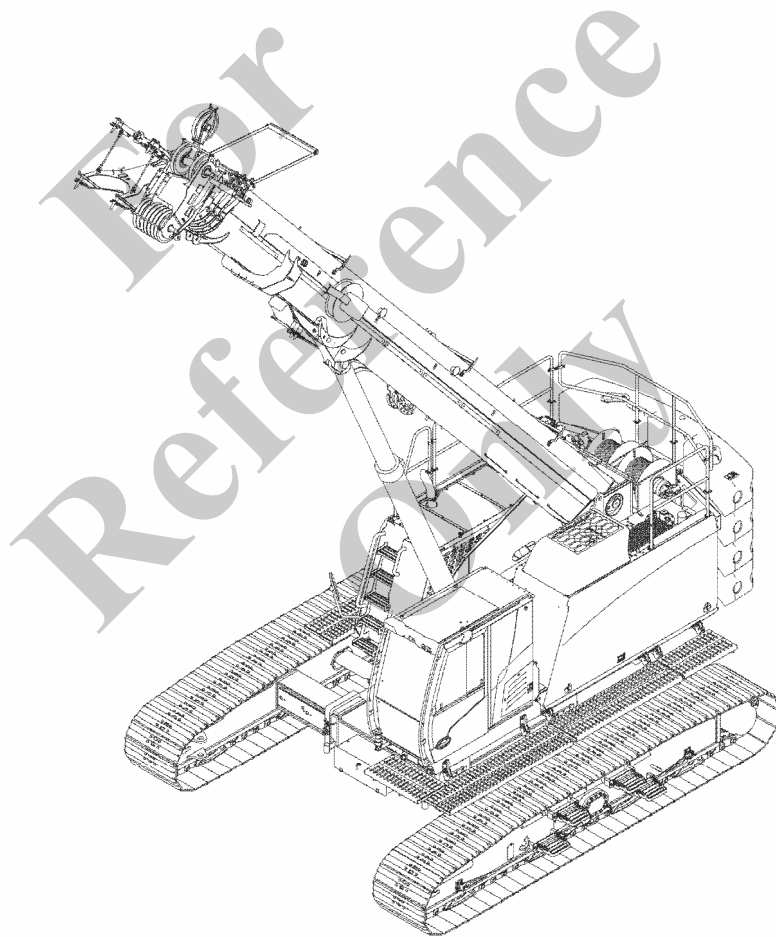


Operation manual

GHC 75

Telescopic crane



Translation of the original operating manual
Keep the manual in the machine at all times.

Version: 3.0

Read this manual prior to performing any task!

For
Reference
Only

GHC 75+, 12, en_US

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 nerozumiete 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 dati v obratovanje. Po potrebi se obrnite na svojega regionalnega prodajalca z izdelki Grove.	

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 almanıza 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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Table of contents

1	Overview.....	11
1.1	Overall machine.....	11
1.2	Uppercarriage.....	12
1.3	Undercarriage.....	15
1.4	Counterweight (ballast).....	16
1.5	Cab.....	17
1.6	Winch.....	27
2	Safety.....	28
2.1	Symbols in the manual.....	28
2.1.1	Warnings.....	28
2.1.2	Structure of safety instructions.....	28
2.1.3	Tips and recommendations.....	28
2.2	Proper use.....	28
2.3	Foreseeable misuse.....	29
2.4	Residual risks.....	31
2.5	Danger zone.....	36
2.6	Safety devices.....	37
2.7	Responsibilities of the owner.....	40
2.8	Personnel qualifications.....	42
2.9	Personal protective equipment.....	43
2.10	Diesel fuel.....	44
2.11	Engine oil.....	45
2.12	Hand signals.....	45
3	Technical data.....	53
3.1	Machine emissions.....	53
3.2	Rating plate.....	53
3.3	Crane categorization.....	53
3.4	Dimensions and weight.....	55
3.4.1	Overall machine and weights.....	55
3.4.2	Transport dimensions of the overall machine.....	56
3.4.3	Attachments.....	57
3.5	Cummins QSB 6.7 diesel engine.....	58
3.6	Electrical system.....	59
3.7	Work speed.....	59
3.8	Hydraulic system.....	59
3.9	Vibration.....	59
3.10	Operational environment.....	60
3.11	Permissible maximum wind speeds.....	61
3.12	Permissible ground pressure.....	62
3.13	Winch.....	62
3.14	Bottom hook block.....	62
3.15	Reeving diagram.....	63
3.16	Load-bearing capacity.....	67

3.16.1	Explanation of the load lift charts.....	67
3.16.2	Adverse conditions.....	68
3.16.3	Load lift charts.....	68
4	Make ready for operation.....	69
4.1	Safety notifications before start-up.....	69
4.2	Applications planning.....	69
4.2.1	Work site usage.....	69
4.2.2	Pontoon operation.....	70
4.3	Initial start-up.....	73
4.3.1	Steps.....	73
4.3.2	Switching on the battery disconnect switch.....	74
4.3.3	Check machine and accessory equipment.....	74
4.3.4	Bring machine up to operating temperature.....	76
4.4	Start-up.....	76
4.4.1	Switching on the battery disconnect switch.....	76
4.4.2	Check machine and accessory equipment.....	76
4.4.3	Machine start.....	77
4.4.4	Fastening the seat belt.....	77
4.4.5	Starting the diesel engine.....	78
4.4.6	Opening setup status.....	79
4.4.7	Bring machine up to operating temperature.....	79
4.5	Startup after preservation.....	79
4.6	Shutting down the machine.....	80
4.7	Preservation and storage.....	80
5	SENCON 2.0.....	82
5.1	SENCON 2.0.....	82
5.2	Controls overview.....	83
5.2.1	Overview.....	83
5.2.2	Show.....	84
5.2.3	Menu icons.....	85
5.3	Start screen.....	86
5.3.1	Overview.....	86
5.3.2	Operating status.....	87
5.3.3	Telescopic boom and Slew uppercarriage notification icons.....	89
5.3.4	Diesel engine notification and warning icons.....	90
5.3.5	LML notification and warning icons.....	92
5.3.6	Machine notification and warning icons.....	93
5.3.7	Working diagram.....	94
5.3.8	Winch parameters.....	95
5.4	Set-up status.....	95
5.4.1	Opening setup status.....	95
5.4.2	Entering the uppercarriage inclination.....	98
5.4.3	Entering winch reeving.....	99
5.4.4	Configuring track width.....	100

5.4.5	Specifying attachments and starting the setup program.....	101
5.4.6	Enter counterweight.....	105
5.5	Set speed of crane control functions.....	105
5.6	Set response behavior of crane control functions.....	109
5.7	Setting the language.....	113
5.8	Setting brightness.....	114
5.9	Setting date and time.....	114
5.10	Setting units.....	115
5.11	USB.....	116
5.12	Request access.....	117
5.13	General information.....	117
5.14	Registration information.....	118
5.15	Speed ranges of the diesel engine.....	118
5.16	Winch line pull.....	119
5.17	Diagnostics.....	121
5.17.1	Overview.....	121
5.17.2	Previous faults machine.....	122
5.17.3	Active Faults RCL.....	123
5.17.4	Opening.....	124
5.17.5	Messages.....	125
5.17.6	Network.....	128
5.17.7	Incoming signals.....	130
5.17.8	Transmitting signals.....	131
6	Operation.....	132
6.1	Safety instructions for operation.....	132
6.2	Safe entry and exit.....	133
6.3	Start-up.....	133
6.4	Machine key.....	134
6.5	Enter the cab.....	135
6.6	Exit from the cab.....	136
6.7	Shift position of the ignition switch.....	137
6.8	Adjusting the driver seat.....	138
6.9	Cab lighting.....	144
6.10	rearview mirror.....	145
6.11	Sun visor and roller shade.....	146
6.12	Switching on the battery disconnect switch.....	147
6.13	Turning off the battery disconnect switch.....	147
6.14	Windshield.....	148
6.14.1	Opening the windshield.....	148
6.14.2	Closing front windshield.....	149
6.15	Opening the door windows.....	149
6.16	Machine lighting.....	150
6.16.1	Switching the work lights on and off.....	150
6.16.2	Switching the beacon on and off (option).....	150

