahl der auf einer Länge von 6 x Seildurchmesser oder 30 x Seildurchmesser gefundenen äußeren, oder wenn diese zugänglich sind, auch inneren Drahtbrüche.

Die Ablegebruchzahl ist in DIN 12050 Blatt 2, Seite 3, in Abhängigkeit von der Zahl der tragenden Drähte in den Außenlitzen des Drahtseiles und der Triebwerksgruppe des Seiltriebes dargestellt. Die Tabelle unterscheidet ferner zwischen Kreuzschlag- und Gleichschlagseilen.

Die Ablegedrahtbruchzahl von Kreuzschlagseilen ist im Mittel doppelt so hoch wie die Ablegedrahtbruchzahl von Gleichschlagseilen.

Mit größer werdender Zahl der tragenden Drähte steigt die Ablegedrahtbruchzahl. In den Triebwerksgruppen 2 m, 3 m 4 m und 5 m ist die Ablegedrahtbruchzahl doppelt so hoch wie in den hochbelasteten Triebwerksgruppen 1 Em bis 1 Am.

f) 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.

g) 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.

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.



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Die Angabe von Ablegedrahtbruchzahlen für eine Länge von 6 x Seildurchmesser (ungefähr eine Seilschlaglänge) und für eine Länge von 30 x Seildurchmesser (ungefähr 5 Seilschlaglängen) berücksichtigt das mögliche Auftreten von lokal begrenzten Beschädigungen oder Drahtbruchnestern: Selbst wenn die Ablegedrahtbruchzahl für eine Länge von 30 x Seildurchmesser noch nicht erreicht ist, kann das Drahtseil infolge einer lokalen Beschädigung bereits nicht mehr betriebssicher sein. Es muß dann wegen des Erreichens der Ablegedrahtbruchzahl für 6 x Seildurchmesser abgelegt werden.

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.

For
Reference
Only



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**4.6 Wie muß ein Drahtseil inspiziert werden? /
 How must a wire rope be inspected?**

**4.6.1 Hilfsmittel /
 Aids**

Bei einer fachmännischen Inspektion des Drahtseiles und des Seiltriebes sollten folgende Hilfsmittel zur Verfügung stehen:

- eine Schieblehre (evtl. mit Meßflächen)
- ein Bandmaß
- ein Stück weiße Kreide, ein Stück schwarze Wachskreide
- eine Endlosrolle Papierstreifen
- ein Schraubendreher
- eine Lupe (evtl. Meßlupe, Fadenzähler)
- zwei Satz Rillenlehren
- ein Putzlappen
- ein Notizblock oder ein Inspektionsformular
- die Protokolle der vorausgegangenen Inspektionen
- ein Kugelschreiber o. ä.
- eine Übersicht über die Ablegekriterien

The following aids should be available for a competent inspection of the wire rope and the rope drive:

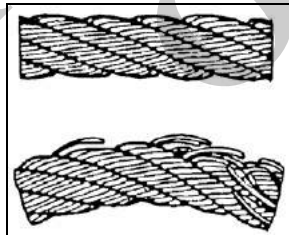
- *a sliding gauge (possibly with measuring surfaces)*
- *a tape measure*
- *a piece of white chalk, a piece of black wax chalk*
- *an endless roll of paper tape screwdriver*
- *a magnifier (possibly measuring magnifier, thread counter)*
- *two sets of groove gauges*
- *a cleaning rag*
- *a notepad or inspection form*
- *the records of the previous inspections*
- *a ball-point pen or the like*
- *a list of the discard criteria*



4.6.2 Ermittlung der Drahtbruchzahlen / Determination of the numbers of wire breaks

Die Ermittlung der Drahtbruchzahlen muß durch eine äußere visuelle Begutachtung erfolgen. Zunächst muß hierbei durch eine Überprüfung möglichst der gesamten Seillänge die Seilzone mit der größten Drahtbruchhäufung ermittelt werden. Auf den schlechtesten Seilzonen werden mit Hilfe eines Bandmaßes Strecken der Länge 30 x Seildurchmesser abgemessen und mit Kreide markiert. Bei Auftreten von Drahtbruchnestern oder lokalen Beschädigungen des Drahtseiles wird außerdem eine Strecke von 6 x Seildurchmesser (ungefähr eine Seilschlaglänge), die die Schäden beinhaltet, markiert. Auf diesen Strecken werden nun sorgfältig alle Drahtbrüche durch Sichtkontrolle und Abtasten des Seiles auf dem Umfang gezählt. Zur besseren optischen Kontrolle kann es hierbei erforderlich sein, die Seiloberfläche mit Hilfe eines Putzlappens und die Täler zwischen den Litzen mit einem Schaber von Schmiermittel und Schmutz zu befreien.

Das Abtasten des Seiles ist bei der Ermittlung der Drahtbruchzahl ebenso wichtig wie die optische Kontrolle, da sich häufig, besonders bei gut vorgeformten Seilen, die Drahtbruchenden nicht aus dem Seilverband herausheben. Außerdem ist häufig der schmale Spalt zwischen den Bruchenden mit Schmiermittel zugesetzt und daher optisch selbst bei gesäuberten Seilen kaum wahrnehmbar. Wer bei der Seilkontrolle keine schmutzigen Finger bekommt, arbeitet nicht gründlich genug!



Drahtbrüche von Außendrähten, die nicht auf den Litzenkuppen, sondern an den Berührungsstellen zweier benachbarter Drähte oder sogar an der Litzenunterseite auftreten, sind sehr schwer zu erkennen. Bei dünnen Seilen, die vollständig entlastet werden können, lassen sich derartige Drahtbrüche durch starkes Biegen des Seiles sichtbar machen.

Die ermittelten Drahtbruchwerte werden notiert und mit den nach DIN 15020 zulässigen Drahtbruchzahlen verglichen. Bei Überschreiten der zulässigen Drahtbruchzahlen muß das Drahtseil abgelegt werden.

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.



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4.6.3 Ermittlung des Seildurchmessers / Determination of the rope diameter

Die Messung des Seildurchmessers sollte bereits am fabrikanneu angelieferten Seil mehrfach durchgeführt werden. Zum einen kann durch diese Messung festgelegt werden, ob das neue Seil innerhalb der von den Normen vorgeschriebenen Toleranz von Seilnennendurchmesser + 0% bis Seilnennendurchmesser + 5% liegt (bei Verwendung spezieller Spulsysteme kann der zulässige Durchmesserbereich für das Drahtseil weiter eingengt sein). Zum anderen kann der Mittelwert der gemessenen Durchmesser im Neuzustand als Vergleichswert für alle folgenden Messungen dienen.

Durch Messungen des Seildurchmessers während der weiteren Betriebszeit des Seiles soll gewährleistet werden, daß abnormal schnelle Verringerungen des Seildurchmessers (zum Beispiel durch Bruch der Stahleinlage) schnell erkannt werden. Weiterhin sollen die Messungen sicherstellen, daß das Seil bei Erreichen der von den Normen vorgeschriebenen maximalen Durchmessererringerung abgelegt wird. Bei einer Abnahme des Seildurchmessers auf 90% seines Nennwertes muß nach DIN 15020 ein Drahtseil abgelegt werden.

Zur exakten Bestimmung des Seildurchmessers an verschiedenen charakteristischen oder auch außergewöhnlichen Zonen des Drahtseiles bedienen wir uns einer Schieblehre. Die Schieblehre sollte nach Möglichkeit zwei plane Meßflächen aufweisen, eine Digitalanzeige ist vorteilhaft.

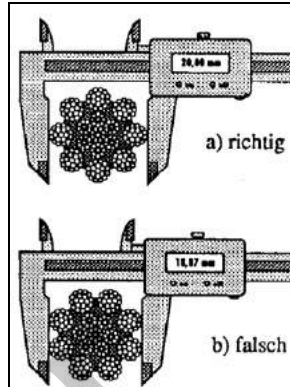
The rope diameter should be measured several times on the brand-new rope. Firstly, it can be established by this measurement whether the new rope is within the tolerance of rope nominal diameter + 0 % to rope nominal diameter + 5 % specified in the standards (if special winding systems are used the permissible 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.



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Der Seildurchmesser ist definiert als der Durchmesser des Hüllkreises der Außenlitzen. Die Messung muß also die höchsten Stellen der Außenlitzen erfassen, eine Messung über den Tälern ergäbe einen zu kleinen Wert.

An jeder Meßstelle sollten zwei senkrecht zueinander stehende Seildurchmesser gemessen werden, um auch eventuelle Unrundheiten des Seiles erkennen zu können

Die Eintragung in das Prüfprotokoll könnte heißen: „Seildurchmesser 20.4/20.5 mm“.

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".

4.6.4 Messung der Seilschlaglänge / Measurement of the rope lay length

Zur Messung der Seilschlaglänge benötigen wir Bandmaß und Kreide. Um den Fehler bei der Messung möglichst gering zu halten, messen wir über drei oder mehr Schlaglängen und dividieren anschließend die gemessene Länge durch das gewählte Vielfache.

Hierzu markieren wir im interessierenden Bereich eine beliebige Litze auf der Kuppe mit einem Kreidepunkt (Kuppe Null), und auf der weiteren Seillänge jede Kuppe an der Stelle, wo dieselbe Litze nach einer Umrundung des Seiles wieder auftaucht. Bei einem achtlitzigen Seil zum Beispiel markieren wir die achte, sechzehnte, vierundzwanzigste und zweiunddreißigste Kuppe.

Die Strecke von unserer ersten Markierung (Kuppe Null) bis zur letzten schließt nun genau vier Seilschlaglängen ein.

Wir messen die Strecke, dividieren den erhaltenen Wert durch vier und erhalten so mit relativ geringem Meßfehler die Seilschlaglänge in dieser Zone.

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.



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Wie der Durchmesser soll auch die Seilschlaglänge beim fabrikneu angelieferten Seil durch mehrere Messungen ermittelt und schriftlich festgehalten werden, auch hier kann der Mittelwert als Vergleichswert für alle folgenden Messungen dienen. In der Regel kann die Seilschlaglänge im Anlieferungszustand des Seiles jedoch auch später noch auf den Totwindungen auf der Trommel gemessen werden.

Die Größe der Schlaglänge allein besitzt für den Seilbetreiber keine Aussagekraft, deutliche Veränderungen der Seilschlaglänge sind jedoch ein Alarmsignal, welches darauf hinweist, daß irgend etwas nicht in Ordnung ist.

Eine andere Möglichkeit, die Seilschlaglänge zu messen, die gleichzeitig noch ein archivierbares Dokument liefert, ist der Abdruck der Seiloberfläche auf einem langen Papierstreifen. Der Abdruck wird folgendermaßen hergestellt: Zunächst wird das freie Ende des aufgerollten Papierstreifens auf dem Seil mittels Klebeband befestigt. Dann entrollt man den Streifen über der Seillänge und fährt gleichzeitig mit einem Stück Wachskreide über das Papier. Über den Litzenkuppen entsteht so ein sauberer Abdruck der Außendrähte des Seiles. Der Papierstreifen wird für die spätere Auswertung beschriftet.

Vor Ort kann durch Übereinanderlegen eines Abdrucks der toten Trommelwindung und der untersuchten Zone und Betrachtung gegen das Licht bereits grob festgestellt werden, ob sich Veränderungen ergeben haben.

4.6.5 Überprüfung der Festigkeit des Drahtseilgefüges / Checking the strength of the wire rope structure

Die Festigkeit des Drahtseilgefüges ermitteln wir, indem wir einen Schraubendreher zwischen zwei Decklitzen stecken und ohne große Gewaltanwendung versuchen, durch Drehen des Handgriffs einen Spalt zu erzeugen. Wenn das Drahtseil dieser Verdrehung keinen großen Widerstand entgegensetzt, uns eventuell sogar ein Durchstecken des Schraubendrehers unter zwei benachbarte Litzen erlaubt, liegen Lockerungen des Seilgefüges vor.

In gleicher Weise überprüfen wir, ob sich die Außendrähte des Seiles im Litzenverband gelockert haben.

Ein gewaltsames Abheben der Decklitzen mit Hilfe eines Schraubers oder eines Spleißnagels, wie es verschiedentlich praktiziert wird, um den Zustand des Herzseiles zu begutachten, sollte nach Möglichkeit vermieden werden. Nur zu oft trägt hier das Drahtseil bleibende Beschädigungen davon.

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 labelled 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.

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 practised to evaluate the condition of the rope core, is best avoided. All too often the wire rope suffers permanent damage in this case.



4.6.6 Überprüfung auf Strukturveränderungen / Checking for structural changes

Im Hauptarbeitsbereich laufender Drahtseile, d. h. in den Seilzonen, die die größte Zahl von Biege- wechsellern ausführen, erwartet man im Normalfall die ersten Seilschäden. Seilverformungen wie Korkenzieher, Korbformungen oder Schlaufenbil- dungen finden sich aber sehr häufig außerhalb des Hauptarbeitsbereiches der Seile, da die Seil- rollen die verursachenden Litzten- oder Drahtüber- längen aus dem Überrollungsbereich herausmas- sieren. Auch vor der Seiltrommel oder aber vor den Endbefestigungen können sich derartige Seil- schäden ausbilden. Diese Bereiche sind daher mit der gleichen Sorgfalt zu untersuchen.

Während der Untersuchung sind die Seile auch einmal zu bewegen, um auch momentan nicht zugängliche Seilzonen begutachten zu können.

Schleifspuren an Konstruktionsteilen können wert- volle Hinweise auf einen nicht einwandfreien Seil- trieb und mögliche Seilschäden sein.

Störungen des Seilverbandes sind die am schwie- rigsten zu beurteilenden Ablegekrriterien. Wenn auch nur die geringsten Zweifel an der Betriebssi- cherheit des Drahtseiles vorliegen, sollte das Seil abgelegt werden.

4.6.7 Überprüfung von Seilrollen und Seiltrommeln / Checking rope pulleys and rope drums

Neben dem Drahtseil selbst verdienen auch alle Teile der Anlage, mit denen das Seil in Berührung kommt, unsere Aufmerksamkeit. Die im folgenden für die Seilrollen gemachten Aussagen gelten in analoger Form auch für die Seiltrommeln.

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.

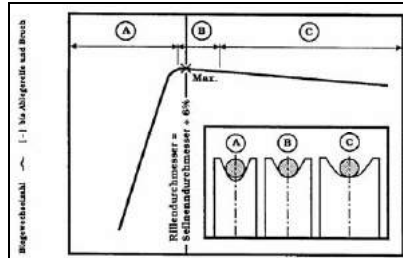
Abrasion marks on structural parts may be useful indications of an unsatisfactory rope drive and possible rope damage.

Faults in the rope assembly are the most difficult dis- card criteria to evaluate. The rope should be discarded even if only the slightest doubt exists with regard to its reliability.

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.



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Die Rillen der Rollen sollten glatt sein und einen Durchmesser aufweisen, der geringfügig größer ist als der Effektivdurchmesser des Seiles. DIN 15020 empfiehlt einen Rillendurchmesser von mindestens 1,05 mal dem Seilnennendurchmesser. Der optimale Durchmesser im Rillengrund liegt bei etwa 1,06 bis 1,08 mal Seilnennendurchmesser. Durch eine zu enge Rille wird das Drahtseil starken Pressungen in radialer Richtung ausgesetzt. Diese Beanspruchung führt frühzeitig zu Drahtbrüchen oder zu Strukturveränderungen des Seiles.

Eine zu weite Rille hingegen bietet dem Drahtseil zu wenig Auflagefläche und seitliche Unterstützung. Die erhöhten Pressungen im Rillengrund und die Zusatzspannungen durch die verstärkte Seilverformung (Ovalisierung des Seiles) führen ebenfalls zu einem Abfall der Seillebensdauer. Die Überprüfung der Rillen erfolgt mittels Rillenlehren. Derartige Lehren sind zwar im Handel erhältlich, am besten sind jedoch auf der Drehbank hergestellte kreisrund Schablonen.

Zweckmäßigerweise fertigt man sich für den jeweils zu prüfenden Seiltrieb eine kreisförmige Rillenlehre, die im Durchmesser exakt um die gewünschten sechs Prozent größer ist als der Seilnennendurchmesser, sowie für vergleichende Messungen Lehren mit etwas kleineren und größeren Durchmessern.

Zur Überprüfung des Rillenmaßes legen wir die Rillenlehre, die nach obigen Ausführungen am besten passen sollte, in die Rille und überprüfen die Auflageverhältnisse. Liegt die Schablone über einem großen Teil des Umfangs gut auf, ist das Rillenmaß in Ordnung. Liegt die Schablone nur an den Flanken auf, ist die Rille zu eng, liegt sie nur auf einem kleinen Teil des Umfangs auf, ist sie zu weit. In beiden Fällen benutzen wir unsere weiteren Schablonen, um festzustellen, wie groß die Abweichung vom Sollwert ist.

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.



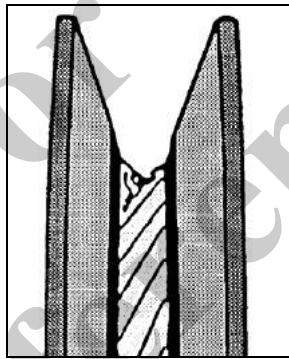
Handhabung, Montage und Wartung von Drahtseilen / Handling, assembly and maintenance of wire ropes

Die beengten Platzverhältnisse auf vielen Anlagen erschweren oft die Begutachtung. Wenn keine Möglichkeit besteht, die Anschmiegung der Schablone von der Seite her zu kontrollieren, kann man die Schablone durch die Rille ziehen und die Beurteilung anhand der Gleitspuren im Schmiermittel vornehmen.

Eine schmale Spur in der Mitte bedeutet: Die Rille ist größer als die Schablone. Eine breite Spur im gesamten Rillengrund bedeutet: Die Rille und die Schablone sind gleich groß. Zwei schmale Spuren an den Flanken zeigen an, daß die Schablone größer ist als die Rille

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 centre 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.

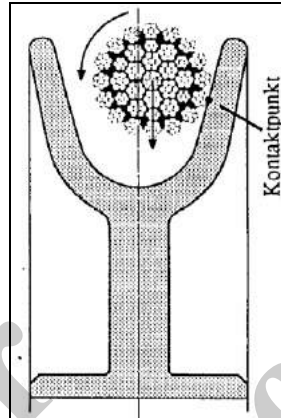


Während der Messung der Rille überprüfen wir gleichzeitig die Tiefe des Rillengrundes und seine Oberflächenbeschaffenheit. Eingrabungen und andere Oberflächenveränderungen setzen die Seillebensdauer oft stark herab. Wenn sich im Rillengrund ein Negativprofil des aufliegenden Drahtseiles herausgebildet hat, so kann dieses Profil für das jeweilig aufliegende Seil zwar optimal Auflageverhältnisse bieten, spätestens aber das beim nächsten Seilwechsel aufgelegte Seil würde nicht mehr in diese Kontur hineinpassen und sehr schnell zerstört werden. Rollen mit derartigen Eingrabungen müssen bei einem Seilwechsel ebenfalls ausgetauscht werden.

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.



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Auch die Flanken der Seilrollen sollten regelmäßig überprüft werden. Radial zum Rillengrund weisende Schleifspuren zeigen uns, daß das Seil beim Lauf über die Rolle zunächst auf die Flanke aufläuft, und dann erst bei weiterer Drehung der Rolle in den Grund hinabrutscht. Hierbei besteht zum einen die Gefahr einer gewaltsamen Seilverdrehung, die zu Strukturveränderungen führt, andererseits die Gefahr eines Hausspringens des Seiles aus der Rolle

Die Ursache für ein Auflaufen des Seiles auf den Flanken liegt häufig in einem unzulässig hohen Ablenkwinkel des Seiles zur Rollenebene. Die DIN 15020 empfiehlt mit Recht, Ablenkwinkel von 4 Grad für nicht drehungsfreie Seile und von 1,5 Grad für drehungsfreie Seile nicht zu überschreiten. 4 Grad entsprechen einer Ablenkung von etwa 1 m auf 15 m, 1,5 Grad entsprechen einer Ablenkung von etwa 1 m auf 40 m.