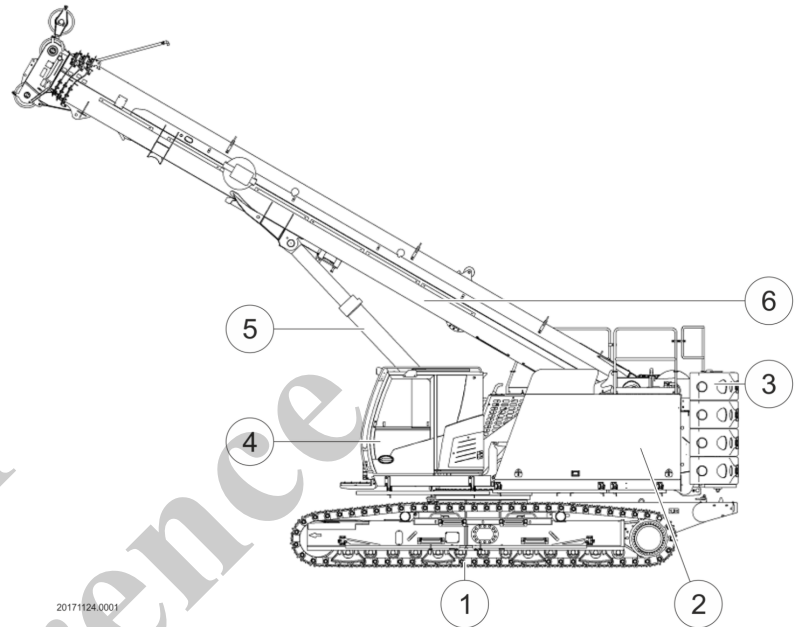
6.17	Radio.....	150
6.18	Camera system.....	151
6.19	Windshield wiper and windshield washer system...	151
6.19.1	General.....	151
6.19.2	Windshield wiper and windshield washer system	151
6.20	Control panel for climate control system.....	153
6.21	Turning on the diesel filter heating.....	155
6.22	Safety lever positions.....	156
6.23	Activate coolant preheating.....	156
6.24	Starting / stopping / jump-starting the diesel engine.....	156
6.24.1	Starting the diesel engine.....	156
6.24.2	Stopping a diesel engine.....	158
6.24.3	Jump starting diesel engines.....	158
6.25	Load moment limitation (LML).....	160
6.25.1	Safety instructions.....	160
6.25.2	Mode of operation.....	160
6.25.3	Set-up status.....	163
6.25.4	Operation.....	163
6.25.5	Operating mode selection.....	163
6.25.6	Operating modes table.....	165
6.25.7	Bypass LML.....	167
6.25.8	Bypassing the load moment limitation (RCL).....	168
6.25.9	Safety components.....	169
6.26	Warm-up the machine.....	172
6.27	Roatate engine speed.....	173
6.28	Exhaust aftertreatment system.....	173
6.29	Check and refill the DEF level (For Tier 4f engines).....	175
6.30	Suppressing exhaust aftertreatment system regeneration.....	176
6.31	Starting the exhaust aftertreatment system regeneration manually.....	177
6.32	Stopping manual exhaust aftertreatment system regeneration.....	178
6.33	Refuel the machine.....	178
6.34	Remote radio control.....	180
6.35	Assignment of the joysticks and pedals.....	190
6.36	Travelling.....	192
6.36.1	Uppercarriage locking mechanism.....	192
6.36.2	Secure the bottom hook block on the uppercarriage.....	193
6.36.3	Moving the machine.....	195
6.36.4	Traveling with suspended load.....	197
6.36.5	Restrictions when traveling on slopes and inclined ground.....	199
6.37	work mode.....	199

6.37.1	Safety instructions for operation.....	199
6.37.2	Tilting the cab.....	200
6.37.3	Slewing the uppercarriage.....	201
6.37.4	Lift and lower loads.....	204
6.37.5	Operate with two winches.....	206
6.37.6	Lifting and lowering the telescopic boom.....	210
6.37.7	Extending and retracting the telescopic boom.....	211
6.37.8	Working range limitation.....	211
6.37.9	Normal operations as a carrier for the driving / removing of pile driving equipment.....	213
6.38	Parking the machine.....	215
6.39	Depressurizing the hydraulic system.....	216
7	Setup.....	217
7.1	Safety instructions regarding setup.....	217
7.2	Walkways.....	217
7.2.1	Steps.....	217
7.3	Track widths.....	218
7.3.1	General information.....	218
7.3.2	Track width markings.....	218
7.3.3	Increasing the track width.....	219
7.3.4	Decreasing the track width.....	221
7.4	Setup mode.....	224
7.5	Softkeys - quick-action icon setup.....	226
7.6	Set up the swing barrier protection (option).....	228
7.7	Installing the counterweight.....	230
7.7.1	Counterweight components.....	230
7.7.2	Safety instructions.....	231
7.7.3	Attaching ballast support.....	231
7.7.4	Lifting counterweight onto ballast support.....	231
7.7.5	Lifting counterweight onto uppercarriage.....	239
7.8	Removing the counterweight.....	245
7.8.1	Safety instructions.....	245
7.8.2	Attaching ballast support.....	245
7.8.3	Lowering counterweight onto ballast support.....	245
7.8.4	Lifting counterweight off ballast support.....	250
7.9	Fly boom.....	254
7.9.1	General information.....	254
7.9.2	Attachment - deflection sheave.....	255
7.9.3	Attaching the fly boom.....	256
7.9.4	Taking down the fly boom.....	260
7.9.5	Folding the fly boom into transport position.....	262
7.9.6	Folding the fly boom into working position.....	269
7.9.7	Fly boom support (option).....	276
7.9.8	Folding the fly boom from 0° to 20°.....	279
7.9.9	Folding the fly boom from 0° to 40°.....	280

7.9.10	Folding the fly boom from 20° to 40°.....	281
7.9.11	Folding the fly boom from 40° to 20°.....	282
7.9.12	Folding the fly boom from 20° or 40° to 0°.....	283
7.10	Fly jib extension.....	285
7.10.1	Attaching the fly boom extension.....	286
7.10.2	Detaching the fly boom extension.....	289
7.11	Auxiliary jib.....	290
7.11.1	Installing the auxiliary jib.....	290
7.11.2	Dismantling the auxiliary jib.....	293
8	Transport.....	295
8.1	Safety instructions.....	295
8.2	Controls for unloading the machine.....	298
8.3	Switching on the battery disconnect switch.....	299
8.4	Unloading the machine.....	299
8.4.1	Safety instructions.....	299
8.4.2	Setup mode.....	299
8.4.3	Moving the machine off the transport vehicle.....	300
8.5	Lashing the machine.....	303
8.6	Lifting the machine.....	304
8.6.1	Lifting the machine.....	304
9	Maintenance schedule.....	308
10	Tightening torques.....	313
10.1	General information.....	313
10.2	Standard connections.....	313
10.3	Rotary connection.....	315
11	Fault search.....	316
11.1	General information.....	316
11.2	Safety instructions for troubleshooting.....	316
11.3	Drive engine.....	316
11.4	Hydraulic system.....	317
11.5	Heating/climate control system.....	317
11.5.1	Heat output.....	317
11.5.2	Cooling capacity.....	319
11.5.3	System very noisy.....	320
11.6	Slewing gear.....	320
11.7	Travel gear/undercarriage.....	320
11.8	Cab.....	321
12	Removal and disposal.....	322
	Appendix.....	323
A	ANSI signage for GHC 75.....	324
B	Additional documentation.....	377

1 Overview

1.1 Overall machine



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- 1 Undercarriage
- 2 Uppercarriage
- 3 Counterweight (ballast)
- 4 Cab
- 5 Luffing cylinder
- 6 Boom

Overview

Uppercarriage

1.2 Uppercarriage

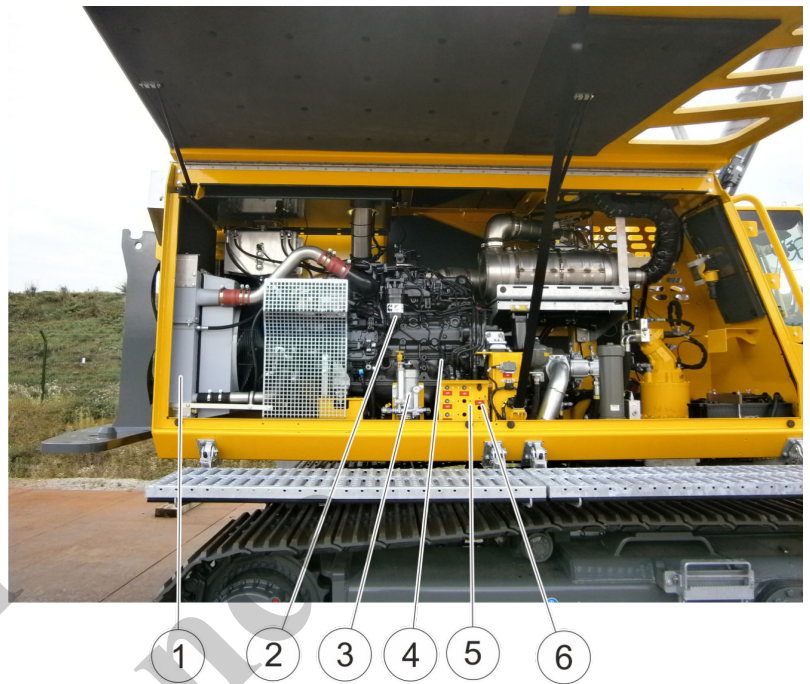
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- 1 DEF tank (for Tier 4f engines)
- 2 Electrical system control cabinet
- 3 Bypass switch - RCL
- 4 Supply unit DEF
- 5 Hydraulic oil cooling system
- 6 Hydraulic system