Wenn bei entlastetem Seil die Möglichkeit besteht, sollten die Seilrollen auch durch Drehen auf Gängigkeit der Lager und ihrer Rundheit hin überprüft werden.

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.



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5 **Schlußbemerkung /** **Concluding remarks**

Durch die Konzeption der Geräte und die Auswahl der in der Erstbeseilung aufliegenden Drahtseile hat die Firma Grove die Voraussetzungen für zufriedenstellende Seilstandzeiten gelegt. Durch Beachtung der hier angesprochenen Empfehlungen für die Handhabung, Montage, Wartung und Inspektion von Drahtseilen können Sie einen zusätzlichen Betrag zur Wirtschaftlichkeit und Sicherheit ihres Gerätes leisten.

Zu speziellen Fragen nehmen die Firma Grove und der Autor dieser Schrift, Dipl.-Ing. Roland Verreet, gerne Stellung.

Ingenieurbüro für Fördertechnik
Dipl.-Ing. Roland Verreet
Grünenthaler-Str. 40a
D-5100 Aachen
Tel. 0241-173147
Fax: 0241-12982

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By the special design of its equipment and selection of the initially used wire ropes, Grove has created the prerequisites for satisfactory rope life. You can make an additional contribution to the economical operation and safety of your equipment by following the above recommendations for the handling, assembly, maintenance and inspection of wire ropes.

The Grove company and the author of this publication, Dipl.-Ing. Roland Verreet, will be pleased to comment on specific questions.

*Ingenieurbüro für Fördertechnik
Dipl.-Ing. Roland Verreet
Grünenthaler Str. 40a
D-5100 Aachen
Phone +49-241-173147
Fax +49-241-12982*

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Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

For
Reference
Only

9/95 - 32

Supplemental documentation

A.4 Camera system

| Name | Data |
|----------------|--------------------------------------|
| Designation | Camera system |
| Type | Camera system |
| Number | 4010040000 |
| Type of manual | Operation, installation instructions |
| Manufacturer | Motec GmbH |

For Reference Only



MD3072B

Art.-no. 401 0040 000

MD3072B-Quad

Art.-no. 401 0041 000

| | |
|--|------------|
| BEDIENUNGS- UND MONTAGEANLEITUNG | D |
| INSTALLATION AND OPERATING INSTRUCTIONS | GB |
| INSTRUCTIONS DE SERVICE ET DE MONTAGE | F |
| BEDIENINGS- EN MONTAGEHANDHANDLEIDING | NL |
| ISTRUZIONI D'USO E DI MONTAGGIO | I |
| MANUAL DE OPERACIÓN Y DE MONTAJE | E |
| MANUAL DE MONTAGEM E OPERAÇÃO | P |
| BETJENINGS- OG MONTERINGSANVISNING | N |
| MONTERINGS- OCH BRUKSANVISNING | S |
| KÄYTTÖ JA ASENNUSOHJE | FIN |
| BETJENINGS OG MONTERINGSVEJLEDNING | DK |
| INSTRUKCJA OBSŁUGI I MONTAŻU | PL |
| NÁVOD K OBSLUZE A MONTÁŽI | CZ |
| KEZELÉSI ÉS SZERELÉSI ÚTMUTATÓ | H |
| РУКОВОДСТВО ПО МОНТАЖУ И ЭКСПЛУАТАЦИИ | RUS |
| KULLANMA VE MONTAJ TALIMATI | TUR |



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General information about this manual

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Make sure to keep this document available for reference at any time.

Please read this document carefully before starting to use our product. Since all our products are subject to continuous advancement, Motec GmbH reserves the right to modify this product without prior notification.

1.0 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.

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.

1.2 Declaration of conformity

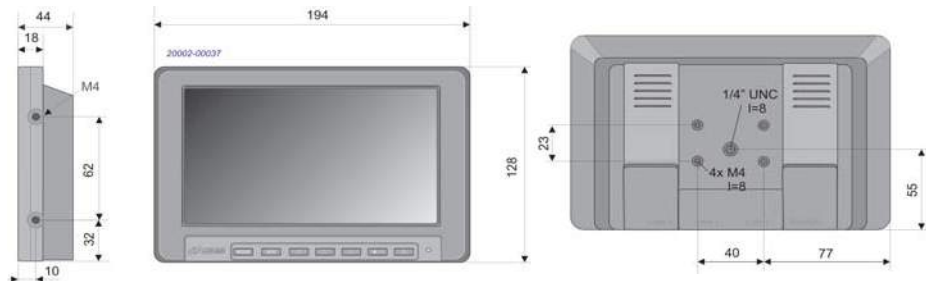
GB

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 request. 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.

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 | IP 30 |
| Shock resistance | 20g |
| Display dimensions (mm) | 194 x 128 x 44 |
| Mounting thread | ¼" UNC or M4x1.5 |
| Type of installation | Any |
| Access | Connector |
| Diagonal screen size | 17,8 cm (7", 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 |



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Supplemental documentation

1.4 Optional accessories

GB

| 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 |

2.0 Safety Instructions

WARNING!

The electrical connection and commissioning of this system may only be performed by qualified personnel, in accordance with this document!

The device may only be operated if the user is fully aware of all risks and dangers that may result from the operation of the device.

Do not operate the device if damaged. Do not connect to 230 V DC supply.

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.

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 installing 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.

3.0 Operating and Display Elements

GB



Display on / off



Menus are activated and toggled in the order:

| | |
|-------------|---|
| Brightness | Brightness - 0(MIN) ... 60(MAX) |
| Contrast | Contrast - 0(MIN) ... 60(MAX) |
| Color | Color saturation - 0(MIN) ... 60(MAX) |
| Standard | Reset to factory settings |
| Volume | Volume - 0(MIN) ... 10(MAX) |
| Language | Language - English, French, German, Spanish, Italian, Portuguese, polish |
| Mirroring | The camera image is mirrored. Select the „Entry“ menu item to return to the main menu. Select „Exit“ to terminate the menu. |
| Video | PAL, NTSC, Auto |
| Poc | OFF/ON. Monitor is activated via ignition |
| Timer | OFF/ON. Activates the timer mode |
| Timer Setup | Selection of camera(s) to be displayed in timer mode and setting of display activation time (OFF/ON 5-30 sec.) |
| Exit | Exits the menu |



Select key „Plus“



Select key „Minus“



Day / Night Selection



This key can be used to toggle to camera 1, camera 2, camera 3 and camera 4 in single camera mode.
 In split screen mode you can toggle to cameras 1/2, 2/3, 3/4, 4/1, 1/3 and 2/4.
 In timer mode this key can be used as Play/Pause function.
 In three or four camera operation mode, this button has no function.
 Camera selection is only possible if no control line is busy.



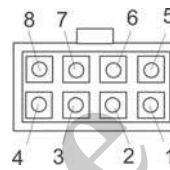
Press the Mode key to toggle to the individual display modes (single image, split screen (2), split screen (3), split screen (4) and timer mode.

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4.0 Commissioning

- GB** 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 | Colour |
|-----|---------------|-----------------------------------|-----------|
| 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 (MD3072B-Quad) | Red/blue |
| 8 | SEL1 | Selection camera 1 (MD3072B-Quad) | 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.

4.1 Operating Modes

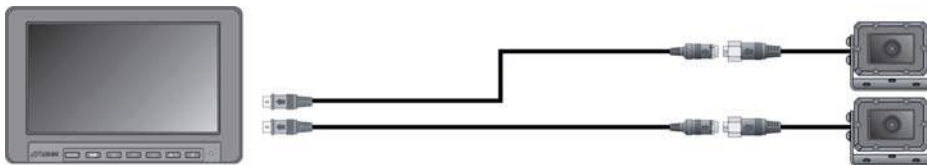
4.1.1 Single Camera Operation

A single camera is connected to C1 in this operating mode.



4.1.2 Twin Camera Operation

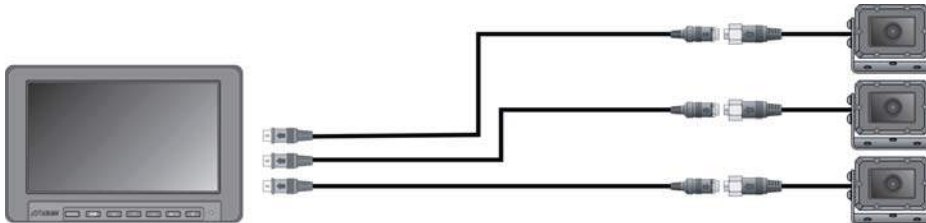
Two cameras are connected in this operating mode. Camera 1 has the highest priority, i.e. images of camera 1 will be displayed on the screen if both cameras have been selected simultaneously.



4.1.3 Three Camera Operation

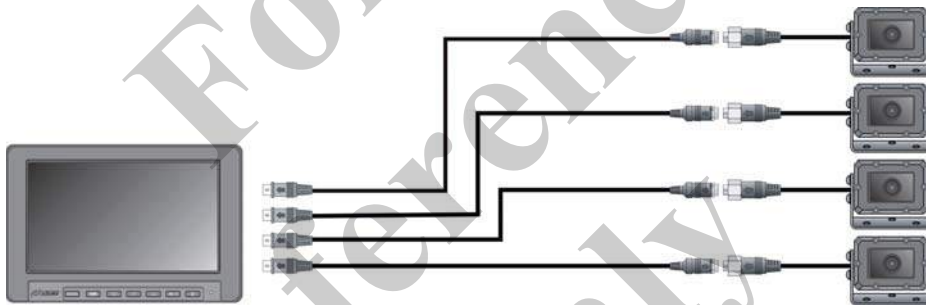
Three cameras are connected in this operating mode. Camera 1 has the highest priority, i.e. images of camera 1 will be displayed on the screen if other cameras have been selected simultaneously. Camera 2 has a higher priority than camera 3.

GB



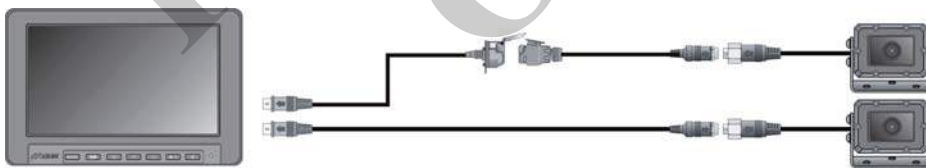
4.1.4 Four Camera Operation

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.



4.1.5 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).



4.2 Malfunctions

GB 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.

5.0 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.

5.1 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

6.0 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.



Notes

GB

For
Reference
Only

17

For
Reference
Only



Motec
Gesellschaft für mobil-
technische Electronic mbH
Oberweyerer Str. 21
65589 Hadamar-Steinbach
GERMANY

Phone +49 (64 33) 91 45 0
Fax +49 (64 33) 91 45 45

info@motecgmbh.de
www.motecgmbh.de

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BA-MD3072B| REV. 1.6 | Subject to change without notice!

A.5 Remote radio control

| Name | Data |
|----------------|------------------------|
| Designation | Radio Remote Control |
| Type | Radio Remote Control |
| Number | - |
| Type of manual | Operation instructions |
| Manufacturer | Abitron GmbH |

For
Reference
Only

Betriebsanleitung Allgemein

General Operating Manual



www.abitronremote.com



ABITRON Austria GmbH

Wiesnerstraße 20
4950 Altheim • Österreich
Tel.: +43 (0) 7723 44860
Fax: +43 (0) 7723 44860-94
Email: info@abitron.at



ABITRON Germany GmbH

Adalbert-Stifter-Straße 2
84085 Langquaid • Deutschland
Tel.: +49 (0) 9452 189-0
Fax: +49 (0) 9452 189-201
Email: info@abitron.de

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General Operating Manual →

CE Konformitätserklärung / EC Declaration of Conformity →

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Originalbetriebsanleitung Version 2017-03-22

Technische Änderungen vorbehalten

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Verfasser: ABITRON Germany / Austria GmbH

Manual Version 2016-03-22

Subject to technical changes without prior notice

This is a translation from German. In case of doubt, the German version of the operating manual is authoritative.

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Author: ABITRON Germany / Austria GmbH

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Allgemeine Betriebsanleitung

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1. Einleitung

1.1 Die Betriebsanleitung

Wir freuen uns, dass Sie sich für ein Qualitätsprodukt von ABITRON entschieden haben. Unsere Sicherheitsfunkfernsteuerungen stehen für ein hohes Maß an Qualität, Zuverlässigkeit und Innovation.

Sie möchten die ganze Welt von ABITRON erleben und kennenlernen?

Besuchen Sie einfach unsere Homepage.

Lesen Sie die Betriebsanleitungen aller Systembestandteile sorgfältig und vollständig durch, bevor Sie die Anlage betreiben. Der Inhalt wird Sie mit den Sicherheitsanweisungen und den Bedienelementen während des normalen Betriebes und der Wartung vertraut machen. Die Betriebsanleitung ist so aufzubewahren, dass der Benutzer sie immer einsehen kann.

1.2 Wie die Anleitung anzuwenden ist

- Die Anleitung ist als Teil des Produktes zu betrachten.
- Die Anleitung ist so lange zu behalten, wie die Anlage in Betrieb ist.
- Die Anleitung ist an jeden nachfolgenden Besitzer oder Benutzer des Produktes weiterzugeben.
- Stellen Sie sicher, dass jede erhaltene Ergänzung der Anleitung beigelegt wird, z. B. technisches Datenblatt.

1.3 Produktions- und Systemnummern

Wenn Sie sich mit Ihrem Händler oder Partner wegen Reparaturen, Wartungsarbeiten oder Ersatzteilen in Verbindung setzen, sollten Sie die Systemnummern des Senders und Empfängers bereithalten. Die Nummern finden Sie auf dem Typenschild, welches sich außen auf Sender und Empfänger befindet.

| | | |
|-----------------|---------|-------------|
| | | |
| 10 | | |
| Item-No.: | Cert: | RF-Band: |
| 1 | 4 | 7 |
| Production-No.: | Supply: | RF-Setting: |
| 2 | 5 | 8 |
| System-No.: | Supply: | Current: |
| 3 | 6 | 9 |

Typenschild - Felder und Bedeutung

1. Sender- bzw. Empfängertyp
2. Produktionsnummer
3. Systemnummer
4. Baumusterzertifizierung
5. Bemessungsspannung DC
6. Bemessungsspannung AC
7. Frequenzbereich
8. HF-Teil Kanaleinstellung
9. Zulässiger Speisestrom Iz
10. Firmenangaben / Zulassungen

Erklärung zu Produktions- & Systemnummer
 Jede Produktionsnummer setzt sich aus 12 Ziffern und jede Systemnummer aus 7 Ziffern zusammen. Die Bedeutung der einzelnen Ziffern von links nach rechts:

| | | | |
|-------|--------|---------|----------------------------|
| 1 | 0814 | 1000001 | Produktionsnummer |
| 1 | 08 | | Herstellercode |
| | 14 | | Produktionsmonat |
| | | 1000001 | Produktionsjahr |
| | | 7000001 | fortlaufende Nummer (ABIG) |
| | | | fortlaufende Nummer (ABIA) |
| <hr/> | | | |
| 1 | 000001 | | Systemnummer |
| 1 | | | Herstellercode |
| | 000001 | | fortlaufende Nummer |

| Herstellercode | |
|----------------|--------------------------|
| A | ABITRON Germany (ABIG) 1 |
| B | ABITRON Austria (ABIA) 7 |

- z. B. A Produktionsnummer = 108141000001 = produziert in Deutschland, August, 2014, # 1000001
 z. B. B Produktionsnummer = 708147000001 = produziert in Österreich, August, 2014, #7000001 usw.

Bitte beachten Sie die Pläne im Anhang sowie die dazugehörigen technischen Datenblätter auf unserer Homepage.
 Die Pläne zeigen Ihnen die genaue Ausführung Ihrer Funkfernsteuerung.

2. Sicherheitsmaßnahmen

2.1 Sicherheit dieser Funkfernsteuerung

Diese Funkfernsteuerung verfügt über elektronische und mechanische Sicherheitsvorrichtungen, für die funktionale Sicherheit, Störfestigkeit und Störsicherheit. Es ist nicht möglich, Steuerbefehle, die von anderen Sendern stammen, zu verarbeiten bzw. an andere Empfangseinheiten zu übertragen, da alle Informationen von Sender und Empfänger verschlüsselt sind.

2.2 Sicherheitshinweise

Die Benutzung einer Funkfernsteuerung ermöglicht dem Bediener in seinem Arbeitsbereich große Bewegungsfreiheit und eine erhöhte Bedienungsgenauigkeit. Dennoch müssen der Bediener und das mit der Wartung anvertraute Personal stets aufmerksam sein, um alle Vorteile nutzen zu können. Eine korrekte und sichere Benutzung der Funkfernsteuerung zwingt den Bediener dazu, den Lauf der gesteuerten Maschine stets zu beobachten.

2.3 Autorisierte Bediener müssen gemäß Betriebssicherheitsverordnung geschult sein!

Prüfen Sie stets die Arbeitsanweisungen Ihrer Maschine, um eventuell weitere wichtige Informationen zu erhalten!

Der Bediener muss sich davon überzeugen, dass **nicht autorisierte Personen** den Sender nicht bedienen können. Hierzu muss er das Gerät am Schlüsselschalter ausschalten, den Schlüssel abziehen oder die Batterien aus dem Gehäuse entfernen und das Gerät an einem sicheren Ort verschließen. Nur so können wirksam rechtswidrige Handlungen durch nicht autorisierte dritte Personen verhindert werden. Der Benutzer muss Zugang zu allen Arbeitsanweisungen haben, die zu einem korrekten Funktionieren der zu steuernden Maschine nötig sind. Wenn das Gerät nicht vom Käufer selber benutzt wird, verliehen, vermietet oder verkauft wurde, stellen Sie diese Anleitung und die notwendige Sicherheitseinweisung vor dem Betrieb zur Verfügung.

Vor Benutzung der Funkfernsteuerung muss der Bediener die Anweisungen jedes Kapitels in diesem Handbuch gelesen haben und sicher sein, diese genau verstanden zu haben.

2.4 Gefahrenquellen

Das System ermöglicht die Steuerung von Maschinen über Funk. Die Übertragung von Steuerkommandos erfolgt jedoch auch außerhalb der Sichtweite!

Darum:

- Wenn der Sender nicht benutzt wird, schalten Sie ihn aus und ziehen Sie den Schlüsselschalter ab.
- Falls Ihr Sender keinen Schlüsselschalter besitzt, entfernen Sie den Akku.
- Die Sicherheitseinrichtungen dürfen nicht entfernt oder verändert werden.
- **ACHTUNG!** Bei Zuwiderhandlung entfallen die Mängelansprüche nach ABGB/UGB bzw. **BGB/HGB und die Ersatzpflicht gemäß dem Produkthaftungsgesetz.**



2.5 Sicherheitsmaßnahmen und Vorkehrungen im Arbeitsbereich

Stellen Sie sicher, dass im Arbeitsbereich, in dem die Funkfernsteuerung verwendet wird, keine Gefahr für den Bediener besteht. Überzeugen Sie sich z. B. davon, dass im Arbeitsbereich keine Hindernisse stehen oder gefährliche Situationen entstehen können, die die Arbeitssicherheit beeinträchtigen könnten.

Sorgen Sie für einen rutschsicheren Stand. Vergewissern Sie sich vor jeder Inbetriebnahme der Funkfernsteuerung, dass sich niemand im Arbeits- oder Schwenkbereich Ihrer Last befindet. Falls für Ihren Sender eine Tragehilfe vorgesehen ist, so ist diese auch zu benutzen.