Right



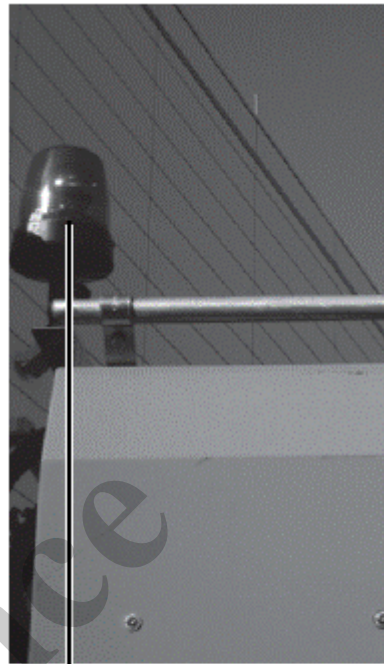
- 1 Radiator
- 2 Diesel fine filter
- 3 Diesel pre-filter
- 4 Drive engine
- 5 Fuses
- 6 Battery disconnect switch

Overview

Uppercarriage

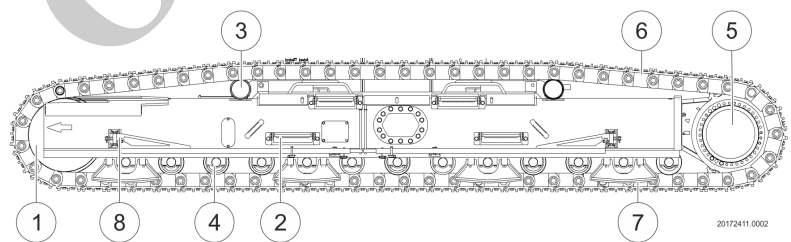


- 1 Engine oil filter
- 2 Exhaust aftertreatment system (for Tier 4f engines)
- 3 Lubricating nipple bar
- 4 HydroClean
- 5 Slewing gear
- 6 Slewing gear expansion tank
- 7 Batteries



1 Beacon

1.3 Undercarriage

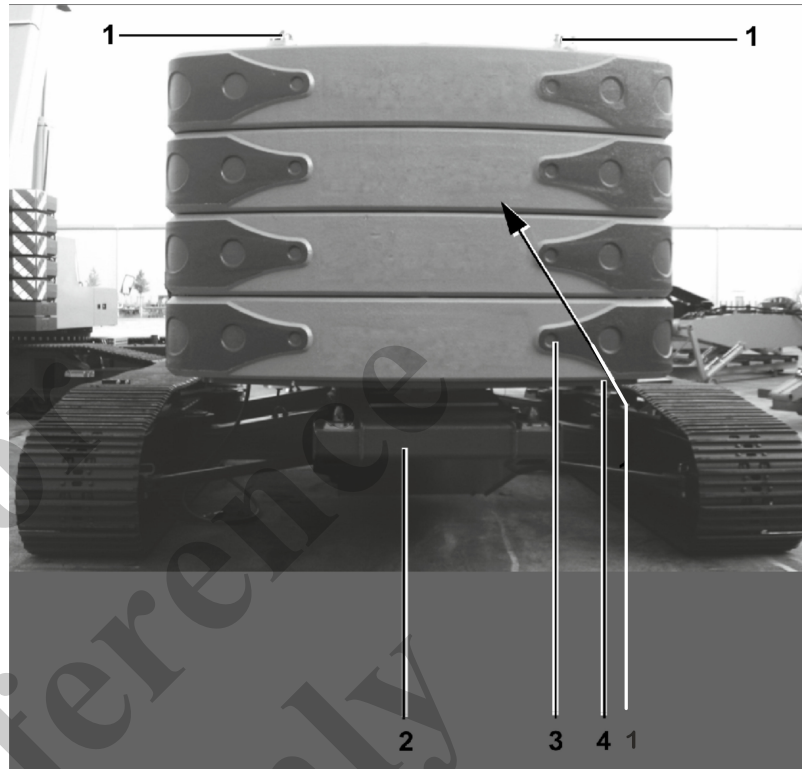


- 1 Idler (forward direction of travel)
- 2 Access ladder, hinged (4x)
- 3 Carrier roller
- 4 Track roller
- 5 Drive wheel (rear, in direction of travel)
- 6 Crawler track
- 7 Chain guide
- 8 Swing barrier protection

Overview

Counterweight (ballast)

1.4 Counterweight (ballast)



- 1 Ballast rods with locking mechanism
- 2 Ballast support
- 3 Ballast rocks 4 x 4.3 t (4 x 9,479 lbs)
- 4 Ballast bracket

1.5 Cab

Cab outer

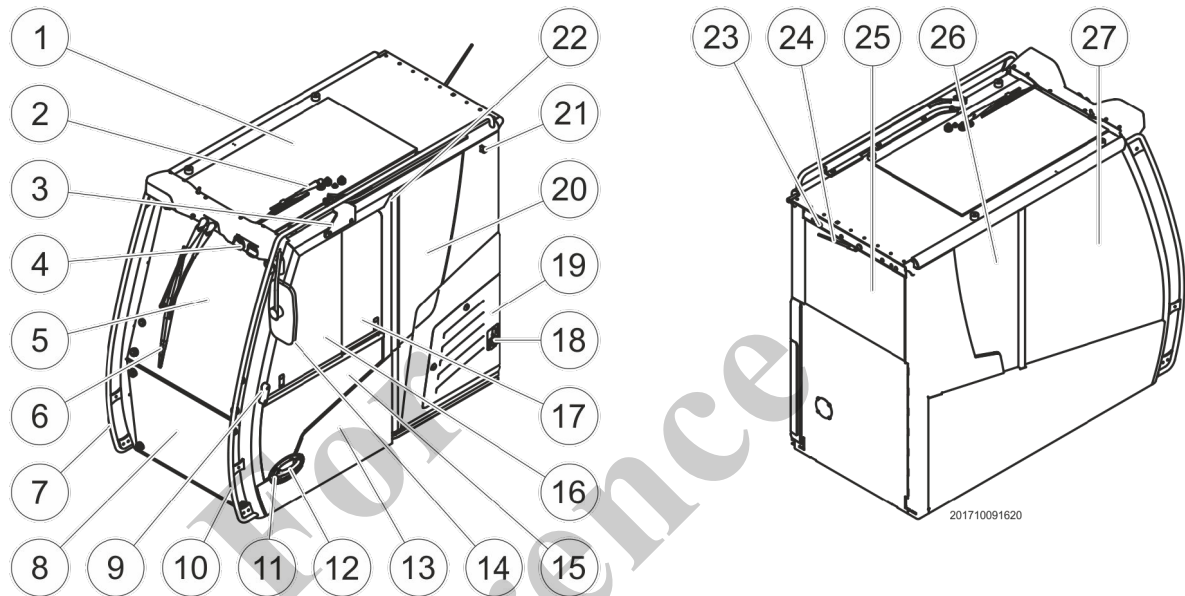


Fig. 1: Maxcab cab 2

- | | |
|--------------------------------------|----------------------------------|
| 1 Skylight | 15 Below door window |
| 2 Windshield wiper | 16 In front of door window |
| 3 Roller carriage | 17 Behind door window |
| 4 Work light | 18 Below door hinge |
| 5 Upper windshield | 19 Climate control system cover |
| 6 Windshield wiper, upper windshield | 20 Side window left side |
| 7 Right grip handle | 21 Above door hinge |
| 8 Lower windshield | 22 Door switch |
| 9 Outer handle | 23 24 volt power socket |
| 10 Left grip handle | 24 Antenna |
| 11 Door lock | 25 Rear Window |
| 12 Door handle | 26 Right rear side window panel |
| 13 Cab door | 27 Right front side window panel |
| 14 Rearview mirror | |