2.6 Schutzeinrichtungen

Alle industriellen ABITRON Funkfernsteuerungen sind mit einer Stoptaste ausgerüstet, die sich auf der Sendereinheit befindet.

Das Funksystem verfügt über Schutzeinrichtungen, die in folgenden Fällen automatisch eingreifen:

- Störfunk im Arbeitsbereich, der auf den Frequenzbereich der ABITRON Funksteuerung einwirkt.
- Übertretung des Aktionsradius der Sendereinheit.

In diesen Fällen versetzt sich die Funkfernsteuerung sofort in den Nothaltsstatus und unterbricht jedes Ausgangssignal der Empfangseinheit.

2.7 Verhalten im Notfall

- 1 Drücken Sie den roten Stoptaster.
- 2 Drehen Sie den Schlüsselschalter auf „OFF“.
- 3 Warten Sie, bis die Maschine stillsteht.
- 4 Verhalten Sie sich, wie es in der Anleitung der Maschine steht.



Drehentriegelbarer Stopp



Drehentriegelbarer Stopp



Druck-Zug-Stopp

3. Sicherheitseinrichtungen

3.1 Sender

Schlüsselschalter:

Unsere Sender sind zum größten Teil mit einem Schlüsselschalter ausgestattet. Dieser Schlüssel ermöglicht es dem Bediener den Sender abzuschalten, wenn er nicht benutzt wird. Außerdem schützt er vor Missbrauch durch Unbefugte und im Fall von Wartungsarbeiten an der Maschine.

Selbsttest:

Nach Einschalten des Senders mittels Schlüsselschalter führt das System einen Selbsttest durch. Ein positives Testergebnis wird durch zwei akustische Signale bestätigt. Die grüne LED bestätigt die Startbereitschaft des Senders durch Blinken.

Taster „Start/Hupe“ – Nullstellungszwang:

Nach dem Selbsttest muss der Sender durch Drücken des Tasters „Start/Hupe“ gestartet werden. Dadurch wird der Empfänger in Betrieb gesetzt. Alle Steuerfunktionen müssen in Nullstellung sein, damit das System gestartet werden kann. Wenn eine der Steuerfunktionen aktiviert ist, kann das System nicht in Betrieb genommen werden. Diese Sicherheitseinrichtung gewährleistet, dass keine Maschinenbewegung versehentlich ausgelöst werden kann. Der Startknopf kann nicht durch Zerstörung oder außer Kraft setzen übergangen werden. Wenn der Startknopf während des Selbsttests gedrückt wird, wird das System nicht gestartet.

Stopptaster:

Unsere Sender sind mit einem überlistsicheren Stopptaster ausgestattet. Das Stoppsignal wird als digitales Signal gesendet. Außerdem wird der Stoppzustand während des Selbsttests bei der Inbetriebnahme überwacht. Wenn der Stopptaster während der Inbetriebnahme gedrückt wird, wird das System nicht gestartet. Der Stopptaster ist die wichtigste Sicherheitseinrichtung der Funkfernsteuerung. Er gewährleistet, dass der Bediener die Maschine während des Betriebes unverzüglich stoppen kann.

Akku-Überwachung:

Der Batteriestatus wird laufend von der Senderelektronik überwacht. Sollte die Batterie eine Unterspannung erreichen, so wird der Bediener optisch oder akustisch für ca. 30 Sekunden gewarnt. Im Anschluss gibt der Sender einen Befehl aus, wodurch die Maschine in einen sicheren Zustand gebracht wird. Bitte beachten Sie, dass eine frühzeitige Unterspannungserkennung (ca. 10 Minuten) erhältlich ist.

Mechanischer Aufbau:

Ein mechanischer Schutz rund um den Sender schützt die Schalter und Bedienhebel vor Stößen und bei Herabfallen. Ebenso verwenden Sie hierfür die ergonomisch gestalteten Tragehilfen. Das Sendergehäuse hält den Anforderungen des täglichen Betriebes stand.

3.2 Empfänger

Selbsttest:

Nachdem der Empfänger mit Strom versorgt wurde, führt die Software einen Selbsttest durch. Wenn während des Selbsttests ein Fehler auftritt, wird sich der Empfänger nicht einschalten und im sicheren Zustand bleiben.

Nothaltstromkreis:

Im Empfänger ist ein spezieller Sicherheitsstromkreis eingebaut. Durch einen redundanten Aufbau funktioniert dieser selbstüberwachend.

Stopp:

Sobald der Empfänger das Nothaltssignal vom Sender empfängt
- wird die interne Stromversorgung zu den Ausgangsmodulen abgeschaltet.
- wird ein störungssicheres, selbstüberwachendes Nothaltausgangsrelais aktiviert.

Die Reaktionszeit für aktiven Stopp beträgt < 450 ms.

Spannungsversorgung:

Der Empfänger hat seine eigene elektronische Spannungsversorgung, die alle Empfängermodule mit Strom versorgt.

3.3 System

Systemnummer:

Jeder Funkfernsteuerung wird aus Sicherheitsgründen ihre eigene Adresse zugeordnet. Sie stellt sicher, dass nur der vorgesehene Empfänger vom dazugehörigen Sender aktiviert werden kann.

Funktstörung:

Im Fall einer Funkstörung schaltet das System nach 450 ms in den sicheren Zustand.

Software:

Die Software des Systems führt nach dem Einschalten einen Systemcheck durch, bei dem alle Sicherheitseinrichtungen überprüft werden. Das System schaltet in einen sicheren Zustand, falls eine Störung auftritt.

4. Installation

4.1 Positionieren der Empfangseinheit

Damit die Funksteuerung störungsfrei funktioniert, muss die Empfangseinheit so installiert werden, dass die Antenne einen maximalen Empfang hat. Metallteile der zu steuernden Maschine in der Umgebung der Empfangseinheit bilden eine Barriere, die einen guten Empfang verhindert. Wenn der Empfänger in einem metallisch geschlossenen Gehäuse oder in einem abgeschirmten Raum montiert wird, muss eine entsprechende Verlängerung und eine dazu passende Antenne eingesetzt werden, um eine entsprechende Reichweite zu erzielen. Von ABITRON können hierzu ausführliche Informationen bezogen werden. Die Empfangseinheit sollte weiterhin an einem sicheren und gut zugänglichen Ort angebracht werden, um spätere Installations- und Wartungsarbeiten zu erleichtern. Installieren Sie die Empfangseinheit so, dass die Kabelverbindung nach unten gerichtet ist. Bei Installationen an fahrbaren Maschinen oder Fahrzeugen müssen Gummipuffer angebracht werden, die verhindern, dass starke Vibrationen von der Maschine auf die Empfangseinheit übertragen werden. Bei der Montage der Gummipuffer ist unbedingt das Anzugsdrehmoment von 2 Nm zu beachten. Ebenso ist der Gummipuffer gegen selbstständiges Lösen zu sichern. Falls diese nicht bereits als Serienartikel zu Ihrer Funkfernsteuerung mitgeliefert werden, können die Gummipuffer bei Ihrem Händler direkt bestellt werden.



ACHTUNG!

- **Nur eine befähigte Person, die sowohl den Stromkreis der Maschine als auch die technischen Eigenschaften der Funkfernsteuerung kennt, darf die Empfangseinheit einer Funkfernsteuerung an das elektrische System der Maschine anschließen.**
- **Während aller Installationsarbeiten müssen sowohl Sender als auch Empfänger stromlos sein.**
- **Alle Vorschriften, die die Gesundheit der im Umkreis der Installation anwesenden Personen betreffen, alle geltenden örtlichen Bestimmungen und Brandschutzbestimmungen sind strikt einzuhalten.**
- **ABITRON übernimmt keine Haftung oder Garantie für Personen- oder Sachschäden, die durch unsachgemäßen oder fahrlässigen Gebrauch der Funkfernsteuerung oder auf Grund eines Nichtbeachtens der Vorschriften oder Arbeitsanweisungen verursacht wurden.**

4.2 Installation der Ausgangsverdrahtung

Schalten Sie die zu steuernde Maschine stromlos, bevor Sie die Spannungsversorgung des Empfängers anschließen.

Beauftragen Sie eine qualifizierte Fachkraft mit der Verdrahtung. Unsachgemäße Verdrahtung kann ernsthafte Systemschäden verursachen und zum Verlust der Garantie führen. Die Ausgangsverdrahtung muss nach dem Schaltplan der Maschine und der Funkfernsteuerung installiert werden. Verwenden Sie nur Kontakte von guter Qualität, um einen einwandfreien elektrischen Kontakt sicherzustellen. Detaillierte Informationen zur Empfängerverdrahtung finden Sie in der dem System beigelegten Dokumentation.

Die Stromversorgung und das Erdungskabel sind äußerst wichtig. Sie müssen an betriebssichere Stromanschlüsse angeschlossen werden.

4.3 Korrekte Montage der Empfangseinheit / Antenne



Wichtig!

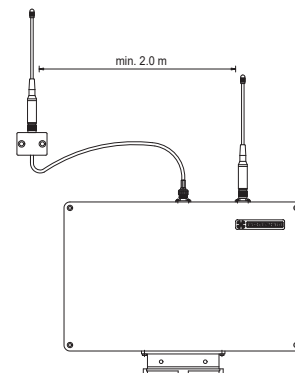
Um einen bestmöglichen Betrieb zu gewährleisten, folgen Sie dieser Antennen-Montageanleitung!

Generell:

- Es dürfen nur von ABITRON freigegebene Antennen verwendet werden.
- Sender sowie Empfänger dürfen nicht ohne Antenne betrieben werden.

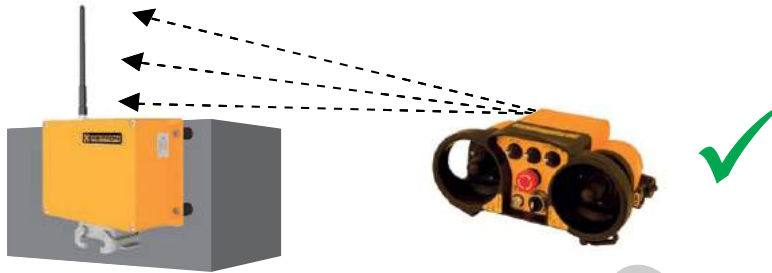
Für Rückmeldeanlagen:

- Abstand zwischen der Sender- und Empfängerantenne von mindestens 2 m einhalten.

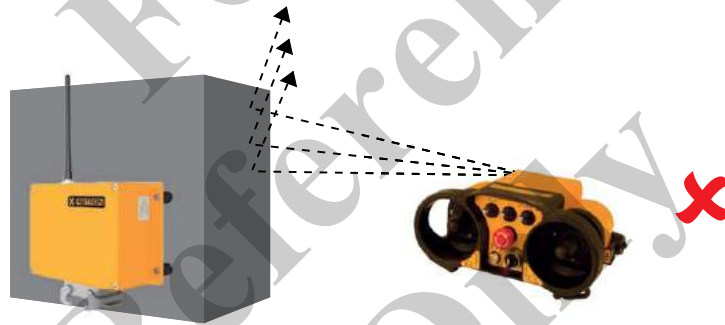


4. Installation

Die Antenne ist vertikal zu montieren. Es sollte von allen Positionen des Bedieners Sichtkontakt zur Antenne bestehen.

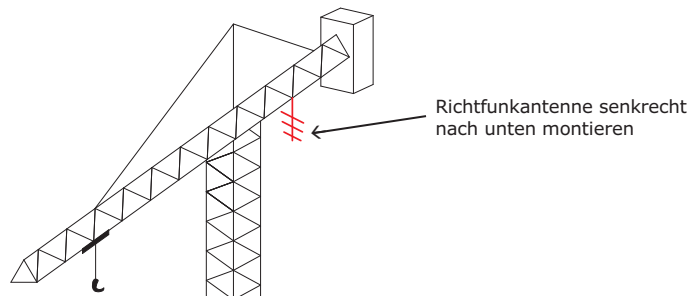


Achten Sie beim Positionieren der Empfangseinheit darauf, dass die Antenne möglichst frei steht und sich keine abschirmenden Materialien um die Antenne befinden. Falls eine solche Montage der Empfangseinheit nicht möglich ist, verwenden Sie bitte eine Antennenverlängerung, um die Antenne an einer geeigneten Position zu montieren.



Montagehinweis für Richtfunkantennen am Obendreherkran:

Die Befestigung der Richtfunkantenne ist am Gegenausleger des Krans vorzunehmen. Der Einbauort sollte offen zugänglich sein und nicht durch Teile des Krans verdeckt werden. Die Antenne muss stets nach unten zeigend (Haltebügel oben) montiert werden und die 3 parallel angeordneten Strahlenelemente müssen einen 90° Winkel mit dem Ausleger bilden (siehe Abbildung).



4.4 Kennzeichnung

Ist für den Bediener nicht klar ersichtlich welche Maschine oder welches Maschinenteil die Sendeeinheit steuert, ist dies durch den Maschinenhersteller oder gegebenenfalls auch durch den Maschinenbetreiber eindeutig zu kennzeichnen.

5. Kontrolle vor der Inbetriebnahme

5.1 Hinweis zur Bedienung

Haben Sie die Bedienungsanleitung, insbesondere Kapitel 2 „Sicherheitsmaßnahmen“ und Kapitel 3 „Sicherheitseinrichtungen“, gelesen und verstanden? Sie dürfen das Gerät vorher nicht bedienen!

5.2 Sichtkontrollen

ACHTUNG!



Kontrollieren Sie vor jedem Arbeitseinsatz, ob der Sender Schäden aufweist!

- Befinden sich alle Sicherheitseinrichtungen am richtigen Platz und sind diese funktionstüchtig?
- Sind eventuell Teile beschädigt?
- Ist jeder Gummischutz und jede Abdeckung intakt? (Sender)
- Sind alle Verbindungsstecker und Kabel in Ordnung? (Empfänger)

ACHTUNG!



Arbeiten Sie nie mit einer Funkfernsteuerung, die Mängel aufweist! Vor Arbeitsbeginn müssen alle Mängel durch eine kompetente Fachkraft behoben werden!

5.3 Vor der Inbetriebnahme

- Stellen Sie sicher, dass das System vollständig montiert wurde.
- Machen Sie sich mit sämtlichen Sicherheitsvorkehrungen in der Bedienungsanleitung vertraut.
- Beachten Sie alle Sicherheitsvorkehrungen in der Bedienungsanleitung und überprüfen Sie die Steuerfunktionen und den Betrieb von Maschine und Funkfernsteuerung.
- Wenn der Sender nicht in Benutzung ist, schalten Sie ihn aus und verwahren Sie ihn an einem sicheren Ort. Der Betrieb muss unbefugten Personen unzugänglich gemacht werden.
- Vergewissern Sie sich immer, dass die Stoppfunktion von Maschine und Funkfernsteuerung einwandfrei funktioniert.
- Wenn die Maschine nicht richtig anspricht, stoppen Sie den Betrieb umgehend. Schalten Sie den Sender aus und entfernen Sie die Batterie. Bitte suchen Sie sofort einen kompetenten Ansprechpartner auf.
- Vor Wartungsarbeiten entnehmen Sie bitte die Batterie des Senders und unterbrechen die Stromzufuhr des Empfängers.
- Wenn Sie Akkus verwenden, stellen Sie sicher, dass sich ein Akku immer im Ladegerät befindet und das Ladegerät immer an einer festen Stromversorgung angeschlossen ist.
- Montage, Einrichtung und Kundendienst dürfen nur von autorisierten Technikern durchgeführt werden.
- Verwenden Sie ausschließlich ABITRON Ersatzteile.

ACHTUNG!



Schalten Sie die Maschine sofort aus, falls sich ein Problem zeigt. Betreiben Sie eine Maschine niemals, wenn der Nothalt nicht einwandfrei funktioniert. Bei Nichtbeachtung dieser Vorschrift besteht Gefahr für Personen und Sachwerte. Das Ausführen von Arbeitsschritten, die dieser Betriebsvorschrift nicht entsprechen, kann zum Entzug der Betriebserlaubnis und zum Verfall Ihrer Garantie führen!

5.4 Funktionstest der Stopptaste

ACHTUNG!



Vor der täglichen Inbetriebnahme der Funkfernsteuerung muss die Kontrolle des Stopptasters durchgeführt werden!

- Stellen Sie sicher, dass der Sender nur mit vollständig geladenen ABITRON Akkus bzw. Alkali-Batterien betrieben wird.
- Stecken Sie den Schlüssel in den Schlüsselschalter am Sender (nur bei Sender mit Schlüsselschalter).
- Sender einschalten wie in Punkt 6.1 bzw. 6.2 beschrieben.
- Überprüfen Sie jetzt, ob der Stopptaster einwandfrei funktioniert. Gehen Sie hierzu wie folgt vor:
 - (1) Drücken Sie den Stopptaster auf dem Sender
 - (2) Beobachten Sie die Blinkfrequenz der grünen LED
 - (3) Bei gedrücktem Stopptaster = schnelle Blinkfrequenz
 - (4) Bei entriegeltem Stopptaster = normale Blinkfrequenz
- Funktioniert die Stopptaste, können Sie die Anlage starten.
- Funktioniert die Stopptaste nicht, müssen Sie für eine Überprüfung durch eine befähigte Person sorgen.
- Jetzt ist Ihre Funkfernsteuerung einsatzbereit. Führen Sie nun eine beliebige Funktion mit dem Sender aus und kontrollieren Sie so, ob die Maschine bei Unterbrechung der Funktion ihre Arbeit sofort einstellt.

6. Inbetriebnahme / Betrieb

6.1 Einschaltvorgang für Sender OHNE Schlüsselschalter

1. Akku oder Batterien einlegen.
2. Der Sender wird mit dem grünen Starttaster gestartet (2x betätigen für Systemstart).
3. Sender mit Tip-Betrieb werden mit einem Funktionstaster gestartet.
4. Die grüne LED muss blinken.
5. Wenn die Taste nicht mehr betätigt ist, wird die Bewegung gestoppt.
6. Bei rot blinkender LED muss die Batterie bzw. der Akku gewechselt werden (Unterspannungstest ist optional).

6.2 Einschaltvorgang für Sender MIT Schlüsselschalter

1. Mit dem Schlüsselschalter wird der Sender in Betrieb genommen.
2. Nach dem Einschaltvorgang müssen 2 kurze Signaltöne zu hören sein.
3. Nach der Selbstkontrolle blinkt die grüne LED auf dem Sender.
4. Zur täglichen Kontrolle gehört der Test des Stopptasters (wie in Punkt 5.4 beschrieben).
5. Zum Starten der Funkfernsteuerung müssen Sie die grüne Starttaste betätigen. Die Ausführung des Senders kann sich zur Abbildung unterscheiden. Bitte im Plan nachlesen, welche Funktion die Taster haben!
6. Achtung: Steuerfunktionen, welche sich nicht in Nullstellung befinden, verhindern den Startvorgang!



Grüne Starttaste und Schlüsselschalter



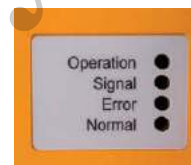
Roter Stopptaster

6.3 Statusanzeige im Empfänger

1. Kompakte Ausführung mit Sichtfenster:
Das LED Fenster befindet sich auf der rechten Seite des Gehäuses.
2. Kompakte Ausführung ohne Sichtfenster:
Die LEDs sind nur im geöffneten Zustand sichtbar.
3. Modulare Ausführung:
Auf Decoder und Notstopp-Decoder befinden sich je 3 LEDs.

LED Erklärung:

| | | |
|------|---|-----------------------|
| Gelb | = | Betrieb |
| Grün | = | Funkverbindung |
| Rot | = | Störung |
| Gelb | = | Normal (Stoppzustand) |



6.4 Betrieb mit Kabelsteuerung (optional)

Verfügt Ihre ABITRON Funkfernsteuerung über eine Kabelsteuerung, kann diese alternativ ohne Funksignale und Akku betrieben werden. Dabei wird der Sender vom Empfänger mit Strom versorgt und die Kommunikation zwischen Sender und Empfänger erfolgt über das Kabel.

Folgende Varianten sind optional möglich:

- „2-Draht-Technik“ (ohne Rückmeldung):
Hier erfolgt die Kommunikation und die Spannungsversorgung des Senders über das Akkufach. Bei dieser Variante muss die Kabelsteuerung sender- und empfängerseitig immer abgesteckt werden, um einen Funkbetrieb wieder zu ermöglichen.
- „Mehrdraht-Technik“ (mit Rückmeldung):
Hier erfolgt die Kommunikation und die Spannungsversorgung des Senders über einen separaten Stecker. Hier reicht es die Kabelsteuerung sender- oder empfängerseitig abzustecken um in den Funkbetrieb zu wechseln.

Die Pol-Zahl und die Stecker-Variante kann je nach Ausführung der Funkfernsteuerung variieren.

ACHTUNG!



Achten Sie bitte im Kabelsteuerungsbetrieb auf die erhöhte Stolpergefahr durch das Steuerungskabel für den Bediener und andere Personen im Maschinenbereich.



7. Ladegerät- und Akkuhandhabung

7.1 Wechseln und Aufladen der Akkus

Die Akkus müssen vor Inbetriebnahme vollständig geladen werden! Das Ladegerät sowie die Akkus müssen an einem sauberen und trockenen Ort platziert bzw. gelagert werden. Schließen Sie das Ladegerät, entsprechend der Ausführung, an eine unterbrechungsfreie Stromversorgung an. Geben Sie den leeren Akku in das Ladegerät. Der Ladevorgang wird hierdurch gestartet. Unter Punkt 7.2 wird die Anzeige des jeweiligen Ladegerätes genau beschrieben! Alle ABITRON Ladegeräte starten den Ladevorgang nach Einlegen des Akkus automatisch und verfügen über eine Ladezustandserkennung.

Ist der Akku vollständig geladen, wechselt das jeweilige Ladegerät in den Erhaltungsladungsmodus.

TIPP!

Um Ausfallzeiten zu vermeiden, empfiehlt es sich, stets einen geladenen Akku bereitzuhalten.

Um eine Schädigung der Akku-Zellen zu vermeiden empfehlen wir eine Ladetemperatur von 0° C bis +40° C.

Beauftragen Sie ein Fachunternehmen mit der Verwertung und Entsorgung!

7.2 Anzeigen und Fehlermeldungen des ABITRON Ladegerätes BCM-1

LED-Anzeigen des Ladegerätes:

- Ladegerät ist mit Spannung versorgt: gelbe LED [1] leuchtet
- Ladevorgang läuft: grüne LED [2] blinkt
- Ladevorgang abgeschlossen: grüne LED [2] leuchtet, Erhaltungsladung läuft
- Akku defekt: rote LED [3] leuchtet

Fehlererkenntnisse des Ladegerätes:

- Kurzschluss an den Akkupins
- Überspannung des Akkus
- Unterspannung des Akkus
- Defekte Akkuzellen



Wird durch das Ladegerät ein defekter Akku angezeigt, ist der Akku keinesfalls weiter zu verwenden!



ACHTUNG!

Die ABITRON Ladegeräte sind nicht für den Außenbereich geeignet!

Verwenden Sie ausschließlich ABITRON Akkus! Andernfalls besteht Explosionsgefahr. Austretende chemische Substanzen oder sich lösende Teile können irreparable Schäden verursachen.

HINWEIS!

Akkublöcke gelten als Sondermüll und sind ordnungsgemäß zu entsorgen.

Defekte Akku-Packs können auch direkt über ABITRON entsorgt werden.

8. Batteriehandhabung

8.1 Wechseln der Alkali-Batterien (Größe AA – Mignon)

Die Batteriespannung wird stets vom Sender überwacht. Wenn die Spannung zu gering ist, leuchtet die LED am Sender rot auf und je nach Ausführung ertönt ein Signal. Bitte tauschen Sie die Batterien umgehend aus. Dazu verfahren Sie wie folgt:

- Bringen Sie den Kran oder die Maschine schnellstmöglich in eine sichere Position.
- Drücken Sie den Stoptaster des Senders.
- Entfernen Sie die leeren Batterien wie in den folgenden Abbildungen gezeigt.
- Befolgen Sie die Anleitung zur Inbetriebnahme, um das System wieder zu starten.

8.2 ABITRON Batteriefach

- Um das Batteriefach zu entnehmen, verfahren Sie wie beim Akkuwechsel.
- Bitte achten Sie auf die Polarität der Batterien +/-.



ACHTUNG!

Verwenden Sie ausschließlich alkalische Batterien!
Alkalische Batterien dürfen nicht im Ladegerät geladen werden!

Halten Sie den Akku fern von leitenden Gegenständen, die eine Überbrückung der Kontakte verursachen könnten. Bei falscher Anwendung kann Flüssigkeit aus dem Akku austreten. Vermeiden Sie Kontakt und beachten Sie die allgemeinen Verhaltensregeln.

9. Diagnose

| Problem | Mögliche Ursachen | Problemlösung |
|--|--|---|
| Der Sender zeigt beim Einschalten keine Reaktion. | Der Akku ist leer. | Laden Sie den Akku oder ersetzen Sie diesen. |
| | Die Coderplatine ist defekt. | Die Coderplatine muss durch eine Fachkraft erneuert werden. |
| | Der Schlüsselschalter/Kontaktblock ist defekt. | Der Schlüsselschalter/Kontaktblock muss durch eine Fachkraft erneuert werden. |
| | Die Akkukontakte sind verschmutzt. | Bitte reinigen Sie die Akkukontakte mit einem Tuch. |
| | Die Federkontakte im Akkufach sind defekt. | Lassen Sie die Federkontakte von einer Fachkraft erneuern. |
| Kommunikationsstörungen zwischen Sender und Empfänger. | Die Reichweite wurde überschritten. | Gehen Sie in Richtung des Empfängers. |
| | Eine Funksteuerung mit der gleichen Frequenz arbeitet in der unmittelbaren Nähe. | Die HF-Einstellung muss durch eine Fachkraft angepasst werden. |
| | Ein Objekt befindet sich zwischen Sender und Empfänger. | Bitte ändern Sie die Position des Senders oder verändern Sie die Antennenposition mittels einer Verlängerung. |
| Die Betriebszeit ist zu kurz. | Der Akku ist leer oder defekt. | Geben Sie den Akku in das Ladegerät und legen Sie einen geladenen Akku in den Sender ein. Überprüfen Sie die Kontrollanzeigen des Ladegeräts. |

Haben Sie noch Fragen?
Bitte nehmen Sie Kontakt mit Ihrem Händler oder mit dem ABITRON Service-Team auf. Wir helfen Ihnen gerne weiter.

9. Diagnose

| Problem | Mögliche Ursachen | Problemlösung |
|---|--|---|
| Das Funksignal wird empfangen, aber einige vom Sender ausgeführte Funktionen reagieren nicht. | Die Verbindung zwischen der Maschine und dem Empfänger ist unterbrochen. | Möglicherweise haben sich Kabel gelöst. Überprüfen Sie die Verkabelung des Empfängers an der betreffenden Funktion. |
| | Das Ausgangsmodul ist defekt. | Prüfen Sie, ob auf dem Ausgangsmodul im Empfänger eine LED leuchtet. |
| Nach normaler Inbetriebnahme lässt sich das System nicht starten. | Der Stoptaster ist gedrückt oder defekt. | Lösen Sie den Stoptaster. Betätigen Sie die Start/Hupe Taste. |
| | Der Joystick befindet sich nicht in Mittelstellung. | Versichern Sie sich, dass sich alle Joysticks in Mittelstellung befinden. |
| | Der Akku des Senders ist leer. | Überprüfen und wechseln Sie gegebenenfalls den Akku. |
| | Der Empfänger ist stromlos. | Die gelbe LED (Grundplatine) muss blinken. Überprüfen Sie die Sicherungen. |
| | Der Starttaster ist defekt. | Der Starttaster muss durch eine Fachkraft erneuert werden. |

Haben Sie noch Fragen?
 Bitte nehmen Sie Kontakt mit Ihrem Händler oder mit dem
 ABITRON Service-Team auf. Wir helfen Ihnen gerne weiter.

10. Allgemeine technische Daten

10.1 System

| | |
|-------------------------|---|
| Frequenzbereich: | Europa 433/434 MHz und 869 MHz, Sonderfrequenzen auf Anfrage |
| HF-Synthesizer: | Mikroprozessor gesteuerter PLL Synthesizer mit 32 wählbaren Frequenzen |
| HF-Leistung: | < 10 mW Standard, höhere Sendeleistung auf Anfrage erhältlich |
| Modulation: | FM – schmale Bandbreite |
| Bandbreite: | 12,5 kHz / 25 kHz, je nach Ausführung |
| Reichweite: | bis zu 100 Meter mit Standardantenne, bis zu 200 Meter mit Spezialantenne |
| Adressierung: | 20 Bit (1 Million einzelne Möglichkeiten) |
| Temperaturbereich: | -25° C bis +70° C (-13° F bis 158° F) |
| Feuchtigkeitsresistenz: | 0 - 97 % Maximum (gilt nicht für Kondensation) |
| Ansprechungsdauer: | ca. 450 ms |
| Baudrate: | 2400/4800/9600 bps |
| Diagnose: | Statusanzeige für HF-Kommunikation, Betriebsspannungsanzeigen für Sender und Empfänger, Unterspannungsanzeige |
| Zertifikate: | CE, TÜV, ISO 9001 u. v. a. |
| Steuerfunktion: | bis Performance Level »c« nach EN ISO 13849-1:2008 (Abhängig von der technischen Ausführung) |
| Stoppfunktion: | bis Performance Level »e« nach EN ISO 13849-1:2008 (Abhängig von der technischen Ausführung) |

10.2 Sender

| | |
|------------------|---|
| Art: | ergonomisch geformtes Gehäuse |
| Gehäusematerial: | glasfaserverstärktes Polyamid oder Polycarbonat, je nach Sendervariante Sonderausführungen auch in anderen Materialien |
| IP-Schutzklasse: | IP 65 |
| Antenne: | innenliegend |
| Batteriegehäuse: | elektrisch getrennt mit vergoldeten, selbstreinigenden Kontakten |
| Betriebsdauer: | standardmäßig 14 – 20 Stunden, je nach Ausführung unterschiedlich |
| Drucktaster: | ein- oder zweistufig |
| Joystick: | Joysticks je nach Ausführung automatisch rückstellend, mehrstufig oder stufenlos. Optional mit Totmann und/oder Kreuzkulisse |
| Stromaufnahme: | ≤ 150 mA, bei Sonderausführungen bis ≤ 300 mA |

10.3 Empfänger

| | |
|---------------------------------|--|
| Gehäusematerial: | glasfaserverstärktes Polyamid oder glasfaserverstärktes Polyester, je nach Empfängervariante, Sonderausführungen auch in anderen Materialien |
| Anschlussverbindung: | durch feuchtigkeitsabweisenden Anschlussstecker |
| IP-Schutzklasse: | IP 65 |
| Betriebsspannung: | 12/24 VDC, 48/115/230 VAC |
| Stromaufnahme: | < 0,8 A, je nach Bauart |
| Antenne: | Außenantenne, mit feuchtigkeitsabweisender Verbindung, zum Teil innenliegend |
| Digitale Ausgänge: | fehlersicherer und selbstüberwachender Nothaltkreis. Alle Relaisausgänge 275 VAC / 8 A |
| Prop. Auflösung: | 8 Bit (256 Stufen pro Funktion), eingebaute Rampenfunktion wählbar |
| Prop. Ausgänge: | PWM-Signal mit wählbarer Dither-Frequenz und Strombereich, lineare Ausgangsspannung, Einstellung der prop. Funktionen über den Sender mit Quick-Set-Eigenschaften oder über Potentiometer, mehrere Geschwindigkeitsbereiche wählbar, alle prop. Funktionen einstellbar mit Anfangs- und Endgeschwindigkeit |
| Serielle Schnittstellen: | RS232/485, CAN-Open, Profi-Bus-DP, Profi-Net |
| Absicherung gegen Rückspeisung: | Die Absicherung der proportionalen Ausgänge wird standardmäßig im Kabel eingebaut. Wird das Kabel durch den Kunden angefertigt, muss er für diese Absicherung Sorge tragen. |
| Schutzklasse: | I, II, III |

10. Allgemeine Technische Daten

10.4 Akku und Ladegerät

| | |
|-------------------|---------------------------------------|
| Betriebsspannung: | 9 - 36 VDC oder 100 - 240 VAC |
| Ladezeit: | ~ 4 Stunden |
| Lebensdauer: | ≥ 500 Ladungen |
| Art: | NiMH |
| Kapazität: | 1900 mAh |
| Kontakte: | vergoldete, selbstreinigende Kontakte |
| Ladetemperatur: | 0° C bis +40° C (32° F bis 104° F) |

10.5 Technische Unterlagen

Genauere Informationen zu Ihrem jeweiligen Gerät finden Sie auf dem Typenschild, in den technischen Datenblättern unter www.abitronremote.com oder in den mitgelieferten Plänen.

10.6 Allgemein

Der Rechtsstand der CE-Erklärung gilt für alle Länder der Europäischen Gemeinschaft.



ACHTUNG!

Der Einsatz des HF-Teils CS434 ist anmelde- und gebührenfrei. Der Sender darf niemals ohne Antenne betrieben werden, da das HF-Modul zerstört werden kann. Die Einstellung der Frequenz wird von ABITRON werksseitig vorgegeben. Wenn Sie Probleme mit der Funkverbindung Ihres Systems haben, benachrichtigen Sie bitte Ihren Händler oder den ABITRON Kundendienst.

For Reference Only

11. Wartung, Garantie, Entsorgung

11.1 Wartung

Bitte beachten Sie folgende Hinweise, um stets eine sichere Funkfernsteuerung zu haben:

Jede Funksteuerung muss mindestens einmal im Jahr kontrolliert werden. Das mit der Wartung beauftragte Personal muss sicherstellen, dass die Sender- und die Empfangseinheit während der Kontroll- und Inspektionsarbeiten stromlos geschaltet sind. Eine regelmäßige Wartung durch den Benutzer verlängert die Lebensdauer der Funkfernsteuerung.

Einbau, Einrichtung und Kundendienst dürfen nur von befähigten Personen durchgeführt werden. Eventuelle Reparaturen dürfen nur in anerkannten Reparaturwerkstätten, in von ABITRON empfohlenen Werkstätten oder direkt in den technischen Kundendienst- und Ersatzteilzentren von ABITRON vorgenommen werden.

Eine eventuelle Benutzung von nicht originalen Ersatzteilen oder von nicht autorisiertem Personal ausgeführte Arbeiten führen zu sofortigem Erlöschen der Garantie.

ACHTUNG!



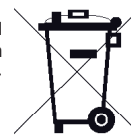
Sind eventuell elektrische Kontakte oxidiert, so verwenden Sie kein Anti-Oxidationsmittel oder ähnliches! **Wenden Sie sich in diesem Fall zur sofortigen Auswechslung der betroffenen Teile an Ihren Händler.** Die Benutzung von chemischen Mitteln in der Funkfernsteuerung verursacht Schäden an den inneren Bauteilen.

11.2 Garantie und Gewährleistung

Die Konditionen bezüglich Garantie und Gewährleistung entnehmen Sie bitte unseren Allgemeinen Geschäftsbedingungen bzw. unseren Liefer- und Zahlungsbedingungen und den Garantiebedingungen.

11.3 Entsorgung

Vermeiden Sie Umweltverschmutzung! Elektronische Geräte und Teile davon sind **Problem Müll! Dies gilt besonders für aufladbare Akkupacks! Beauftragen Sie ein Fachunternehmen mit der Verwertung und Entsorgung! Defekte Akkupacks können auch direkt über ABITRON entsorgt werden!**



11.4 Befähigte Personen nach Betriebssicherheitsverordnung

Bitte beachten Sie, dass nur befähigte Personen im Sinne der Betriebssicherheitsverordnung mit der richtigen Berufsausbildung, Berufserfahrung und zeitnaher beruflicher Tätigkeit Arbeiten mit der Funkfernbetriebung, Wartungsarbeiten und Reparaturen durchführen dürfen.

11.5 Ersatzteile

Verwenden Sie nur ABITRON Ersatzteile. Die Verwendung anderer Ersatzteile kann sich auf die Leistung, die Lebensdauer und die Sicherheit des Systems auswirken und zum Erlöschen der Garantie führen.

ABITRON lehnt alle Haftungsansprüche für Sachschäden, Körperverletzung oder Tod ab, die durch die Verwendung von nicht zugelassenen Ersatzteilen oder unbefugten Service entstehen.

12. Abkürzungen und Begriffserklärungen

12.1 Abkürzungen

| | |
|-------|--|
| AK | Analogkanal |
| DK | Digitalkanal |
| EPROM | Elektrisch programmierbarer Festwertspeicher |
| FM | Frequenzmodulation |
| GND | Bezugspotential |
| HF | Hochfrequenz |
| KHz | Kilohertz |
| LED | Leuchtdiode |
| mAh | Milliamperestunden |
| mA | Milliampere |
| msec | Millisekunden |
| MHz | Megahertz |
| mW | Milliwatt |
| NiMH | Nickel-Metall-Hydrid |
| PWM | Pulsweitenmodulation |
| RF | Funkfrequenz |
| RX | Empfänger |
| SMD | Stark minimierte Dimension von Bauteilen |
| TTL | Transistorenlogik |
| TX | Sender |
| UB | Betriebsspannung |
| VAC | Wechselstrom |
| VDC | Gleichstrom |

12.2 Begriffserklärungen

| | |
|-------------------------|--|
| Akustisches Signal | Summer oder anderer Klang, als Warnsignal |
| Analoges Signal | Proportional stufenlose Steuerung |
| Coder | Wandelt Eingangssignale in serielle Datennachrichten um |
| Decoder | Wandelt serielle Datennachrichten in Ausgangssignale um |
| Digitalsignal | An/aus Funktion |
| Rastende Funktion | Die Funktion ist aktiviert, wenn der Schalter in Position „On“ ist. Die Funktion ist nicht mehr aktiviert, wenn der Schalter in Position „Off“ ist |
| Tastende Funktion | Die Funktion ist solange aktiv, wie der Taster gedrückt bleibt |
| Proportionale Steuerung | Eine stufenlose Ansteuerung mit verschiedenen Geschwindigkeiten |

13. Erklärung zu Einbau- und Sicherheitstest

Dieses Formular ist unbedingt durch den für den Einbau Verantwortlichen zu ergänzen und zu unterzeichnen.

ABITRON kann keine Gewährleistung für die korrekte Installation der Funkfernsteuerung übernehmen. Der Bediener muss sich davon überzeugen, dass Funkfernsteuerung und Maschine aufeinander angepasst und geprüft wurden und die Sicherheitsbestimmungen eingehalten werden. Der Bediener muss alle Sicherheitsvorkehrungen dieser und anderer maßgeblicher Anleitungen befolgen.

Daten der Kundenmaschine

Daten der Funkfernsteuerung

Hersteller

Hersteller

Modellnummer

Modell

Seriennummer

Typ

Produktionsjahr

Systemnummer

Ich / Wir habe(n) den Einbau, die Inbetriebnahme und die Sicherheitsprüfung der Funkfernsteuerung an der oben genannten Maschine durchgeführt. Die geltenden Vorschriften und Gesetze für die Maschinenart wurden dabei erfüllt.