Operating elements in the inner cab

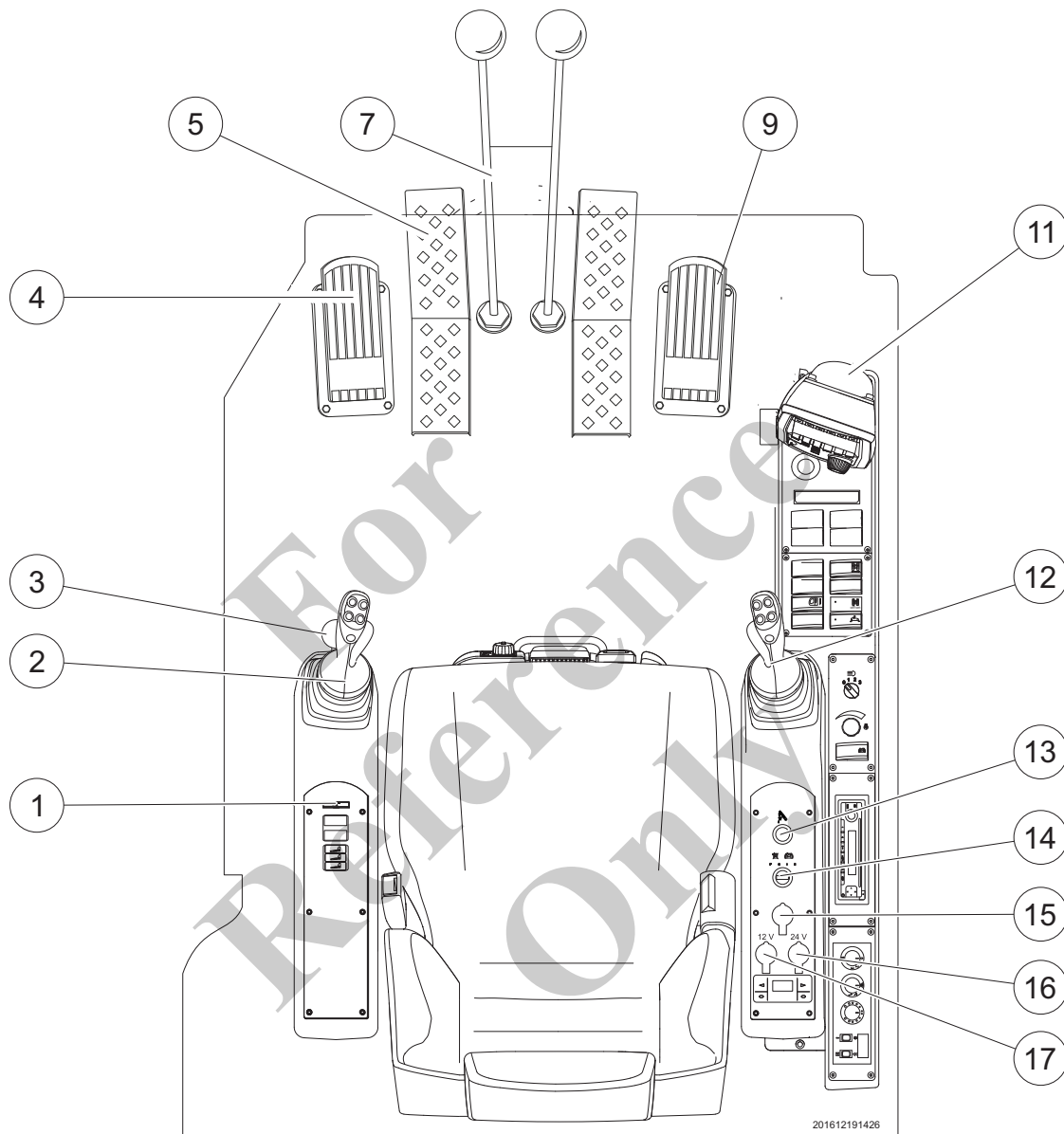
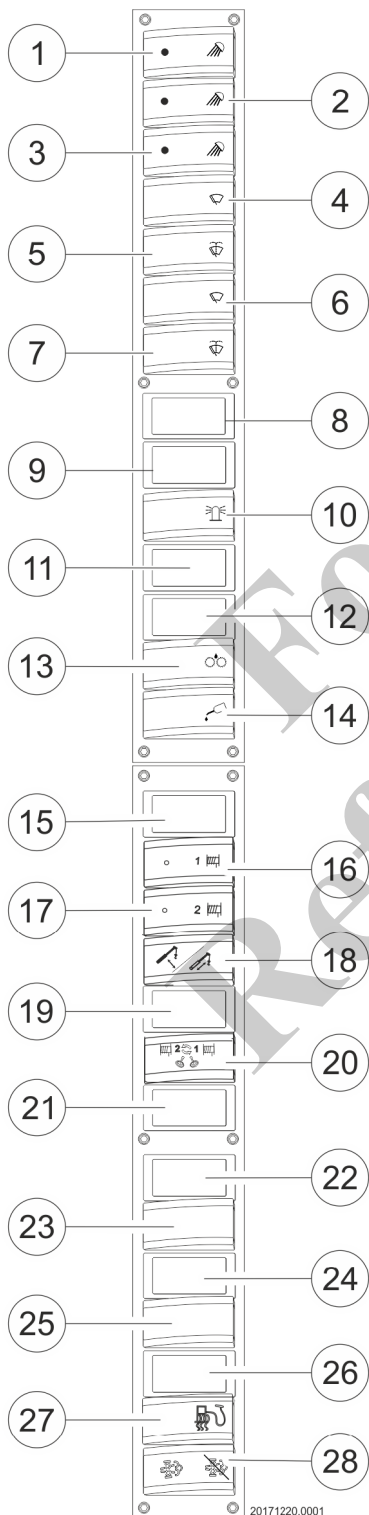


Fig. 2: Operating elements in the cab

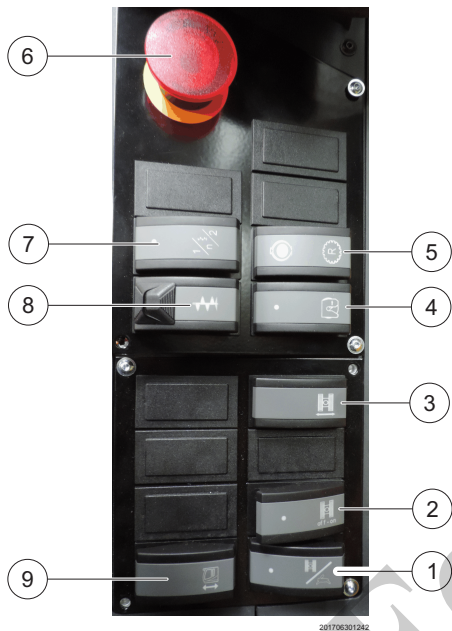
- | | | | |
|---|--------------------|----|-----------------------|
| 1 | Seat functions | 11 | SENCON 2.0 |
| 2 | Left joystick | 12 | Right joystick |
| 3 | Safety lever | 13 | Bypass, raise boom |
| 4 | Slewing gear brake | 14 | Ignition switch |
| 5 | Drive pedal | 15 | USB power socket, 5 V |
|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

Upper right control panel



- 1 Roof work lighting
- 2 Working headlight, 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 Not used
- 9 Not used
- 10 Beacon (option)
- 11 Not used
- 12 Not used
- 13 Slewing ring lubrication (option)
- 14 Central lubrication system (option)
- 15 Not used
- 16 Activate winch 1
- 17 Activate winch 2
- 18 Changeover in joystick control for: luffing down-up/Telescope in - out
- 19 Not used
- 20 Changeover in joystick control for: winch 1/winch 2
- 21 Not used
- 22 Not used
- 23 Not used
- 24 Not used
- 25 Not used
- 26 Not used
- 27 Diesel filter heater on/off
- 28 Start/stop regeneration of exhaust aftertreatment system

Front right control panel



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

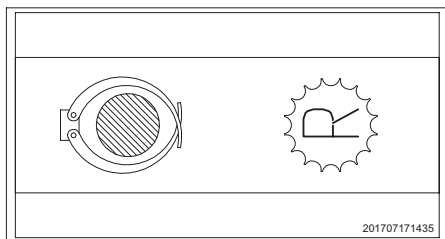
Fig. 3: Front right control panel



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.