Ort, Datum

Firma (Anschrift) / Stempel

Name des Verantwortlichen

Unterschrift

General Operating Manual

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1. Introduction

1.1 Operating Manual

We are glad that you have chosen an ABITRON quality product. Our safety radio remote control systems offer maximum quality, reliability and innovation.

Do you want to know more about ABITRON?

Just visit our website!

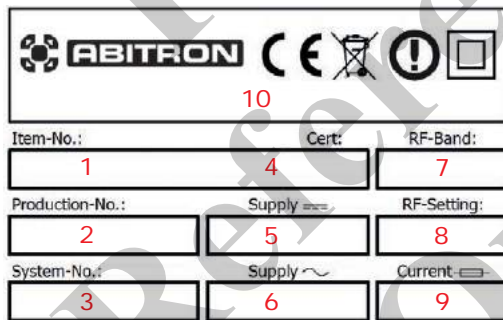
Read the manual of all system components carefully in full before operating the system. The content will make yourself familiar with the safety instructions and the controls during standard operation and maintenance. Keep the manual in a place where the operator can access it at any time.

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, f.e. technical data sheet.

1.3 Production and System Numbers

When you contact your dealer or partner 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 plate on the outside of the transmitter and receiver housing.



Type Plate – Labeling and meaning

1. Transmitter and receiver type
2. Production number
3. System number
4. Type approval certificate
5. Rated voltage DC
6. Rated voltage AC
7. Frequency range
8. RF-part channel setting
9. Maximum current Iz
10. Company information / approvals

Explanation for Production- & System number
Each production number consists of 12 digits and each system number of 7 digits. Below you will find the meaning of the particular digits from left to right:

| | | | |
|---|--------|---------|-------------------------|
| 1 | 0814 | 1000001 | Production number |
| 1 | 08 | | Manufacturer code |
| | 14 | | Month of production |
| | | 1000001 | Year of production |
| | | 7000001 | Continous number (ABIG) |
| | | | Continous number (ABIA) |
| 1 | 000001 | | System number |
| 1 | | 000001 | Manufacturer code |
| | | | Continous number |

Manufacturer code

| | | |
|---|------------------------|---|
| A | ABITRON Germany (ABIG) | 1 |
| B | ABITRON Austria (ABIA) | 7 |

f. e. A production number = 108141000001 = produced in Germany, August, 2014, # 1000001
f. e. B production number = 708147000001 = produced in Austria, August, 2014, # 7000001 etc.

Please notice the attached drawings and the respective technical data sheets on our website!

The drawings will show the specific version of your radio remote control.

2. Safety Precautions

2.1 Safety of this Radio Remote Control System

This radio remote control system is equipped with both, electronic and mechanical protection devices for the functional safety, fault-free operation and interference resistance. Control commands from other transmitters cannot be processed or transmitted to other receiver units, as all information from the transmitter and the receiver is encoded.

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.

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 fully understand all instructions of every chapter of this manual.

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.
- **ATTENTION! In case of non-compliance, warranty claims according to the Civil Code (ABGB/BGB) and the Commercial Code (UGB/HGB), and the duty of replacement according to the Product Liability Act are excluded.**



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.

2.6 Protection Devices

All industrial ABITRON 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 ABITRON 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.

2.7 In Case of 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



Unlock stop button by turning clockwise



Push-pull-stop

3. Protection Devices

3.1 Transmitter

Key switch:

Almost all ABITRON transmitters are equipped with a key switch. This key enables the operator to switch off the transmitter, when it is not in use. Furthermore, the key switch prevents undesired use or misuse by unauthorized persons 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 digital signal. 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.

Battery monitoring:

The transmitter's electronics permanently monitor the battery status. If the battery voltage is low, an optical or acoustic signal for about 30 seconds will alert the operator. Then the transmitter automatically sends out a stop signal and brings the machine into a safe state. Please note that advanced low voltage indication (approx. 10 minutes) is also available.

Mechanical construction:

A mechanical guard on the transmitter protects the buttons and joysticks from shocks and dropping. For this purpose you also use the ergonomically designed carrying devices. The transmitter housing meets the requirements of daily operation.

3.2 Receiver

Self test:

The software runs a self test after the receiver is powered. 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 for active stop is < 450 ms.

Power supply:

The receiver has its own electronic power supply, which powers all receiver modules.

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 after 450 ms.

Software:

After the startup procedure, the software of the system performs a system test, where all safety devices are checked.

4. Installation

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 impair 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 ABITRON 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. When mounting the rubber buffers, please pay attention to the tightening torque of 2 Nm. Furthermore, the rubber buffers need to be secured against loosening. If these rubber buffers are not included in your radio remote control system, you may obtain them from your dealer directly.



ATTENTION!

- **The installation of the receiver 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.**
- **ABITRON 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 remote control or non-compliance with the regulations or instructions.**

4.2 Installation of the Output Wiring

Switch the power supply of the machine off before attaching the voltage supply of the receiver.

Authorize a qualified technician to perform 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 in the enclosed documents. The power supply and the ground wire are extremely important. They have to be connected to fail-safe electrical connections.

4.3 Proper Installation of the Receiver Unit / Antenna



Important!

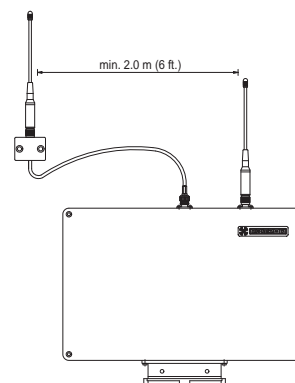
To guarantee an optimal operation, follow the instructions given below to mount the antennas.

General:

- Only antennas, that have been approved by ABITRON, may be used.
- Neither the receiver nor the transmitter may be used without antenna.

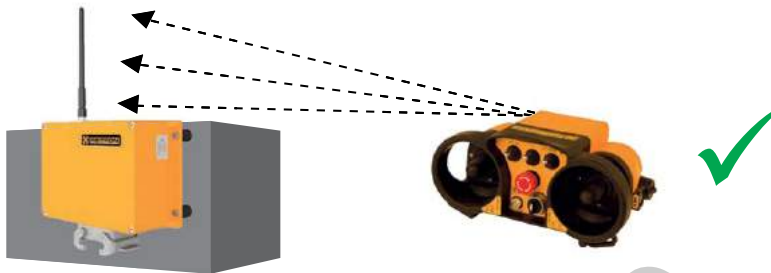
For Feedback-Systems:

- Keep a minimum distance of 2 m (6 ft.) between the receiver antenna and the transmitter antenna.

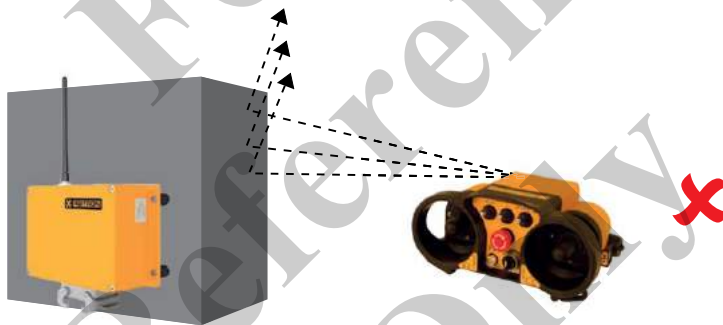


4. Installation

The antenna must be mounted vertically. You should have visual contact from all positions to the antenna.

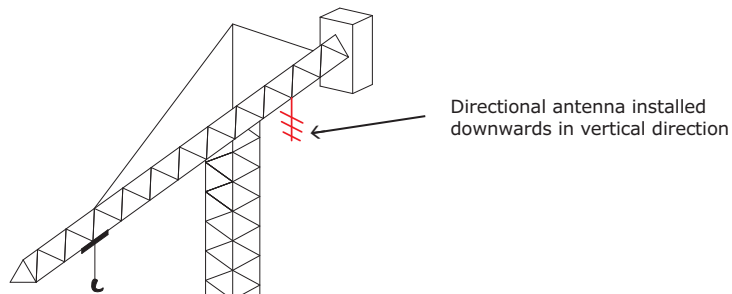


Please note when positioning the receiver unit that the antenna is free of shielding materials. If such a mounting of the receiver unit is not possible, please use an antenna extension to mount the antenna in a suitable position.



Mounting Instructions 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 (see illustration).



4.4 Identification

If it isn't evident for the operator which machine or machine part is controlled by the transmitting unit, this has to be marked clearly by the machine manufacturer or by the machine operator.

5. Check before Operation

5.1 Note for Operation

Have you read and understood the operating manual, in particular section 2 „Safety precautions“ and section 3 „Protection devices“? Please do not use the device until you have done so!

5.2 Visual Inspection



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 all rubber sleeves and the pushbutton caps in good order? (transmitter)
- Are all connections and cables in good order? (receiver)



ATTENTION!

Never operate a radio remote control, that shows any kind defects! All defects have to be repaired by a qualified technician before operation!

5.3 Prior to 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.
- 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 original ABITRON 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!

5.4 Functional Test of the Stop Button



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 ABITRON batteries or alkaline batteries.
- Put the key into the key switch on the transmitter. (only for transmitters with key switch)
- Start the transmitter as described in 6.1 or 6.2.
- 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 inspected 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 interrupted.

6. Startup Procedure / Operation

6.1 Startup Procedure for Transmitters WITHOUT Key Switch

1. Insert a battery or rechargeable battery.
2. The transmitter will be started by activating the green start button (press twice for system start).
3. Transmitter with inching operation will be started by activating a function button.
4. The green LED has to flash.
5. If the function button is released, the motion will be stopped.
6. If the red LED is flashing, the battery or the rechargeable battery has to be changed (Low voltage test optionally).

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.
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 vary 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

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) |



6.4 Operation with Cable Control (optional)

If your ABITRON radio remote control has a cable control, it can also be operated without radio signal and battery. The transmitter will be supplied with power from the receiver. The transmitter communicates with the receiver via cable.

There are two available versions:

- „2-wire-technique“ (without feedback):
The battery case takes care of the communication and the power supply of the transmitter. With this option, the cable control has to be disconnected from the transmitter and the receiver to enable a radio operation.



- „Multi-wire-technique“ (with feedback):
A special plug takes care of the communication and power supply of the transmitter. The cable control only needs to be connected either from the transmitter or the receiver to enable a radio operation.



The number of poles and the plug versions can vary depending on the particular radio remote controls.



ATTENTION!

The risk of tripping for the operator and other persons in the machine area is increased risk during cable control operation because of the control cable.

7. Battery Charger and Rechargeable Batteries

7.1 Replacing and Charging Rechargeable Batteries

The batteries have to be fully charged before startup! The charger and battery have to be placed and stored 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 respective charger is described in section 7.2!

All ABITRON battery charger will start automatically the charging process after inserting the battery and have a state detection of the battery.

When the batteries are fully charged, the battery charger automatically switches over to trickle charging.

NOTE!

In order to avoid downtimes, we recommend to always have a fully charged battery pack ready.

In order to avoid damages of the battery cells, we recommend a charging temperature of 0° C up to +40° C.

Assign a specialist disposal company with the recycling and disposal!

7.2 Display and Error Messages of the ABITRON Battery Charger BCM-1

LED-Display of the battery charger:

- Battery charger power on: yellow LED [1] flashing
- Charging process is running: green LED [2] flashing
- Charging process completed: green LED [2] flashing, trickle charging is running
- Battery is damaged: red LED [3] flashing

Error messages of the battery charger:

- Short circuit at the battery pins
- Overvoltage of the battery
- Undervoltage of the battery
- Damaged batteries



If the battery charger show a damaged battery, the battery may no longer be used!



ATTENTION!

The ABITRON chargers are not suitable for exterior use!

Only use original ABITRON batteries! Failure to observe may result in explosion hazard.

Escaping chemicals and flying parts may cause irreparable damages.

NOTE!

Rechargeable battery packs are to be treated as hazardous waste and have to be disposed properly.

Defective rechargeable battery packs can also be disposed directly through ABITRON.

8. Battery Handling

8.1 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.

8.2 ABITRON Battery Compartment

- Proceed as described in section 8 „Battery charger and rechargeable batteries“, to remove the battery compartment.
- Please note the polarity of the batteries +/-.



ATTENTION!

Only use alkaline batteries!

Alkaline batteries may not be charged in the battery charger!

Keep the battery away from conductive items, that may cause a bridging of the contacts. In case of inproper use, liquid may leak from the battery. Avoid any contact and regard the general rule of conduct.

9. 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 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 or broken. | Charge the battery and insert a fully charged battery into the transmitter. Check the LED display of the charger. |

Do you have any questions?
Please contact your dealer or our ABITRON service team. We are here to help you.

9. Diagnostics

| Problem | Possible Cause | Solution |
|--|--|--|
| 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 is 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. | The start button has to be replaced by an authorized expert. |

Do you have any questions?
Please contact your dealer or our ABITRON service team. We are here to help you.

10. General Technical Data

10.1 System

| | |
|-------------------------|---|
| Frequency range: | Europe 433/434 MHz and 869 MHz, other frequencies upon request |
| RF synthesizer: | microprocessor-controlled PLL synthesizer with 32 selectable frequencies |
| RF-output: | < 10 mW standard, increased transmitting power available on demand |
| Modulation: | FM – narrow bandwidth |
| Bandwidth: | 12.5 kHz, according to the system |
| Range: | up to 100 meters with standard antenna, up to 200 meters with special antenna |
| Addressing: | 20 bit (more than 1 million different possibilities) |
| Temperature range: | -25° C up to +70° C (-13° F up to 158° 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: | up to performance Level »c« according to EN ISO 13849-1:2008 (depending on the technical version) |
| Stop function: | up to performance Level »e« according to EN ISO 13849-1:2008 (depending on the technical version) |

10.2 Transmitter

| | |
|----------------------|---|
| Type: | ergonomically designed housing |
| Housing material: | fiber-enforced polyamid or polycarbonate, according to the transmitter type, other materials available on demand |
| Protection class: | IP 65 |
| 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 two-step |
| Joysticks: | all joysticks with automatic reset function, multiple-steps and stepless, deadman button and/or cross gate optional |
| Current consumption: | ≤ 150 mA, for special equipment up to ≤ 300 mA |

10.3 Receiver

| | |
|-------------------------------------|---|
| Housing material: | fiber-enforced polyamid or polycarbonate, according to receiver type, other materials available on demand |
| Connection: | via moisture repellent connecting plug |
| Protection class: | IP 65 |
| 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, Profi-Net |
| 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 |
| Protection class: | I, II, III |

10. General Technical Data

10.4 Rechargeable Battery and Battery Charger

| | |
|-----------------------|--|
| Operating voltage: | 9 - 36 VDC or 100 - 240 VAC |
| Charging time: | ~ 4 hours |
| Service life: | ≥ 500 charges |
| Type: | NiMH |
| Capacity: | 1900 mAh |
| Contacts: | gold-plated, self-cleaning contacts |
| Charging temperature: | 0° C up to +40° C (32° F up to 104° F) |

10.5 Technical Documents

Detailed information for your system can be found on the type plate, in the technical documentation at www.abitronremote.com or in the supplied drawings.

10.6 General

The legal status of the EC Declaration is valid for all member states of the European community.



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 ABITRON in the factory. In case of radio link problems with your system, please contact your dealer or the ABITRON after sales service.

11. Maintenance, Guarantee, Disposal

11.1 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 ABITRON or directly in ABITRON'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!

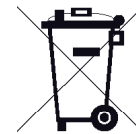
In case of oxidized electric contacts, do not use antioxidant or similar! Please contact your dealer for the immediate replacement of the affected parts. The use of chemical agents will cause damage on the internal components of the radio remote control.

11.2 Guarantee and Warranty

The guarantee and warranty conditions are listed in the General Terms and Conditions for Delivery and Payment.

11.3 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 ABITRON!



11.4 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.

11.5 Spare Parts

Only use ABITRON spare parts. The use of other spare parts may affect the performance, the durability and the safety of the system and result in the expiration of the warranty. ABITRON excludes all liability claims for material damages, personnel injury or death, which result from the use of unauthorized spare parts or services.

12. Abbreviations and Definitions

12.1 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 width 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 |

12.2 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 |

13. Installation and Safety Test Declaration

This form must be completed and signed by the person responsible for the installation of the system.

ABITRON 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 Data

Data of the Radio Remote Control

Manufacturer

Manufacturer

Type number

Model

Serial number

Type

Production year

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

Notizen

For Reference Only

Notes

For Reference Only

CE Konformitätserklärung

Hiermit bestätigen wir, dass die nachfolgend aufgeführten Maschinenbauteile für den Einbau in Maschinen oder andere Geräte, die für Maschinen bestimmt sind oder nicht, gemäß folgenden EU-Richtlinien mit Änderungen und Fortschreibungen geeignet sind:

Maschinenrichtlinie: 2006/42/EG
 Niederspannungsrichtlinie: 2014/35/EU
 EMV-Richtlinie: 2014/30/EU
 RED Richtlinie: 2014/53/EU
 Hersteller: ABITRON Austria GmbH
 Wiesnerstraße 20
 4950 Altheim

Gegenstand der Erklärung: Fernsteuerung GA 609¹/610²/611³

Sender Typ: EURO..., GL..., GR..., NOVA..., FE...

Empfänger Typ: RX..., RX BMS-1/-2⁴..., RX 14+⁵...

Der Gegenstand der oben beschriebenen Erklärung entspricht den Anforderungen der folgenden Dokumente:

| | | | |
|----------------|------|--------------|------|
| EN ISO 13849-1 | 2016 | 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 | | |

Dokumentationsbevollmächtigter: Mathias Friedl
 Wiesnerstraße 20
 4950 Altheim

Sicherheitskategorie, Performance Level, SIL Level und zusätzliche Hinweise siehe Deckblatt.

Benannte Stelle: TÜV NORD CERT GmbH, Langemarkstr. 20, 45141 Essen
 EG Baumusterprüfbescheinigungen
 Nr. 44 205 13146710¹
 Nr. 44 205 13146711²
 Nr. 44 205 13146712³
 Nr. 44 205 13146709⁴
 Nr. 44 205 13146708⁵

Altheim, am 4. August 2016



Daniela Hammerer
 Geschäftsführer



Supplemental documentation

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: 2014/35/EU
EMC-Directive: 2014/30/EU
RED Directive: 2014/53/EU
Manufacturer: ABITRON Austria GmbH
Wiesnerstraße 20
4950 Altheim

Object of declaration: Remote Control GA 609¹/610²/611³
Transmitter Type: EURO..., GL..., GR..., NOVA..., FE...
Receiver Type: RX..., RX BMS-1/-2⁴..., RX 14+⁵...

The object declaration described above is in conformity with the requirements of the following documents:

| | | | |
|----------------|------|--------------|------|
| EN ISO 13849-1 | 2016 | 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 | | |

Authorized for the documentation: Mathias Friedl
Wiesnerstraße 20
4950 Altheim

Safety Category, Performance Level, SIL Level and additional information see Cover Sheet.

Notified Body: TÜV NORD CERT GmbH, Langemarkstr. 20, 45141 Essen
Type approval certificate
Nr. 44 205 13146710¹
Nr. 44 205 13146711²
Nr. 44 205 13146712³
Nr. 44 205 13146709⁴
Nr. 44 205 13146708⁵

Altheim, 4th August 2016



Daniela Hammerer
Managing Director



CE Konformitätserklärung

Hiermit bestätigen wir, dass die nachfolgend aufgeführten Maschinenbauteile für den Einbau in Maschinen oder andere Geräte, die für Maschinen bestimmt sind oder nicht, gemäß folgenden EU-Richtlinien mit Änderungen und Fortschreibungen geeignet sind:

Maschinenrichtlinie: 2006/42/EG
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 EMV-Richtlinie: 2014/30/EU
 RED Richtlinie: 2014/53/EU
 Hersteller: ABITRON Germany GmbH
 Adalbert-Stifter-Str. 2
 84085 Langquaid

Gegenstand der Erklärung: Fernsteuerung GA 609¹/610²/611³

Sender Typ: EURO..., GL..., GR..., NOVA..., FE...

Empfänger Typ: RX..., RX BMS-1/-2⁴..., RX 14+⁵...

Der Gegenstand der oben beschriebenen Erklärung entspricht den Anforderungen der folgenden Dokumente:

| | | | |
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| EN ISO 13849-1 | 2016 | EN 60950-1 | 2006 |
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| EN 14492 | 2009 | EN 300 220 | 2007 |
| EN 60204-32 | 2008 | EN 301 489 | 2002 |
| EN 60529 | 1991 | | |

Dokumentationsbevollmächtigter: Mathias Friedl
 Wiesnerstraße 20
 4950 Altheim

Sicherheitskategorie, Performance Level, SIL Level und zusätzliche Hinweise siehe Deckblatt.

Benannte Stelle: TÜV NORD CERT GmbH, Langemarkstr. 20, 45141 Essen
 EG Baumusterprüfbescheinigungen
 Nr. 44 205 13146710¹
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Langquaid, am 4. August 2016



Daniela Hammerer
 Geschäftsführer



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Manufacturer: ABITRON Germany GmbH
Adalbert-Stifter-Str. 2
84085 Langquaid

Object of declaration: Remote Control GA 609¹/610²/611³

Transmitter Type: EURO..., GL..., GR..., NOVA..., FE...

Receiver Type: RX..., RX BMS-1/-2⁴..., RX 14+⁵...

The object declaration described above is in conformity with the requirements of the following documents:

| | | | |
|----------------|------|--------------|------|
| EN ISO 13849-1 | 2016 | EN 60950-1 | 2006 |
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| EN 14492 | 2009 | EN 300 220 | 2007 |
| EN 60204-32 | 2008 | EN 301 489 | 2002 |
| EN 60529 | 1991 | | |

Authorized for the documentation: Mathias Friedl
Wiesnerstraße 20
4950 Altheim

Safety Category, Performance Level, SIL Level and additional information see Cover Sheet.

Notified Body: TÜV NORD CERT GmbH, Langemarkstr. 20, 45141 Essen
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Nr. 44 205 13146710¹
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Langquaid, 4th August 2016



Daniela Hammerer
Managing Director





ABITRON Austria GmbH

Wiesnerstraße 20
4950 Altheim • Österreich
Tel.: +43 7723 44860
Fax: +43 7723 44860-94
Email: info@abitron.at

ABITRON Germany GmbH

Adalbert-Stifter-Straße 2
84085 Langquaid • Deutschland
Tel.: +49 9452 189-0
Fax: +49 9452 189-201
Email: info@abitron.de

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www.abitronremote.com

Supplemental documentation

A.6 Large roller bearings, slewing gear, flange connections

| Name | Data |
|----------------|--|
| Designation | Large roller bearings, slewing gears, flange connections |
| Type | Various |
| Number | 602-00 |
| Type of manual | Installation instructions |
| Manufacturer | Manitowoc |

For Reference Only



Additional documentation

**Installing large roller
bearings, slewing
gears and flange
connections**

For Reference Only

04/2014

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.

For
Reference
Only

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1 Installing large roller bearings, slewing gear and flange connections

1.1 General

This supplementary information applies to the installation of large roller bearings and flange connections (FV). This concerns e.g.:

- z Flange connection between the upper structure and the slewinggear
- z Flange connection between the upper structure and the slewing ring
- z Flange connection between the slewing ring and the lower assembly
- z Flange connection between the slewing ring and intermediate ring and the lower assembly
- z Flange connection between the slewing ring and the pylon and intermediate ring and the lower assembly
- z Flange connection between the pylon and pylon

DANGER



- z Make sure that there is no-one within the hazardous area before starting the installation!
- z Pay attention to dimensions and weight according to the operating instructions.
- z Observe general safety information for the installation according to the operating instructions.

1.2 Preparatory measures

In order to guarantee a secure connection between the individual components, several important preparations are required:

- z The flange surfaces on the slewing ring are to be kept free of corrosion.
- z 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 recognising it or it could even break eventually.
- z 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.



1.3 Assembly

There are a few important points to observe for the installation:

- z Clean all contact surfaces of the flange connections of any oil and grease.
- z 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.
- z Apply the thread lock compound with a brush on a surface.
- z Centering elements must not come into contact with the thread lock compound, because later dismantling involves difficulties
--> coat centering elements with wax or grease!
- z 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.

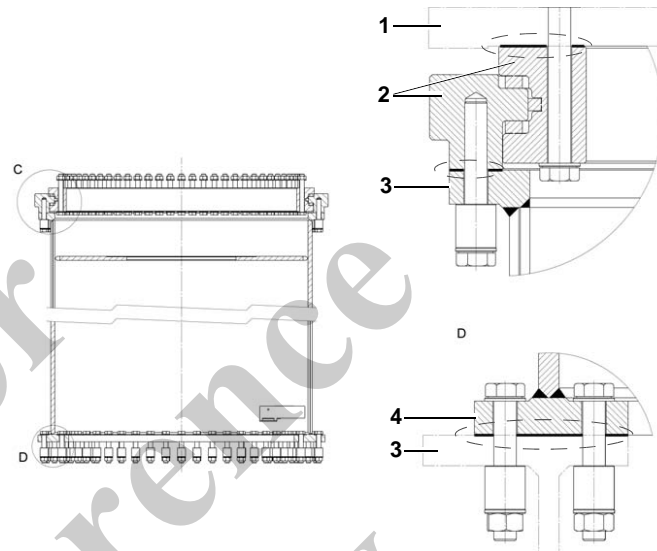
- 1) Upper structure
- 2) Slewing ring
- 3) Pylon or lower assembly
- 4) Pylon



Flange connection with Loctite



Installing large roller bearings, slewing gear and flange connections - Tightening torques for



1.4 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 |

Supplemental documentation

Installing large roller bearings, slewing gear and flange connections - Tightening torques for



| Coarse thread | | Fine thread | |
|---------------|------|-------------|------|
| 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



Installing large roller bearings, slewing gear and flange connections - Tightening torques for

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 | | |

Supplemental documentation

Installing large roller bearings, slewing gear and flange connections - Tightening torques for



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 | 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 | | |

A.7 Pouch socket system

| Name | Data |
|----------------|---|
| Designation | Pouch socket system |
| Type | Pouch socket system |
| Number | 602-00 |
| Type of manual | Operation, installation, maintenance instructions |
| Manufacturer | PFEIFER SEIL- UND HEBE-TECHNIK GMBH |

For
Reference
Only

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.



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



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



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

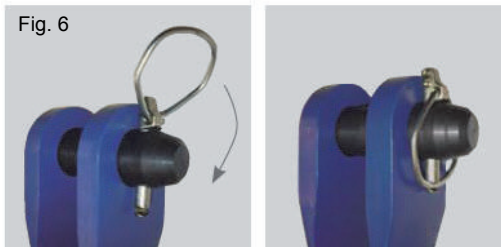


Fig. 7

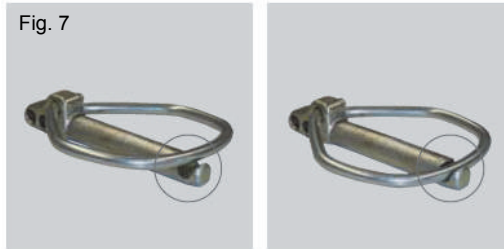


Fig. 8

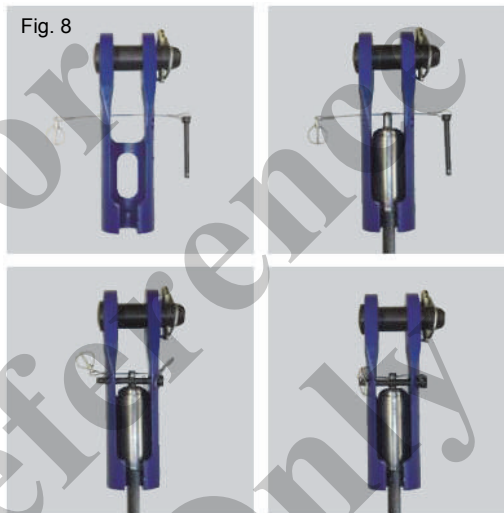


Fig. 9

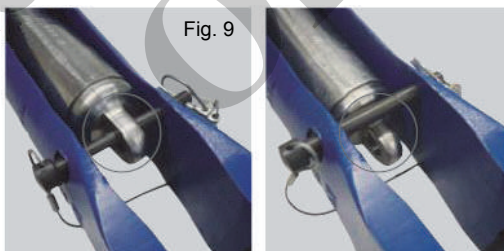


Fig. 10



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°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).



CAUTION

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 Hebeteknik 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 |

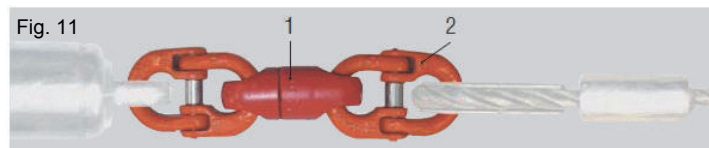


Fig. 11

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.

**PFEIFER
SEIL- UND HEBETECHNIK GMBH
PRÜFSERVICE**
DR.-KARL-LENZ-STRASSE 66
D-87700 MEMMINGEN
TELEPHONE +49 (0) 83 31- 937- 325
TELEFAX +49 (0) 83 31-937-198
E-MAIL: prüfservice-azs@pfeifer.de
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 |

A.8 Cooling system

| Name | Data |
|----------------|--------------------------|
| Designation | Cooling system |
| Type | Cooling system |
| Number | . |
| Type of manual | Maintenance instructions |
| Manufacturer | . |

For
Reference
Only



Additional documentation

**Cleaning the cooling
system**

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10/2009



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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.

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 recommend that it is checked and cleaned several times daily.

Coolant cooler

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.

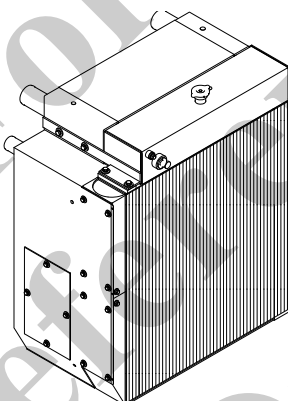


Figure 1 Combination cooler, figure similar

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.

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 deinstalling the cooler.

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 |

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.

Charge-air cooler

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.

Oil cooler

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.

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.

Supplemental documentation

A.9 Winch

| Name | Data |
|----------------|--------------------------|
| Designation | Winch |
| Type | Winch |
| Number | . |
| Type of manual | Maintenance instructions |
| Manufacturer | . |

For Reference Only



1. Residual useful life of winches

1.1 Measures to achieve reliable service periods

1.1.1 General information

Crane inspection

The crane owner is obliged to have the crane inspected at least once a year. See Unfallverhütungsvorschrift der Berufsgenossenschaft Winden, Hub- und Zuggeräte, VBG 8, (German occupational health and safety regulations concerning winches, lifting and pulling devices, VBG 8) or ISO 9927-1.

Attention

- This crane inspection is a legal obligation within the area of application of these health and safety regulations.
- The crane manufacturer recommends to have the crane inspected once a year in all areas outside the applicability of these regulations.

If required, the crane owner assigns the crane inspection to a technical expert for cranes. As part of the crane inspection, the technical expert will also determine the used portion of the theoretical period of use of the individual winches.

General overhaul

Once the theoretical period of use of a winch has been exhausted, the respective winch must not remain in service until after a general overhaul.

The crane owner must have a general overhaul of the winch performed no later than ten years after its commissioning. After a general overhaul, a new theoretical period of use of the winch will commence.

The owner may keep the respective winch in service without performing the general overhaul if defined conditions are met. This applies only if the owner has continuously documented the period of use of the individual winch and if the theoretical period of use has not been completed after ten years in service.

Mandatory time-based crane inspections

If the spent period has not reached the value of the theoretical period of use, then it is mandatory to perform the next crane inspection before the end of the twelfth year of service. After the twelfth year of service has been completed, the winches must be inspected yearly.

Documentation

The technical expert confirms crane inspection and general overhaul in the test report of the respective winch in the crane inspection record. The winch inspection by the technical expert includes a statement concerning the expected residual period of further service of the individual winch. The owner is responsible for the documentation in the crane inspection record.

2.1 Recurring crane inspections

See section 1.1.1



2.2 Measures necessary for winch monitoring

2.2.1 Theoretical period of use

Each crane winch is subject to a theoretical period of use. The theoretical period of use is specified in the test report of the individual winch in the crane inspection record.

The engineer calculating and dimensioning your crane has assumed specific operating conditions and a calculated total service life to determine the theoretical period of use.

The crane winches are classified in accordance with DIN Technical Report 1, ISO 4301/1 or FEM 9.511 as follows:

| | |
|-----------------------|--------------------|
| Drive group: | M..... |
| Load spectrum: | Q..... (L.....) |
| Load spectrum factor: | $k_m = \dots\dots$ |

This results in a **theoretical period of use D**.

Note For applicable values for this calculation refer to table "Winch monitoring" in the crane inspection record.
If the crane is equipped with only **one** hour meter for crane work, then the period of use of each individual winch must be determined and evaluated in accordance with its actual use.

Attention **Never assume the theoretical period of use to be identical with the actual period of use of a winch.**
The actual period of use of a winch is additionally affected by many external factors.

Example

1. Overload conditions caused by improper use of the crane
2. Insufficient maintenance:
 - Oil is not changed in due time
3. Incorrect handling and control:
 - Extreme acceleration or deceleration of the load
 - Load dropping into the ropes
4. Maintenance faults
 - Use of oil of incorrect specification
 - Incorrect fill quantity
 - Oil contaminated during oil change
5. Assembly faults during maintenance and repair
6. Unattended leakage
7. Improperly adjusted safety devices

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8. Hidden defects caused by accidents
9. Extreme ambient conditions
 - Low or high temperatures
 - Aggressive atmosphere
 - Dust and dirt

2.2.2 Used portion of the theoretical period of use

When determining the used portion S of the theoretical period of use, the actual operating conditions (load spectrum) and the operating hours of the lifting devices per inspection interval must be identified. The owner is responsible for the documentation in the crane inspection record.

2.2.2.1 Determining the operating conditions (load spectrum)

The load spectrum of the crane is classified into groups; see DIN Technical Report 1, ISO 4301/1 or FEM 9.511.

Based on the known actual operating conditions, one of the following load spectrums must be selected and entered into the corresponding inspection interval of the crane inspection record.

Note Truck-mounted cranes used for assembly operations usually fall into load spectrum L1 (Q1) with load spectrum factor $k_m = 0.125$.

Reference Only

Supplemental documentation



| Load spectrum Class | Definition of terms | Operating period portions | Load spectrum factor | Graphic representation |
|--------------------------|---|---|----------------------|------------------------|
| light Q 1 L 1 | Power train or parts thereof that are subject to maximum duty only in exceptional cases and that are continuously subject to only very light duty | 10% of the operating period under maximum load (dead load + 1/1 payload) 40% of operating period with dead load + 1/3 payload 50% of operating period with dead load only | $k_m = 0.125$ | |
| heavy Q 3 L 3 | Power train or parts thereof that are frequently subject to maximum duty and that are continuously subject to medium-level duty | 50% of the operating period under maximum load (dead load + 1/1 payload) 50% of operating period with dead load only | $k_m = 0.5$ | |
| very heavy Q 4 L 4 | Power train or parts thereof that are regularly subject to duty levels near the maximum duty | 90% of the operating period under maximum load (dead load + 1/1 payload) 10% of operating period with dead load only | $k_m = 1$ | |

2.2.2.2 Determining the effective operating hours T_i

The effective operating hours are determined as follows and must be entered for the corresponding inspection interval in the crane inspection record.

The following 4 cases are differentiated:

1st case: Each winch is fitted with an hour meter.

- If the crane is fitted with an hour meter for each winch, then the effective number of operating hours T_i per inspection interval can be read off directly.

2nd case: The hour meter counts the entire crane drive.

- The portion that the winches of the overall operating hours of the uppercarriage must be estimated.

Note For truck-mounted cranes used in assembly operations the lifting winches can generally be assumed to have a portion of 20% of the total operating hours of the uppercarriage.

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- 3rd case: One hour meter counts both the hours of travel drive and crane drive**
- The portion of the winches of the overall operating hours of the crane must be estimated.
- Note** For truck-mounted cranes used in assembly operations the uppercarriage operation can generally be assumed to have a portion of 60% of the total operating hours of the crane. Assuming a portion of lifting winch operation of 20% of the operating hours of the uppercarriage (see 2nd case) would result in an equivalent of 12% of the total operating hours of the crane.
- 4th case: No hour meter is fitted**
- The owner must estimate and document the actual operating hours of the winch.
- Note** The recommended percentages stated here generally apply to main lifting winches. The portions of the total operating hours of auxiliary lifting winches and boom control winches may be significantly smaller and must therefore be estimated by the owner.

2.2.2.3 Determining the used portion of the theoretical period of use

An inspection interval i , which requires a maximum of 1 inspection per year according to ISO 9927-1 or VBG 8, results in a used portion S_i of the theoretical period of use when applying the following formula:

$$S_i = \frac{k_{mi}}{k_m} \times T_i$$

Legend

- k_m = Load spectrum factor used as basis for the winch calculations. This factor must be taken from the operating manual.
- k_{mi} = Load spectrum factor in inspection interval i according to section 2.2.2.1
- T_i = Effective hours of operation in inspection interval i according to case 2 in section 2.2.2.2.

This used portion is deducted from the remaining theoretical period of use D_i after each inspection interval. See example.

If the remaining theoretical period of use appears as not sufficient for the subsequent service period, then a general overhaul of the winch must be performed.

Once the theoretical period of use D (see section 2.2.1) has been spent, the winch must not remain in service until a general overhaul has been performed.

In any case, the crane owner must have a general overhaul of the winch performed no later than ten years after the crane has been commissioned.

The general overhaul must be commissioned by the owner, and it must be performed by the manufacturer or by persons authorized by the manufacturer and must be documented in the crane inspection record.

Following the general overhaul, a new theoretical period of use D is specified by the manufacturer or persons authorized by the manufacturer.

If the owner has continuously documented the period of use of the individual winch and if the theoretical period of use has not been completed after ten years in service, then the owner may keep the individual winch in service without a general overhaul under the following conditions:



- A technical expert for cranes checks the individual winch to determine the suitability and correctness of the used portion S of the theoretical period of use D.
- The technical expert performs an in-depth inspection of the winch. The following parameters must be checked and evaluated as a minimum requirement:
 - Visual inspection for leakage, damage and deformation.
 - Oil analysis with special attention to metal particles.
 - Checking the load at minimal and maximum rope tension and at maximum winch speed. Unreeling of at least one layer and checking for any unusual sound.

In any case, the maximum period until the next general overhaul is ten years.

2.2.3. Example

A truck-mounted crane with a separate hour meter for travel drive and crane drive is classified by the manufacturer according to the operating manual as follows:

- Drive group: M3
- Load spectrum: light L1, $k_m = 0.125$
- Theoretical period of use $D = 3200$ h

The used portion S of the theoretical period of use is calculated on the basis of the individual inspection intervals as follows:

1. Inspection (1st year)

In the course of the year before, the crane has been used for assembly work:

- Load spectrum L1, resulting in $k_{m1} = 0.125$.
- 800 h read off the uppercarriage hour meter.
- Of this period, the winch was in operation for approx. 20%, resulting in $T1 = 160$ h.
- This results in a used portion S of the theoretical period of use at the 1st inspection of:

$$S1 = \frac{0,125}{0,125} \times 160 \text{ h} = 160 \text{ h}$$

- Remaining theoretical period of use:
 $D1 = 3200 \text{ h} - 160 \text{ h} = 3040 \text{ h}$

Enter the values stated above into the crane inspection record.
See section 2.2.4.