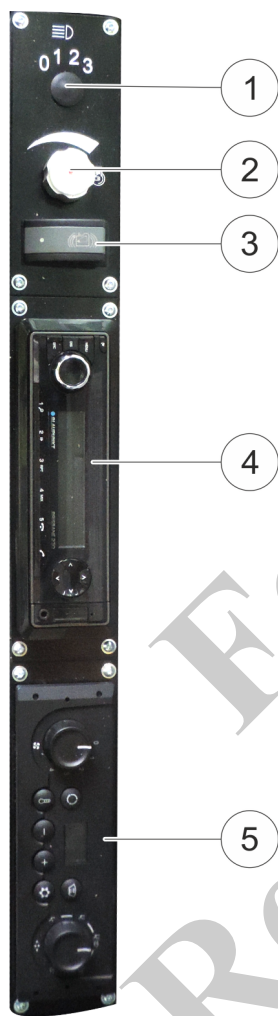
The pole claw will fully close when the Preselect pole claw/supplemental hydraulic system switch is set to the supplemental hydraulic system position. Persons near the pole claw may become crushed. Objects inside the pole claw may be cut apart and fall down. This can cause serious injury or death. The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



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

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

Control panel, right-hand, rear



- 1 Not used
- 2 Hand throttle
- 3 Starting/stopping the diesel engine
- 4 Radio
- 5 Climate control system

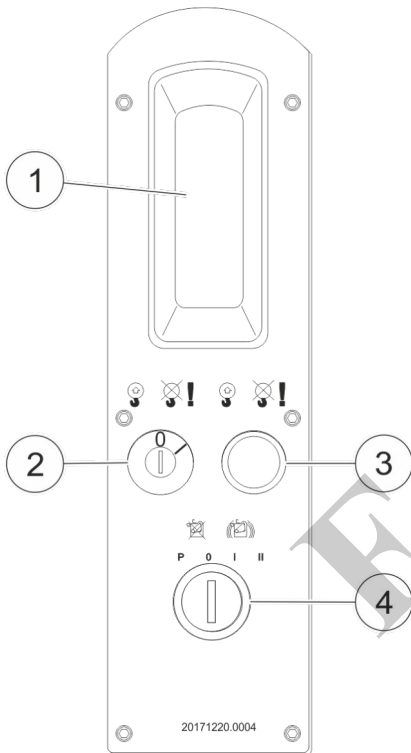
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Fig. 4: Control panel, right-hand, rear

Overview

Cab

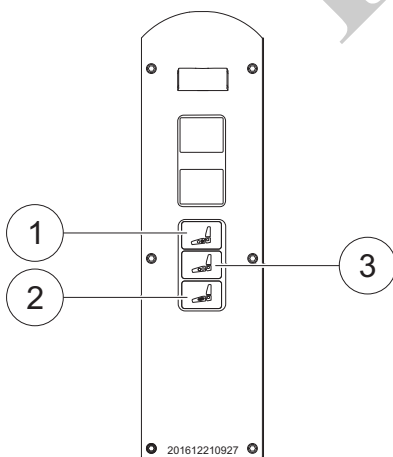
Right control panel next to driver seat



- 1 Storage compartment
- 2 Key switch, bypass lift boom
- 3 Button, bypass lift boom
- 2 Ignition switch

Fig. 5: Right control panel next to driver seat

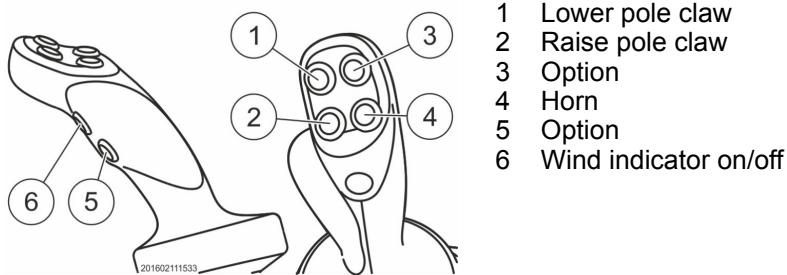
Left control panel next to driver seat



- 1 Switch, lumbar support, lower air chamber
- 2 Switch, lumbar support, lateral supports
- 3 Switch, lumbar support, upper air chamber

Fig. 6: Control panel, left

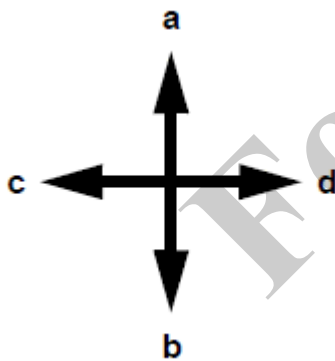
Right joystick



- 1 Lower pole claw
- 2 Raise pole claw
- 3 Option
- 4 Horn
- 5 Option
- 6 Wind indicator on/off

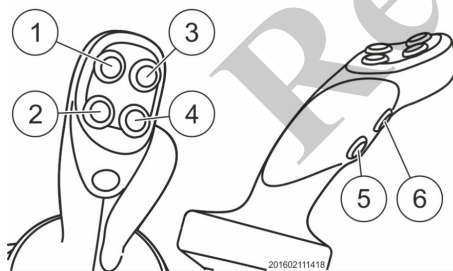
Fig. 7: Right joystick

Directions of movement:



- a Lower winch 1
- b Lift winch 1
- c Lift telescopic boom / Telescope boom in
- d Lower telescopic boom / Telescope boom out

Left joystick



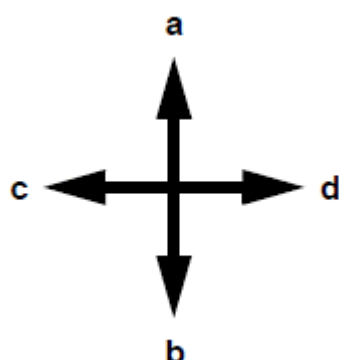
- 1 Slewing gear holding brake
- 2 Open pole claw
- 3 Slewing gear freewheeling
- 4 Close pole claw
- 5 Setting up the fly boom
- 6 Slewing speed - uppercarriage

Fig. 8: Left joystick

Overview

Cab

Directions of movement



- a Lower winch 2
- b Lift winch 2
- c Slew uppercarriage left
- d Slew uppercarriage right

Safety lever

The safety lever (1) serves as a safety device. Only release the safety lever after the engine has been started.

With safety lever activated

- All hydraulic functions are disabled.
- The slewing gear service brake is applied.



Fig. 9: Safety lever activated (pulled back)

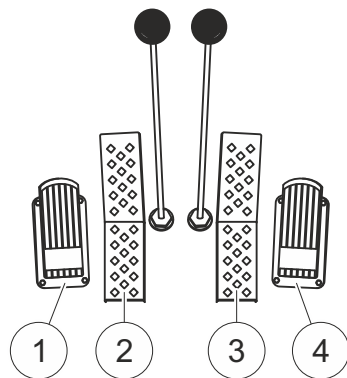
When the safety lever is released (see illustration)

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



Fig. 10: Safety lever released (pushed forward)

Pedals

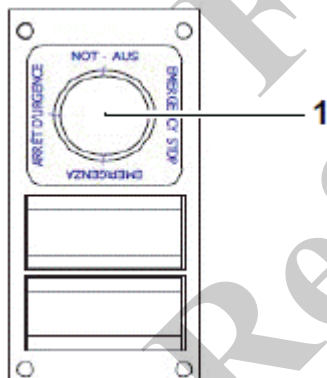


- 1 Slewing gear service brake
- 2 Drive pedal, left, with hand lever
- 3 Drive pedal, right, with hand lever
- 4 Throttle pedal diesel engine

Fig. 11: Pedals

Emergency stop switch

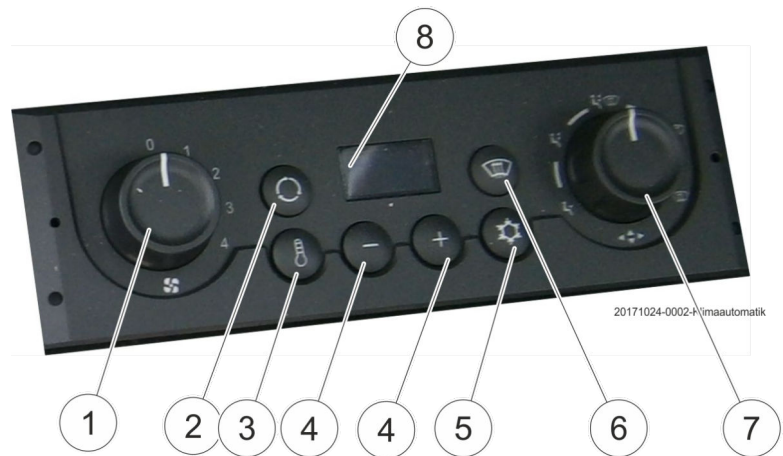
The emergency stop switch (1) is located on the bottom right control panel and immediately shuts down the machine when pressed.



Positions:
 Pulled Machine on
 Pressed Machine off

Fig. 12: Emergency stop switch

Control panel for climate control system



- 1 Fan speed selector switch
- 2 Recirculating-air mode
- 3 Show outside temperature
- 4 Temperature regulator
- 5 Climate control system on/off
- 6 Fresh-air mode
- 7 Air flow selector switch
- 8 Temperature display (°C or °F)



Information

The climate control system can be operated with outside air or circulating air.



Information

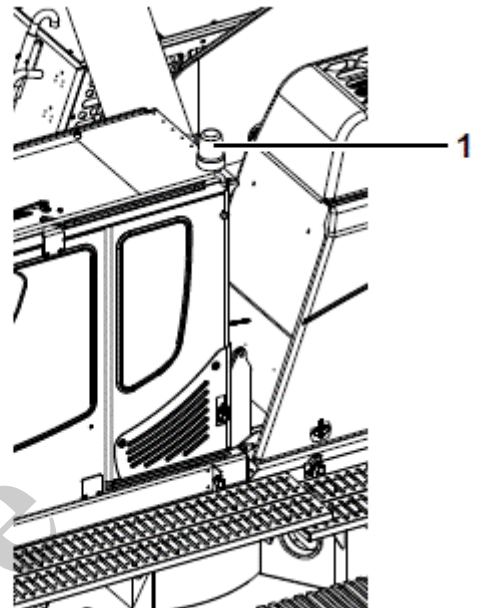
To switch on the heating or air conditioning function, press the button (5).



Information

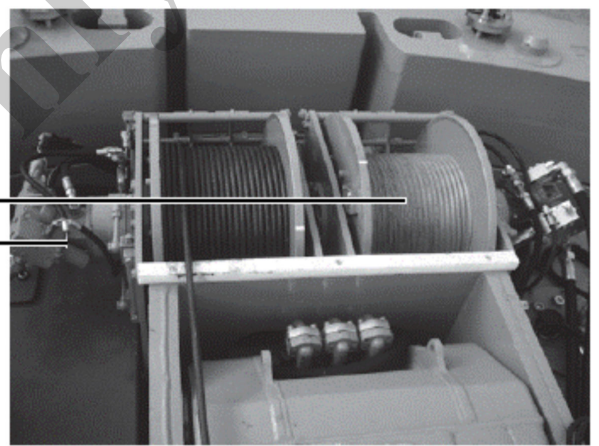
Keep windows and cab door closed to ensure effective air conditioning. The climate control system regulates the temperature depending on the ambient temperature.

Visual warning device



1 Beacon

1.6 Winch



1 Winch 1
2 Winch 2
1a Winch motor

Allocation - attachments to winches

Winch 1: Main boom, auxiliary jib, fly boom 8 m (26.2 ft), fly boom 15 m (49.2 ft)

Winch 2: Main boom

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 avoid, 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, death or severe injury may 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:

- 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 supporting lifts of poles or 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 there are doubts whether the machine is suitable for the present application, ask a GROVE-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, people 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.

For
Reference
Only

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 suitable extinguishing agents (fire blanket, fire extinguisher with CO₂, powder or foam) ready.
- 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.

⚠ 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.

- Work on the hydraulic system may only be carried out by an authorized GROVEservice partner.
- 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.

⚠ 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. When necessary, contact GROVE customer service.

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 on 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 working range.

- Keep an extra safe distance from persons, machinery and structures near the configured working range.
- 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.)
 - Maximum wind speeds
 - Travel with and without load (permissible incline, ground conditions, uppercarriage and boom position)

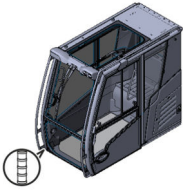
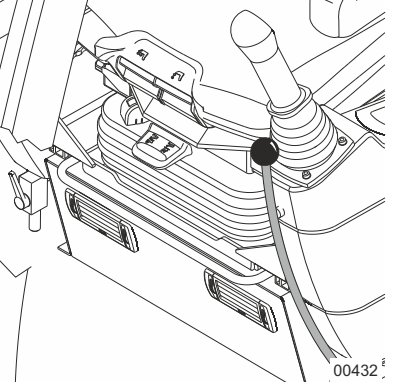
Persons can be caught and injured by a machine that is overturning. The danger zone corresponds to the height of the equipped machine with the boom at a steep angle.

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.

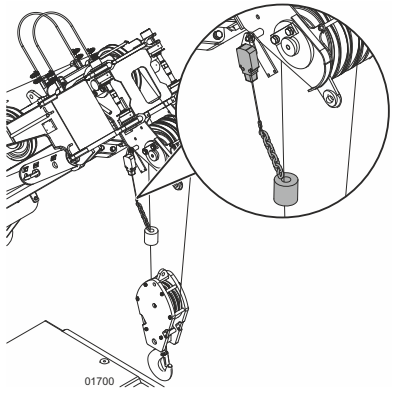
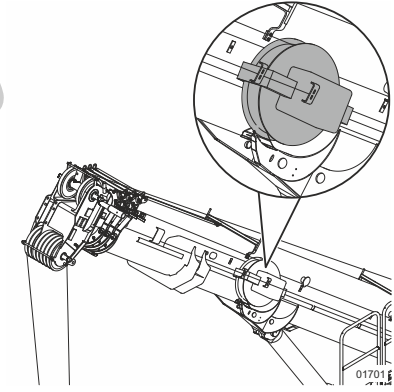
2.6 Safety devices

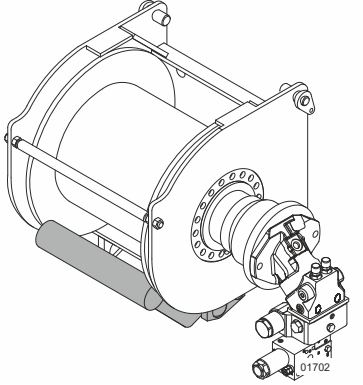
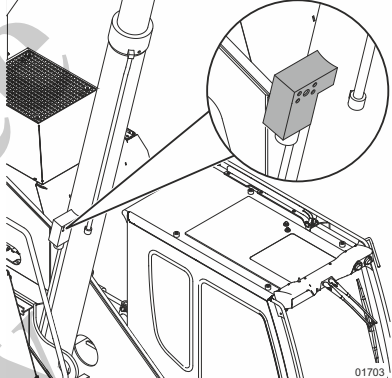
safety feature	Description	Illustration
Load moment limitation	<p>When the crane nears the load-bearing capacity limit, a warning signal rings in the cab and simultaneously the light for the load moment limitation gives out an optical warning signal.</p> <p>If the permitted load moment is exceeded, the load moment limitation switches off all load moment increasing machine movements and the light for the load moment limitation give out an optical and acoustic signal.</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.	
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.	
Yellow beacon	<p>The beacon indicates to those in the vicinity of the machine that the machine is a source of danger.</p> <p>The use of the beacon is compulsory when operating the machine with remote radio control.</p>	
Emergency STOP	Activation of the emergency stop stops all machine operations.	

safety feature	Description	Illustration
Horn and acoustic signals	The horn and acoustic signals indicate to those in the vicinity of the machine that the machine is a source of danger.	
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	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. Additionally, extending and retracting are switched off.	
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.	

safety feature	Description	Illustration
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.	

i 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.

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 people 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 this instruction:
 - 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
- **Experts:** 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>

	<p>Safety goggles Safety goggles protect eyes against flying parts and splashing.</p>
	<p>Protective gloves Protective gloves protect the hands against friction, abrasions, punctures, deep wounds and hot surfaces.</p>
	<p>Hard hat Hard hats protect the head against falling objects, swinging loads and collisions with fixed objects.</p>
	<p>Safety shoes Safety shoes protect feet against crushing, falling parts and slipping on slippery surfaces.</p>
	<p>Protective clothing 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. 13: Information label 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.

i *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 factory-fill from GROVE for engine oil is selected for the use of sulphur-free diesel fuel with a sulphur content of <15 mg/kg.

i *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.

i *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 driving and working range. The banksman gives the necessary signals to ensure safe operation.

Safety


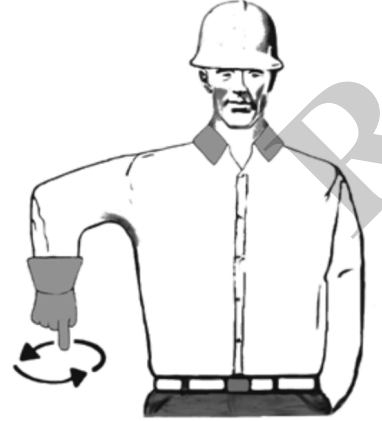
Hand signals



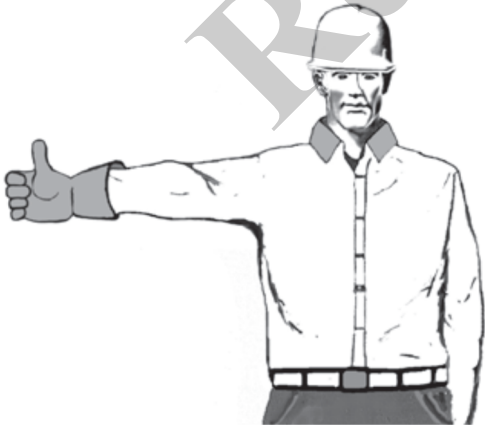
i Only reliable persons may be used as banksmen. They must receive the necessary training before starting their task.

The guide must not be diverted from this task.