2. Inspection (2nd year)

The crane has been used for unloading work in a port:

- Load spectrum L3, resulting in $k_{m2} = 0.5$
- 2000 h read off the uppercarriage hour meter, which means for this period:

$$2000 \text{ h} - 800 \text{ h} = 1200 \text{ h}$$

(800 h have been used during the first year of service).



- Of this period, the winch was in operation for approx. 40%, resulting in $T2 = 480$ h.

This results in a used portion S2 of the theoretical period of use in the 2nd inspection interval as follows:

$$S1 = \frac{0,125}{0,125} \times 160 \text{ h} = 160 \text{ h}$$

Remaining theoretical period of use:

$$D2 = 3040 \text{ h} - 1920 \text{ h} = 1120$$

3. Inspection (3rd year)

The crane has been used for assembly work and occasionally for unloading work in a port:

- Load spectrum L2, resulting in $k_{m3} = 0.25$
- 3000 h are read off the uppercarriage hour meter, which means for this period: $3000 \text{ h} - 2000 \text{ h} = 1000 \text{ h}$ (2000 h have been used within the first two years of service).
- Of this period, the winch was in operation for approx. 30%, resulting in $T3 = 300$ h.

This results in a used portion S3 of the theoretical period of use in the 3rd inspection interval as follows:

$$S3 = \frac{0,25}{0,125} \times 300 \text{ h} = 600 \text{ h}$$

Remaining theoretical period of use:

$$D3 = 1120 \text{ h} - 600 \text{ h} = 520 \text{ h}$$

Enter the the following into the table in the crane inspection record: see table 1.



2.2.4. Appendix

Note

- Table 1 shows an example.
- Use table 2 to document the remaining theoretical period of use.

Table 1: Table for determining the remaining theoretical period of use for winch no. 1 (main hoisting winch)

Table 2: Table for determining the remaining theoretical period of use for winch no.

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Reference
Only



| Table 1: Table for determining the remaining theoretical period of use for winch no. 1 (main hoisting winch) | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Example | | | | | | | | | | | | |
| Crane type: S 613 | | | | | | | | | | | | |
| Plant no.: 613.0 ... | | | | | | | | | | | | |
| First commissioning: 12345 | | | | | | | | | | | | |
| Serial number of the winch according to rating plate: 0815 S_i = Used portion of the theoretical period of use since last inspection | | | | | | | | | | | | |
| Last general overhaul performed on: D_i = Remaining theoretical period of use | | | | | | | | | | | | |
| Design data for winch (see operating manual) D_{i-1} = Remaining theoretical period of use after the previous inspection | | | | | | | | | | | | |
| Drive group: M 3 k_m = Load spectrum factor used as basis for the winch calculations. | | | | | | | | | | | | |
| Load spectrum: Q 1 (L1) = This factor must be taken from the operating manual. | | | | | | | | | | | | |
| Load spectrum factor k_m : 0.125 k_{mi} = Load spectrum factor in inspection interval i according to section 2.2.2.1 | | | | | | | | | | | | |
| Theoretical period of use D : 3200 h T_i = Effective hours of operation in inspection interval i according to section 2.2.2.2 | | | | | | | | | | | | |

| Inspection no. | Date of initial commissioning Date of inspection | Operating conditions since last inspection (load spectrum) | Load spectrum factor | Operating hours of entire crane | Operating hours of uppercarriage | Operating hours of uppercarriage since last inspection | Operating hours of winch | Operating hours of winch since last inspection T_i | Used portion of the theoretical period of use D : $S_i \frac{k_{mi}}{k_m} \times T_i$ | Remaining theoretical period of use $D_i = D_{i-1} - S_i$ | Name of tester | Signature | Remark |
|----------------|---|--|----------------------|---------------------------------|----------------------------------|--|--------------------------|--|--|--|----------------|-----------|--------|
| i | | | [h] | [h] | [h] | [h] | [h] | [h] | [h] | [h] | | | |
| 0 | 94.11.20 | – | – | – | 0 | | | | 0 | 3200 | | | |
| 1 | 95.11.15 | L1 | 0.125 | – | 800 | 800 | – | 160 (20% of 800) | 160 | 3040 | Müller | | |
| 2 | 96.11.17 | L3 | 0.5 | – | 2000 | 1200 | – | 480 (40% of 1200) | 1920 | 1120 | Huber | | |
| 3 | 97.11.23 | L2 | 0.25 | – | 3000 | 1000 | – | 300 (30% of 1000) | 600 | 520 | Meier | | |

Attention A general overhaul must be performed at least every 10 years!

Last general overhaul performed on:

h/g/tb/notiz1/doku/NDWinde

Supplemental documentation



Table 1: Table for determining the remaining theoretical period of use for winch no. 1 (main hoisting winch)

Example

Crane type:

Plant no.:

First commissioning:

Serial number of the winch according to rating plate: S_i = Used portion of the theoretical period of use since last inspection

Last general overhaul performed on: D_i = Remaining theoretical period of use

Design data for winch (see operating manual) D_{i-1} = Remaining theoretical period of use after the previous inspection

Drive group: M..... k_{en} = Load spectrum factor used as basis for the winch calculations.

Load spectrum: Q ... (L...) = This factor must be taken from the operating manual.

Load spectrum factor k_m: k_{mi} = Load spectrum factor in inspection interval i according to section 2.2.2.1

Theoretical period of use D: T_i = Effective hours of operation in inspection interval i according to section 2.2.2.2

| Inspection no. | Date of initial commissioning Date of inspection | Operating conditions since last inspection (load spectrum) | Load spectrum factor | Operating hours of entire crane | Operating hours of uppercarriage | Operating hours of uppercarriage since last inspection | Operating hours of winch | Operating hours of winch since last inspection T _i | Used portion of the theoretical period of use D: S _i $\frac{k_{mi}}{k_m} \times T_i$ | Remaining theoretical period of use D _i = D _{i-1} - S _i | Name of tester | Signature | Comment |
|----------------|---|--|----------------------|---------------------------------|----------------------------------|--|--------------------------|---|---|--|----------------|-----------|---------|
| i | | k _{mi} | [h] | [h] | [h] | [h] | [h] | [h] | [h] | [h] | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Attention A general overhaul must be performed at least every 10 years!

Last general overhaul performed on:

h/g/tb/notiz1/doku/NDWInde

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Reference Only

A.10 List of operating fluids and lubricants

| Name | Data |
|----------------|--|
| Designation | Operating fluids and lubricants |
| Type | Operating fluids and lubricants |
| Number | 693127 |
| Type of manual | List of Operating Fluids and Lubri- cants |
| Manufacturer | . |

For
Reference
Only

For
Reference
Only

ID no.: 693127
Release date: 2014-12-15
Current revision status: 0

Printed copies of this List of Operating Fluids and Lubricants are not
subject to change management.

**List of Operating
Fluids and Lubricants
GHC - en**

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Customer Service Hotline Crane

During business hours:

+49 9421 540-274

Mo – Th: 7 am to 6 pm (CET)

Fr: 7 am to 4 pm (CET)

Outside business hours:

+49 172 420 98 18

Mo – Th: 6 pm to 10 pm (CET)

Fr: 4 pm to 10 pm (CET)

Sa – Su: 8 am to 6 pm (CET)

1, 1, en_US

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

Fig. 2: Temperature ranges - hydraulic oil

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.

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.

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1 Hydraulic system

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 |
| Shell Tellus S2 VA 46 | SE: 179233 Shell: 001D7756 | DIN 51524-3 HVLP-D (ISO VG 46) | |
| Rapidly biodegradable hydraulic oil: | | | |
| Panolin HLP Synth 46 | SE: 149198 | ISO 15380 HEES saturated | Avia Syntofluid PEB 30 |
| 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 | |

2 Diesel engine

2.1 Diesel engine oil

2.1.1 Cummins diesel engine

2.1.1.1 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 | |
| Shell Rimula R5 E 10W-40 | SE: 181934 Shell: 001C4591 | API CI-4; Cummins CES 20078 | |
| Shell Rotella T5 10W-30 ¹⁾ | SE: 179999 Shell: 001D5436 | API CJ-4; Cummins CES 20081 | Castrol Enduron Global 10W-40 |
| Shell Rimula R4 X 15W-40 | SE: 181933 Shell: 001E7746 | API CI-4; Cummins CES 20078 | |

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

2.1.1.2 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 |
| Shell Rotella T3 15W-40 | SE: 187162 Shell: 001D5433 | API CJ-4; Cummins CES20081 | |

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⁾ |

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).

2.3 Fuel

| Emissions level | Fuel specification | Sulfur content |
|-------------------|---|----------------|
| Tier 2 and Tier 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.

Diesel engine

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 |

2.5 Diesel exhaust fluid for Tier 4 Final diesel engines

| Empfehlung | Ident.No. | Spezifikation |
|------------|------------|------------------------------|
| DEF | SE: 149060 | ISO 22241; DIN 70070; AUS 32 |

For
Reference
Only

3 Gearbox

3.1 Slewing gear GHC75

3.1.1 Gear oil

Fig. 6: Temperature range

| 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 |

3.2 Winch gear

3.2.1 Gear oil

Fig. 7: Temperature range

| 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 |

Gearbox

3.2.2 Grease lubricating points

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 |
| Shell Gadus S2 V220 2 | SE: 179226 Shell: 001D8451 | DIN 51825 LI; NLGI 2; KP2K-20 | AUTOL TOP 2000; Cas- trol Olit 2 EP; OMV Signum CX2 |

3.3 Crawler travel drive

3.3.1 Gear oil

Fig. 9: Temperature range

| 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 |

4 Lubrication

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 |
| Shell Gadus S2 V220 2 | SE: 179226 Shell: 001D8451 | DIN 51502 - KP2K-20; NLGI 2 | OMV Signum CX 2; AUTOL TOP 2000; Cas- trol Olit 2 EP |
| 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 |

4.2 Grease - slewing ring, outer gearing

Fig. 11: Temperature ranges

| Recommendation | ID no. | Specification | Alternative |
|-----------------------------------|-------------------------------|------------------------------------|-------------|
| Fuchs Ceplattyn KG 10 HMF - LT | SE: 156982 | DIN 51502 - KPHC2N-50; NLGI 2 | |
| Shell Gadus S2 OG 80 | SE: 184872 Shell: 001D8496 | DIN 51 502 OG PF 0 S-30; NLGI 0 | OKS 490 |

4.3 Grease - manual lubricating points

Fig. 12: Temperature ranges

| Recommendation | ID no. | Specification | Alternative |
|------------------------------|-------------------------------|---|--|
| Fuchs Stabyl LT 50 | SE: 157280 | DIN 51502 - KPHC2N-50; NLGI 2 | Avia Grease PE Polar |
| 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 |
| 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 |

4.4 Grease - undercarriage, telescoping

Fig. 13: Temperature ranges

| Recommendation | ID no. | Specification | Alternative |
|------------------------------|-------------------------------|---|--|
| Fuchs Stabyl LT 50 | SE: 157280 | DIN 51502 - KPHC2N-50; NLGI 2 | Avia Grease PE Polar |
| 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 |
| 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 |

4.5 Grease - telescopic boom

Fig. 14: Temperature range

| Recommendation | ID no. | Specification | Alternative |
|----------------|------------|----------------------------------|-------------|
| Rhenus LEG 2 | SE: 185733 | DIN 51502, KPF 2 N-30; NLGI 2 | |

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) |
| Pfeifer RL-B | SE: 185736 | Rope oil | |

5 Air conditioning system

5.1 Refrigerant

Fig. 16: Temperature range

| Recommendation | ID no. | Specification | Alternative |
|-----------------------|---------------|----------------------|--------------------|
| KLEA 134a | SE: 185737 | R134a | |

5.2 Refrigerant oil

Fig. 17: Temperature range

| Recommendation | ID no. | Specification | Alternative |
|-----------------------|---------------|----------------------|--------------------|
| Sanden SP-10 | SE: 185732 | | |

6 Windshield washer system

6.1 Antifreeze

Fig. 18: Temperature range

| Recommendation | ID no. | Specification | Alternative |
|---|------------|--|-------------|
| Off-the-shelf window cleaners with antifreeze | SE: 185734 | Fresh water with a proportion of at least 50% antifreeze | |

For
Reference
Only

7 Starter batteries

7.1 Battery terminal grease

| Recommendation | ID no. | Specification | Alternative |
|-------------------------|---------------|----------------------|--------------------|
| Battery terminal grease | SE: 071706 | | |

7.2 Battery terminal spray

| Recommendation | ID no. | Specification | Alternative |
|------------------------|---------------|----------------------|--------------------|
| Battery terminal spray | SE: 113732 | | |

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qSCALE S6

Overload protection



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VERSION OVERVIEW

| Issue | Date | Description | Originator |
|-------|------------|-------------------------|------------|
| A | 16/03/2018 | Original German edition | rk |

INTRODUCTION

| | |
|---|--|
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| Manufacturer | WIKAL Mobile Control GmbH & Co. KG Hertzstr. 32-34 76275 Ettlingen Germany Tel: +49 (0)7243 709-0 |

Introduction

Symbols

Identification of hazards and other notices are set forth in this user handbook as shown below:



WARNING

Warning of imminent personal injury and property damage.

Information on preventive measures against danger.



ATTENTION

Warning of dangerous situations. Also warning about property damage.

Advice for preventing danger.

IMPORTANT

Warning of potentially harmful situation for the product.

Instructions on avoiding the potentially harmful situation.



NOTICE

Application notes and information, but no dangerous situation.



TIP

Supplementary instructions and recommendations for the user.

Fault codes

1 Fault codes

1.1 General

This document contains additional information to the "qSCALE S6 – Functions and Security" handbook.

The fault code information contained in this document is valid at the time of publication of this document.

The latest information on fault codes can be found in an Excel file provided by WIKA. This file also serves as a **reference file** for embedding text messages on a console.

The qSCALE S6 provides fault code messages via a J1939 CAN data connection.

SPN Suspect **P**arameter **N**umber

Represents the faulty SPN within the fault code terminology.

FMI Failure **M**ode Identifier

Represents the type of fault that has occurred, e.g. exceeding or falling below value ranges, short circuits at the sensor.

For Reference Only

Fault Code Table

2 Fault Code Table

| | | |
|----------------|-------------------------|---|
| Columns | SPN | Suspect Parameter Number as decimal value |
| | Description | Long text for SPN |
| | Cause | specifies the SPN / also information on FMI (see chapter 0) |
| | Fault correction | Information for resolving the fault |

Error Faults are states in which proper operation of the overload monitoring device is no longer possible, or only severely limited operation is possible (e.g. sensor error or system error).

Warnings Warnings are states which can occur during normal operation of the overload monitoring device (e.g. overload or lifting limit switch triggered).

The following table describes all possible faults and warnings that can be reported by the qSCALE control unit:

| SPN | Description | Cause | troubleshooting |
|-------|--|--|---|
| 33280 | The minimum radius specified in the respective load lift chart was under-shot as a result of over-tipping. | Radius range under-shot. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Luff the boom down to a radius or angle specified in the load lift chart. |
| 33281 | The minimum radius specified in the respective load lift chart was under-shot as a result of over-tipping. | Radius range exceeded. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Luff the boom up to a radius or angle specified in the load lift chart. |
| 33282 | The minimum angle specified in the respective load lift chart was under-shot as a result of over-tipping. | Main boom fell below the angle range. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Luff the boom up to a radius or angle specified in the load lift chart. |
| 33283 | The maximum angle specified in the relevant load lift chart has been exceeded as a result of over-tipping. | Main boom angle range exceeded. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Luff the boom down to a radius or angle specified in the load lift chart. |
| 33290 | Working range limitation exceeded by the slewing angle. | Slewing angle on the left side exceeded. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Turn to the permissible operating range (load lift chart). |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|---|---|--|
| 33291 | Working range limitation exceeded by the slewing angle. | Angle of rotation on the right side exceeded. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Turn to the permissible operating range (load lift chart). |
| 33292 | Working range undershot by the length. | Minimum length undershot. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Telescoping in the allowed operating range (load lift chart). |
| 33293 | Working range exceeded by length. | Maximum length exceeded. - Collective shutdown - Individual shutdown - Fault output - Warning output - Advance warning output | Telescoping in the allowed operating range (load lift chart). |
| 35328 | The maximum load capacity specified by the load lift chart has been exceeded > = 100% | Load capacity >= 100% | Set down load, only operate crane within the allowed parameters. |
| 35329 | The maximum load capacity specified by the load lift chart has been exceeded > = 110% | Load capacity >= 110% | Set down load, only operate crane within the allowed parameters. |
| 35330 | The maximum load capacity specified by the load lift chart has been exceeded > = 120% | Load capacity >= 120% | Set down load, only operate crane within the allowed parameters. |
| 35336 | The maximum load capacity specified by the load lift chart has been exceeded > = 90% | Load capacity >= 90% | Warning, the crane is operated near the shutdown. |
| 35344 | The maximum load capacity imposed by the load lift chart has been reduced due to environmental conditions. Reduction to 66% (can be parameterized) of the load capacity due to the ambient temperature. | Permissible load capacity was reduced | Information on reduced working loads. |
| 35345 | The maximum load capacity imposed by the load lift chart has been reduced due to environmental conditions. Reduction to 0% (can be parameterized) of the load capacity due to the ambient temperature. | Permissible load capacity was reduced | Information on reduced working loads. |
| 35346 | The maximum load capacity imposed by the load lift chart has been reduced due to environmental conditions. Reduction to 0% (can be parameterized) of the load capacity due to the ambient temperature. | Permissible load capacity was reduced | Information on reduced working loads. |
| 35360 | The maximum utilization specified by the load lift chart has been exceeded. | Shutdown due to overload | Set down load, only operate crane within the allowed parameters. |
| 35361 | The maximum prewarning limit specified by the load lift chart has been exceeded. | Approach to the maximum load bearing capacity | Warning, the crane is operated close to the permissible load bearing capacity. |
| 35364 | The lifting limit switch has triggered; the load cannot be lifted. | Lifting limit switch | Lowering the load |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|---|----------------------------------|--|
| 35376 | The setup mode has been selected according to EN13000. | Setup mode 110% | Notice: It is possible that no shutdown functions are active. |
| 35377 | The setup mode for assembly at the factory has been selected. | Setup mode | No monitoring functions are active. No load lift charts are present or setup mode type selected. Warning! Operation is only permitted without load or up to the maximum setup load! |
| 35378 | Bypass switch activated. | Bypass switch | Notice: No monitoring of the load active! |
| 35379 | Bypass switch activated (according to EN13000) | Bypass switch | Notice: No monitoring of the load active! |
| 35380 | Tip up button activated (according to EN13000) | Tip up button | Notice: No monitoring of the load active! |
| 35381 | Bypass of the lifting limit switch activated. | Lifting limit switch is bypassed | Notice: No monitoring of the load lifting active! |
| 35392 | Tipping up not possible due to excessive capacity or working range limitation. | Tipping up blocked | Reduce load, bring crane into the permissible operating range. |
| 35394 | Tipping down not possible due to excessive capacity or working range limitation. | Tipping down blocked | Reduce load, bring crane into the permissible operating range. |
| 35396 | Telescoping out is not possible due to excessive capacity or working range limitation | Telescoping out blocked | Reduce load, bring crane into the permissible operating range. |
| 35398 | Retracting not possible due to high load capacity or working range limitation | Retracting blocked | Reduce load, bring crane into the permissible operating range. |
| 35400 | Slewing left is not possible due to excessive capacity or working range limitation. | Slewing left locked | Reduce load, bring crane into the permissible operating range. |
| 35402 | Slewing right not possible due to high load capacity or working range limitation | Slewing right locked | Reduce load, bring crane into the permissible operating range. |
| 35404 | Load lifting not possible due to high load capacity or working range limitation | Load lifting deactivated | Reduce load, bring crane into the permissible operating range. |
| 35408 | An invalid operating mode was selected. | Invalid operating mode | Select a valid operating mode. |
| 35410 | The rope reeving has taken on an invalid value during operation. | Invalid rope reeving | Check sensors and actuators. Select suitable operating mode. |
| 35411 | The selection of the winch has taken on an invalid value during operation. | Invalid winch selection | Check sensors and actuators. Select suitable operating mode. |
| 35412 | The outrigger has taken on an invalid value during operation. | Invalid outrigger | Check sensors and actuators. Select suitable operating mode. |
| 35418 | This operating mode is not permitted at this time since the crane is under load. | Operating mode under load | Move the crane into a load-free condition. |
| 35419 | No load capacity or an invalid load capacity was calculated. | Invalid load capacity | Check and correct the projected working loads in the load capacity table |
| 35434 | Negative radius calculated | Invalid value | Check sensors and actuators. Crane data programming does not cover the operating mode; adjust after consultation. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|--|------------------|---|
| 35435 | Negative height calculated | Invalid value | Check sensors and actuators. Crane data programming does not cover the operating mode; adjust after consultation. |
| 35436 | Negative boom length calculated | Invalid value | Check sensors and actuators. Crane data programming does not cover the operating mode; adjust after consultation. |
| 35440 | A redundancy fault was determined for the length. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35442 | A redundancy fault was determined for the radius. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35444 | A redundancy fault was determined for the angle. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35446 | A redundancy fault was determined for the power. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35455 | A redundancy fault was determined for the operating mode. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35456 | An error was detected in the module for the redundant load cell X+. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35457 | A difference between the two input signals for the redundant load cell X+ was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35458 | Both input signals for the redundant load cell X+ have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35459 | One of the input signals for the redundant load cell X+ has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35472 | An error was detected in the module for redundant load cell X-. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35473 | A difference between the two input signals for the redundant load cell X- was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35474 | Both input signals for the redundant load cell X- have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35475 | One of the input signals for the redundant load cell X- has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35488 | An error has been detected in the module for the redundant load cell Y+. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35489 | A difference between the two input signals for the redundant load cell Y+ was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35490 | Both input signals for the redundant load cell Y+ have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35491 | One of the input signals for the redundant load cell Y+ has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|--|------------------|--|
| 35504 | An error has been detected in the module for the redundant load cell Y-. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35505 | A difference between the two input signals for the redundant load cell Y- was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35506 | Both input signals for the redundant load cell Y- have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35507 | One of the input signals for the redundant load cell Y- has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35520 | An error has been detected in the module for the redundant length measurement cable. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35521 | A difference between the two input signals for the redundant length measurement cable was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35522 | Both input signals for the redundant length measurement cable have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35523 | One of the input signals for the redundant length measurement cable has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35536 | An error has been detected in the module for the redundant goniometer. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35537 | A difference between the two input signals for the redundant goniometer was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35538 | Both input signals for the redundant goniometer have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35539 | One of the input signals for the redundant goniometer has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35552 | An error was detected in the module for redundant cage tilt measurement X. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35553 | A difference between the two input signals for the redundant cage tilt measurement X was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35554 | Both input signals for the redundant cage inclination measurement X have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35555 | One of the input signals for the cage inclination measurement X has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35568 | An error was detected in the module for redundant cage inclination measurement Y. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35569 | A difference between the two input signals for the redundant cage inclination measurement Y was found. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35570 | Both input signals for the redundant cage inclination measurement Y have failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 35571 | One of the input signals for the cage inclination measurement Y has failed. | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|---|------------------------------------|--|
| 35584 | The configuration of the work platforms type is incorrect. The configuration pins are in the wrong state. | Configuration fault | Check wiring. |
| 35840 | The nominal load of the working cage is greater than permissible. | Nominal load exceeded | Reduce load in working cage. |
| 35841 | Short circuit or cable break at one of the outputs for the proportional valve. | Proportional valve leveling | Check wiring. Replace faulty valve. |
| 35842 | Short circuit or cable break at one of the outputs for the proportional valve. | Proportional valve slewing | Check wiring. Replace faulty valve. |
| 35843 | The load increasing functions were disabled due to excessive cage load or radius overshoot. | Shutdown load increasing functions | Reduce load or radius. Rectify a fault. |
| 35844 | The CAN message can no longer be received. | Timeout Receive PDO 0x20x | Check CAN connections. Check and replace control device. |
| 35845 | The checksum within the message does not match the calculated checksum. | CRC Receive PDO 0x20x | Check CAN connections. Check and replace control device. |
| 35846 | The configuration inputs "FHAB Master" and "FHAB Slave" are mutually implausible. | Master-slave configuration faulty | Check wiring. |
| 35847 | The CAN message can no longer be received. | Timeout Receive PDO 0x21x | Check CAN connections. Check and replace control device. |
| 35848 | The checksum within the message does not match the calculated checksum. | CRC Receive PDO 0x21x | Check CAN connections. Check and replace control device. |
| 35849 | The read back of the relay state to shutdown the load increasing functions does not match the task condition. | Read back relay shutdown | Check relay. Check wiring. |
| 35850 | Both signals of at least one sensor of the cage detection have failed. | Sensors cage load | Check wiring. Check sensors. |
| 35851 | The internal signal of at least one sensor of the cage detection has failed. | Internal sensors cage load | Check wiring. Check sensors. |
| 35852 | The external (redundant) signal of at least one sensor of the cage detection has failed. | External sensors cage load | Check wiring. Check sensors. |
| 35853 | Both signals of at least one sensor of the cage tilt detection have failed. | Sensors cage tilt | Check wiring. Check sensors. |
| 35854 | The internal signal of at least one sensor of the cage tilt detection has failed. | Internal sensors Cage tilt X | Check wiring. Check sensors. |
| 35855 | The external (redundant) signal of at least one sensor of the cage inclination detection has failed. | External sensors Cage tilt X | Check wiring. Check sensors. |
| 35856 | The CAN message can no longer be received. | Timeout Receive PDO 0x22x | Check CAN connections. Check and replace control unit. |
| 35857 | The checksum within the message does not match the calculated checksum. | CRC Receive PDO 0x22x | Check CAN connections. Check and replace control unit. |
| 35858 | Difference in the calculated values of the cage inclination in the X direction. | Difference cage tilting X | Check sensors. Check and replace control unit. |
| 35859 | Difference in the calculated values of the cage inclination in the Y direction. | Difference cage tilting X | Check sensors. Check and replace control unit. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|--|--------------------------------|--|
| 35860 | Difference in the calculated values of the cage load. | Difference cage load | Check sensors. Check and replace control device. |
| 35861 | The Alive Counter within the message has not changed. | Alive Receive PDO 0x20x | Check CAN connections. Check and replace control device. |
| 35862 | The Alive Counter within the message has not changed. | Alive Receive PDO 0x21x | Check CAN connections. Check and replace control device. |
| 35863 | The Alive Counter within the message has not changed. | Alive Receive PDO 0x22x | Check CAN connections. Check and replace control device. |
| 35864 | The CAN message can no longer be received. | Timeout Receive PDO 0x23x | Check CAN connections. Check and replace control device. |
| 35865 | The Alive Counter within the message has not changed. | Alive Receive PDO 0x23x | Check CAN connections. Check and replace control device. |
| 35866 | The checksum within the message does not match the calculated checksum. | CRC Receive PDO 0x23x | Check CAN connections. Check and replace control device. |
| 35867 | The undercarriage incline is outside the permitted range. | Undercarriage incline exceeded | Move undercarriage to the permitted range. |
| 35868 | The leveling actuator test failed. The cage moved too much during the test. | Undercarriage incline exceeded | Check valve to shut off the work cage. |
| 35869 | The two redundant signals of the outrigger (track width detection) report different signals. | Outrigger support | Check wiring. Check sensors. |
| 35870 | The CAN message can no longer be received. | Timeout Receive PDO 0x24x | Check CAN connections. Check and replace control device. |
| 35871 | The Alive Counter within the message has not changed. | Alive Receive PDO 0x24x | Check CAN connections. Check and replace control device. |
| 35872 | The checksum within the message does not match the calculated checksum. | CRC Receive PDO 0x24x | Check CAN connections. Check and replace control device. |
| 35873 | The CAN message can no longer be received. | Timeout Receive PDO 0x25x | Check CAN connections. Check and replace control device. |
| 35874 | The Alive Counter within the message has not changed. | Alive Receive PDO 0x25x | Check CAN connections. Check and replace control device. |
| 35875 | The checksum within the message does not match the calculated checksum. | CRC Receive PDO 0x25x | Check CAN connections. Check and replace control device. |
| 35876 | Difference in the calculated values of the boom angle. | Difference boom angle | Check sensors. Check sensor calibration and CAN project planning. |
| 35877 | Both sensors for detecting the boom angle have failed. | Sensors boom angle | Check wiring. Check sensors. |
| 35878 | The internal sensor for detecting the boom angle has failed. | Internal sensor Boom angle | Check wiring. Check sensors. |
| 35879 | The external sensor for detecting the boom angle has failed. | External sensor Boom angle | Check wiring. Check sensors. |
| 35880 | Difference in the calculated values of the boom length. | Difference boom length | Check sensors. Check sensor calibration and CAN project planning. |
| 35881 | Both sensors for detecting the boom length have failed. | Sensors boom length | Check wiring. Check sensors. |
| 35882 | The internal sensor for detecting the boom length has failed. | Internal sensor Boom length | Check wiring. Check sensors. |
| 35883 | The external sensor for detecting the boom length has failed. | External sensor Boom length | Check wiring. Check sensors. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|---|---------------------------------|--|
| 35884 | The time limit for operation with redundancy fault has expired. | Time limit | Eliminate cause of original error. |
| 35885 | The leveling has been deactivated due to an error or exceeding the permissible range. | Shutdown leveling | Eliminate cause of original error. |
| 35886 | The calibration values for the boom length could not be loaded from the RCL. | Calibration values boom length | Check RCL and sensor calibration. |
| 35887 | The calibration values for the boom angle could not be loaded from the RCL. | Calibration values boom angle | Check RCL and sensor calibration. |
| 35888 | Electrical fault (cable break, short-circuit) on the valve to shutdown the main supply. | Hydraulic shutdown machine | Check wiring. Check valve. |
| 35889 | Electrical fault (cable break, short-circuit) on the valve to shutdown the working orphan supply. | Hydraulic shutdown working cage | Check wiring. Check valve. |
| 28672 | Length sensor Node-ID 14 (0x0E) faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28673 | Angle node ID 12 (0x0C) faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28674 | Luffing cylinder pressure bottom side faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28675 | Luffing cylinder pressure rod side faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28676 | Length sensor Node-ID 15 (0x0F) faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28677 | Angle node ID 13 (0x0D) faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28696 | Configuration pin 1 of work platforms type faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28697 | Configuration pin 2 of work platforms type faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28698 | Configuration pin 3 of work platforms type faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|---|--------------|--|
| 28699 | Configuration pin 4 of work platforms type faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28704 | Load cell X+ signal 1 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28705 | Load cell X+ signal 2 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28706 | Load cell X- signal 1 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28707 | Load cell X- signal 2 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28708 | Load cell Y+ signal 1 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28709 | Load cell Y+ signal 2 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28710 | Load cell Y- signal 1 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28711 | Load cell Y- signal 2 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28712 | Angle of rotation faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28716 | Cage tilt goniometer faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28717 | Cage tilt goniometer faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|---|--------------|--|
| 28718 | Setpoint generator slewing faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28724 | Wind speed faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28728 | Cage tilt X Signal 1 Angle measurement faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28729 | Cage tilt Y Signal 1 Angle measurement faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28730 | Cage tilt X Signal 2 Angle measurement faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28731 | Cage tilt Y Signal 2 Angle measurement faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28732 | Lifting limit switch faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28768 | Output Safety shutdown / Enable pump faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28769 | Output Load shutdown / Enable pump faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28773 | Output Enable telescoping out faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28774 | Output Enable tipping up faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28775 | Output Enable tipping down faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|--------------|--|--------------|--|
| 28778 | Output Enable winch up faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28782 | Red light output (external signal for working platform) faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28783 | Horn output faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28784 | Input feedback safety relay System 1 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28785 | Input feedback safety relay System 2 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28788 | Output for safety relay system 1 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28789 | Output for safety relay system 2 faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28792 | Output for left movement of working platform faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28793 | Output for right movement of working platform faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28794 | Output for lift movement of working platform inclination faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28795 | Output for lower movement of working platform inclination faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28796 | Temperature sensor faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|--|--------------|--|
| 28806 | Undercarriage incline X faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28807 | Undercarriage incline Y faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28808 | Undercarriage track width faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28810 | Speed measurement of the internal combustion engine faulty or input module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28811 | Output proportional valve 1 "a" faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28812 | Output proportional valve 1 "b" faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28813 | Output proportional valve 2 "a" faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28814 | Output proportional valve 2 "b" faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28815 | Output control valve boom hydraulics faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28816 | Outlet control valve main hydraulics faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 28817 | Output control valve drive train faulty or output module faulty. | see FMI list | Check cabling and CAN connections. Check sensor calibration and CAN project planning. Replace faulty sensor. |
| 40704 | Initialization fault of the system or other serious system fault | System fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40706 | The communication with the kinematics module is disturbed. | Timeout | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|--|-------------------------|---|
| 40707 | The communication with the limiter module is disturbed. | Timeout | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40708 | The communication with the data logger module is disturbed. | Timeout | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40709 | The communication with the external system is disturbed. | Timeout | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40710 | The communication with the external system / machine control is disturbed. | Timeout | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40720 | Internal fault of the system application program | Program execution fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40721 | Internal fault of the system application program | Program execution fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40722 | Internal fault of the system application program | Program execution fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40723 | Internal fault of the system application program | Program execution fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40724 | Internal fault of the system application program | Program execution fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40725 | Internal fault of the system application program | Program execution fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40726 | Internal fault of the system application program | Program execution fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40727 | The crane data on the device does not correspond to the application. | Incorrect data | Load the correct crane data onto the device - notify customer service. |
| 40753 | Fault in redundancy system 1 | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40754 | Fault in redundancy system 2 | Redundancy fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40768 | The power supply of the system is too low. | Voltage supply | Check the battery voltage of the crane, check the wiring of the supply voltage. |
| 40769 | The voltage of the buffer battery of the system is too low. | Battery voltage | Contact customer service, replace device. |
| 40770 | The temperature of the power supply unit is too high. | Temperature warning | Check the installation conditions of the device. Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40771 | The temperature of the CPU is too high | Temperature warning | Check the installation conditions of the device. Switch the ignition off and back on again. If the fault occurs again, notify customer service. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|-------|--|----------------------|---|
| 40772 | The status of the CanOpen bus is faulty | CanOpen bus fault | Check CanOpen wiring and power supply. Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40735 | All enable outputs of the device have been deactivated. | Outputs deactivated | Information: Consecutive fault from another system fault. |
| 40751 | All outputs of the device have been deactivated. | Outputs deactivated | Information: Consecutive fault from another system fault. |
| 40767 | The version of the load lift charts / data programming does not match the application version | Version fault | Contact customer service, replace device/software. |
| 40783 | The version of the parameter data does not match the application version | Version fault | Contact customer service, replace device/software. |
| 40959 | The system has detected faults in the RAM or FLASH memory that cannot be corrected. The device can no longer be operated safely. | Serious safety fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40960 | Fault in evaluating the command line. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40961 | Fault in loading the project. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40962 | Fault in loading the crane model. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40963 | Fault in loading the operating mode. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40964 | Fault in initializing the interface. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40965 | Fault in reading/writing the data. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 40976 | Fault in selecting the operating mode. | Module fault | Select a valid operating mode |
| 40977 | Fault in selecting the crane model. | Module fault | Select a valid operating mode |
| 40980 | Fault in selecting the crane model. | Module fault | Select a valid operating mode |
| 43536 | Internal fault of the module, null-pointer | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 43537 | Internal fault of the module, null reference | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |

Fault Code Table

| SPN | Description | Cause | troubleshooting |
|--------------|--|--------------|---|
| 43538 | Internal fault of the module, reference type | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 44773 | The system has detected faults in the RAM or FLASH memory that cannot be corrected. The device can no longer be operated safely. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 45057 | Fault in reading/writing the data. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 45058 | Fault in selecting the operating mode, operating mode ignored. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 45059 | Fault in selecting the operating mode | Module fault | Select a valid operating mode |
| 45060 | No valid working load found | Module fault | Select valid operating mode and operate crane in a valid range. |
| 45061 | Fault in selecting the operating mode, operating mode is null | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |
| 45062 | The system has detected faults in the RAM or FLASH memory that cannot be corrected. The device can no longer be operated safely. | Module fault | Switch the ignition off and back on again. If the fault occurs again, notify customer service. |

Reference Only

Fault Code Table

2.1 FMI list

The FMI is used with the SPN to provide specific information related to a diagnostic trouble code (DTC). The FMI may indicate that an abnormal operating condition or problem has been detected with an electronic circuit or electronic component.

| FMI | Description |
|-----|--|
| 0 | Data valid but above normal area of operation, highest level |
| 1 | Data valid but below normal area of operation, highest level |
| 2 | Data faulty, intermittent or incorrect (rationality) |
| 3 | Voltage above normal or short-circuit to high source |
| 4 | Voltage below normal or short-circuit to high source |
| 5 | Current below normal or idle |
| 6 | Current above normal or grounded circuit |
| 7 | Mechanical system does not respond or is not adjustable |
| 8 | Abnormal frequency or pulse width or period |
| 9 | Abnormal update rate |
| 10 | Abnormal change rate |
| 11 | Fault code not identifiable |
| 12 | Faulty intelligent device or component |
| 13 | Out of calibration |
| 14 | Special warnings |
| 15 | Data valid but above the normal range: Least severe level |
| 16 | Data valid but above normal range: Moderately heavy level |
| 17 | Data valid but below normal range: Lowest severity |
| 18 | Data valid but below normal range: Moderately heavy level |
| 19 | Received network data in case of error: (Multiplexed Data) |
| 20 | Data Drifted High (rationality high) |
| 21 | Data Drifted Low (rationality low) |
| 22 | Reserved for SAE assignment |
| 23 | Reserved for SAE assignment |
| 24 | Reserved for SAE assignment |
| 25 | Reserved for SAE assignment |
| 26 | Reserved for SAE assignment |
| 27 | Reserved for SAE assignment |
| 28 | Reserved for SAE assignment |
| 29 | Reserved for SAE assignment |
| 30 | Reserved for SAE assignment |
| 31 | Condition exists |

Feedback on the handbook

Feedback on the handbook

What do you think about this handbook? We always strive to fully describe the product in our handbooks and to provide important background information so that this product can be used without problems.

We take the task of continuous improvement and reduction of errors very seriously. Your comments and suggestions help us to increase the quality and the level of information in this documentation.

Your assessment for this handbook:

| | very good | good | satisfactory | moderate | bad |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Exact description | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Legibility | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ease of understanding | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Examples | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Structure | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Completeness | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Pictures, photos | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Drawings, graphics | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Tables | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Did you discover any faults in this manual?

If yes, which ones and on which page?

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Feedback on the handbook

Comments, suggestions for improvement, additional suggestions:

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General comments:

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- as a fax to: +49 (0)7243 709 3222
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76275 Ettlingen



Many Thanks!

Notes

For
Reference
Only