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

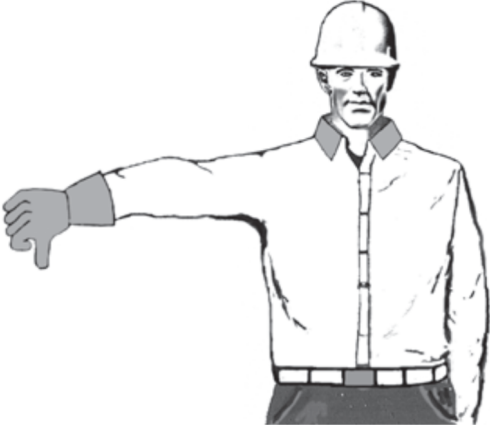

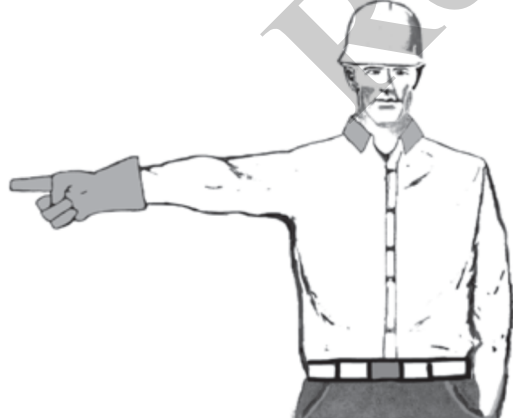
Observe all safety instructions before starting work.

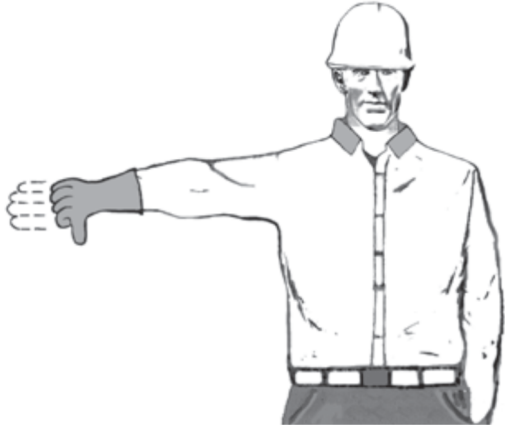
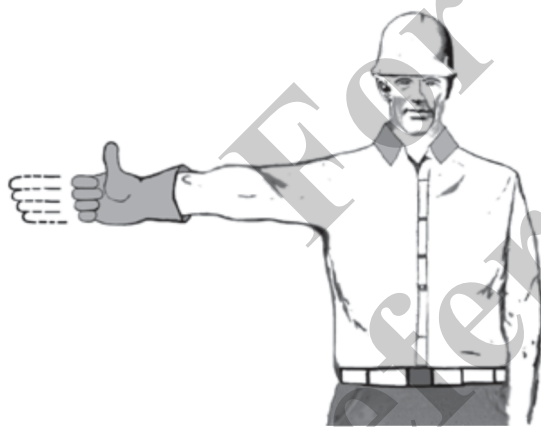

Sign	Meaning
	Lift load (equipment)
	Lower load (equipment)

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

For Reference Only

Sign	Meaning
	<p>Use both lanes</p>
	<p>Use one lane</p>
	<p>Extending the boom</p>

Safety

Hand signals

Sign	Meaning
	Telescope in
	Extending the boom
	Telescope in

3 Technical data

3.1 Machine emissions

Sound pressure level L_{wA} (Outside) ■ Acc. to Machinery Directive 2000/14/EC	104 dB(A)
Sound pressure level L_{pA} (in the cab) ■ acc. to ISO 11201:1993	< 70 dB(A)

3.2 Rating plate



Fig. 14: 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.

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.

For Reference Only

3.4 Dimensions and weight

3.4.1 Overall machine and weights

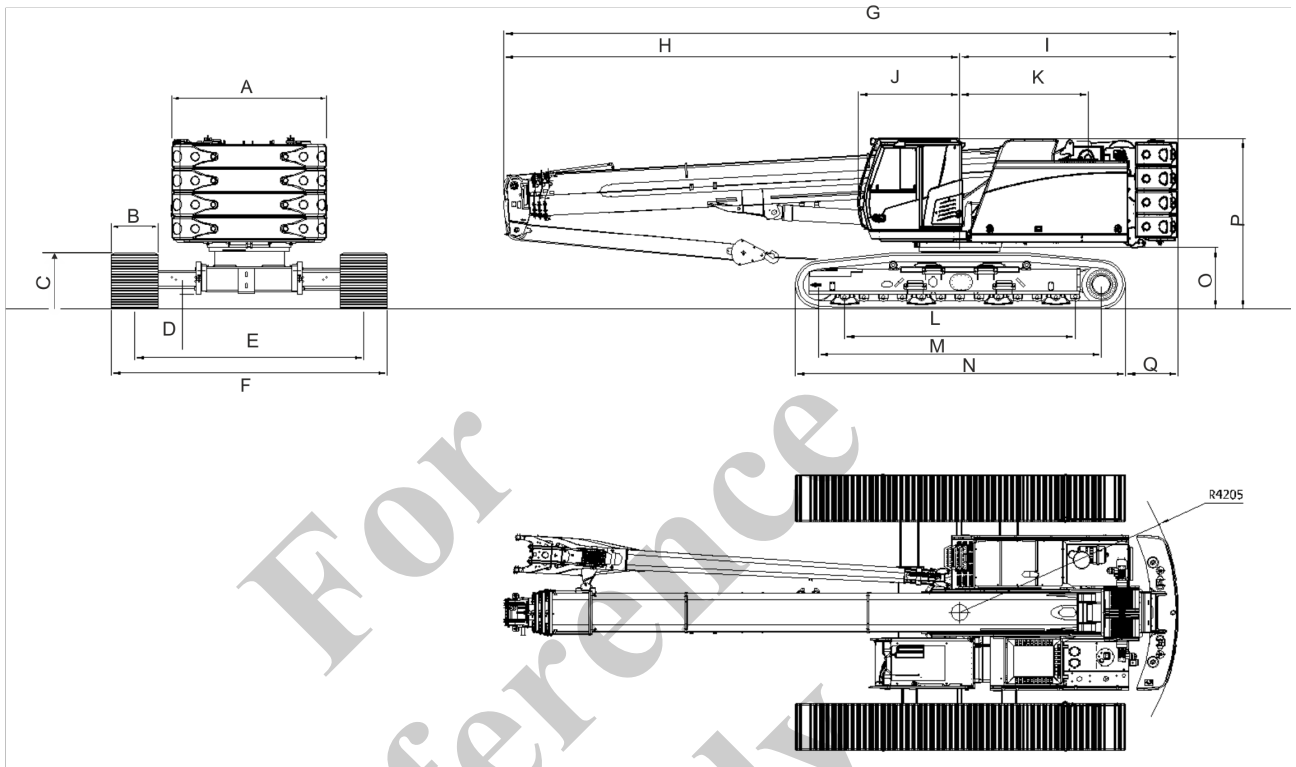


Fig. 15: Machine dimensions

	mm (in)		mm (in)		mm (in)
A	2980 (117.3)	G	12958 (510.2)	M	5430 (213.7)
B	900 (35.6)	H	8763 (345.1)	N	6356 (250.2)
C	980 (38.6)	I	4195 (165.2)	O	1180 (46.4)
D	293 (11.5)	J	1959 (77.1)	P	3274 (128.9)
E	4400 (173.2)	P	2475 (97.4)	Q	1004 (39.5)
F	5300 (208.6)	L	4428 (174.3)		

Transport weight with 900 mm (35.6 in) base plates, with foldable fly boom 8 m (26.2 ft), with counterweight 17.8 t (39.242 lbs), 2 winches, 35 t (77.161 lbs) hook	65.2 t (143,741 lbs)
---	-------------------------

Technical data

Dimensions and weight > Transport dimensions of the overall machine

3.4.2 Transport dimensions of the overall machine

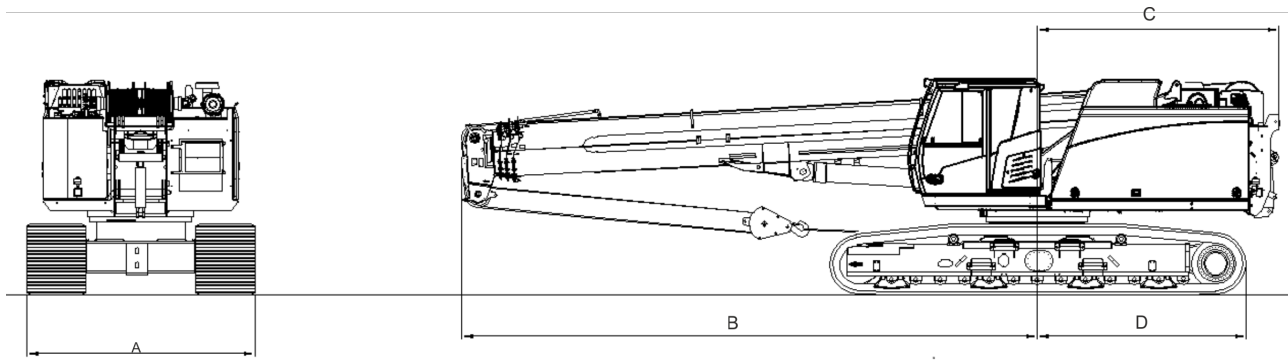
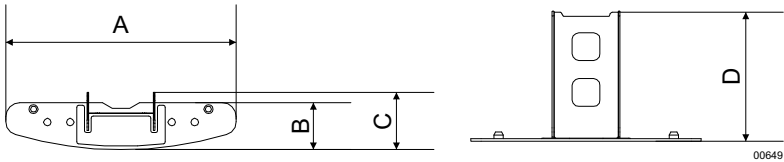
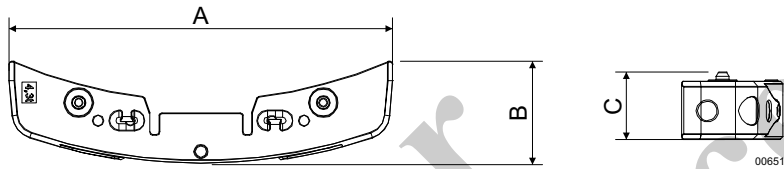
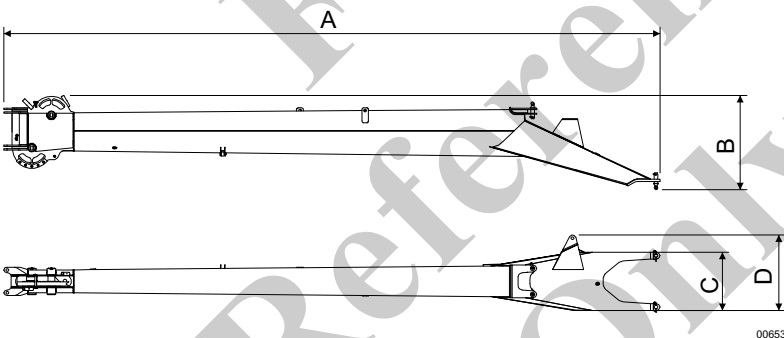
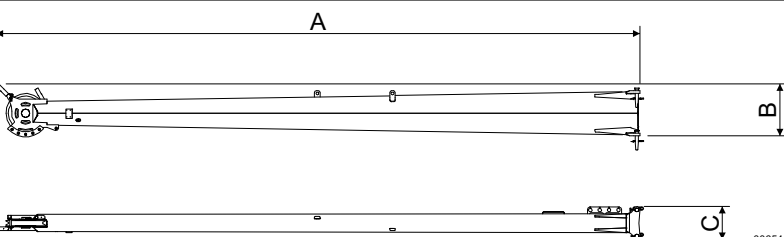


Fig. 16: Transport dimensions of the machine

	mm (in)		mm (in)
A	3480 (137.0)	C	3685 (145.0)
B	8760 (344.8)	D	3190 (125.5)

For Reference Only

3.4.3 Attachments

Ballast bracket		Weight	825 kg (1,818 lbs)
	A	2790 mm (109.8 in)	
	B	510 mm (20.1 in)	
	C	620 mm (24.4 in)	
	D	1415 mm (55.7 in)	
Ballast stone		Weight	4300 kg (9,481 lbs)
	A	2980 mm (117.3 in)	
	B	800 mm (31.5 in)	
	C	520 mm (20.5 in)	
Fly boom 8 m (26.2 ft)		Weight	730 kg (1,610 lbs)
	A	8453 mm (332.7 in)	
	B	1234 mm (48.5 in)	
	C	713 mm (28 in)	
	D	863 mm (33.9 in)	
Fly boom extension 7 m (23 ft)		Weight	305 kg (673 lbs)
	A	6972 mm (274.4 in)	
	B	690 mm (27.1 in)	
	C	360 mm (14.1 in)	

Technical data

Cummins QSB 6.7 diesel engine

Auxiliary jib		Weight	50 kg (110 lbs)
	A	438 mm (17.2 in)	
	B	1056 mm (41.6 in)	
	C	1146 mm (45.1 in)	
	D	156 mm (6.1 in)	
	E	249 mm (9.8 in)	

Ballast support		Weight	1400 kg (3,090 lbs)
	A	751 mm (29.5 in)	
	B	3219 mm (126.7 in)	
	C	1418 mm (55.8 in)	

3.5 Cummins QSB 6.7 diesel engine

Manufacturer	Cummins
Type	QSB6.7
Power	168 kW (228 HP) at 2000 rpm
Displacement	408 in ³
Max. torque	760 lb-ft
Cylinders	6
Emission standard	Tier 4f

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

i Make sure not to exceed the rated alternator output when installing additional current consumers (e.g., headlights).

3.7 Work speed

Travel speed	0–2.7 km/h (1.68 mph)
Slewing speed - uppercarriage	0–2 rpm, variable speed

3.8 Hydraulic system

Delivery rate	Mmax. 375 l/min max. (99.1 US.liq.gal./min)
Operating pressure	330 bar (4786.2 psi)

3.9 Vibration

The alarm values for hand-arm vibration (2.5 m/s^2) and for full-body vibration (0.5 m/s^2) are not exceeded.

3.10 Operational environment

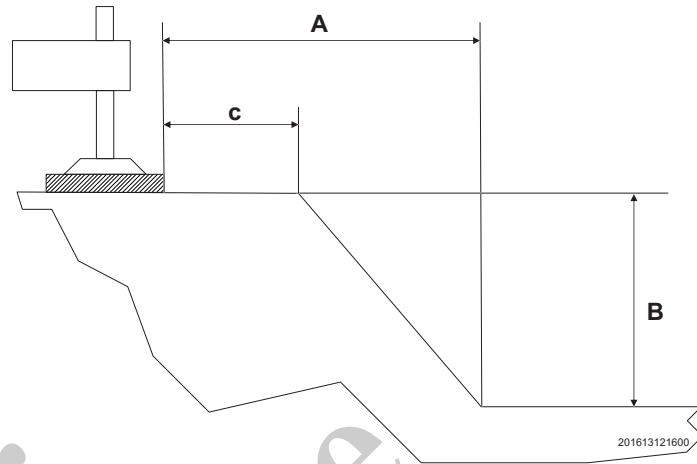


Fig. 17: Safety distance between machine and embankment crown retainer. $A > 2B$ applies.

- 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 between 14 m/s (50 km/h) and 50 km/h (31 mph).
- The following safety distances to overhead electrical lines must be maintained:

Overhead power lines

Safety distances from overhead power lines

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

Environmental conditions

Surrounding area	Level
Temperature ¹⁾	(-4 °F to 104 °F)
Maximum wind speed	31 mph
Maximum wading depth	1.6 ft
¹⁾ in drive and work mode	

i *If the surrounding temperature is outside of the admissible values, contact your manufacturer service partner. If the maximum wading depth is outside of the admissible values, contact your manufacturer service partner.*

3.11 Permissible maximum wind speeds

If the wind speed during operation of the machine reaches 31 mph, the machine must be parked in a secure position.

i *Wind speed can be measured with the optional anemometer.*

Procedure at wind speeds above 50 km/h (31 mph)

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

Procedure at wind speeds above 72 km/h (45 mph)

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

3.12 Permissible ground pressure

Maximum ground pressure of the machine

Crawler track width	Maximum ground pressure
27.6 in	102.4 psi
31.5 in	89.6 psi
35.4 in	79.7 psi

3.13 Winch

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

- Power chain group M5
- Collective class L2
- Utilization class T5

Winch tensile force	50 kN
Admissible cable pull per stand	11000 lbs
Rope diameter	0.63 in

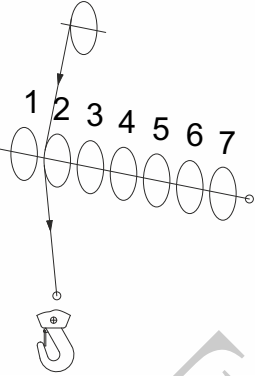
3.14 Bottom hook block

Capacity	Hook weight in lbs
5 t	176
15 t – 1 sheave	419
35 t – 3 sheaves	595
60 t – 6 sheaves	1874

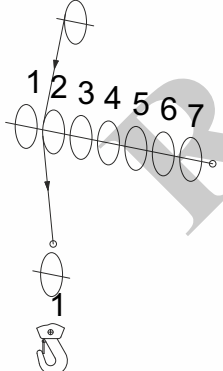
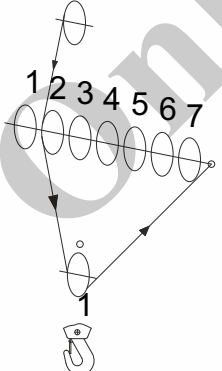
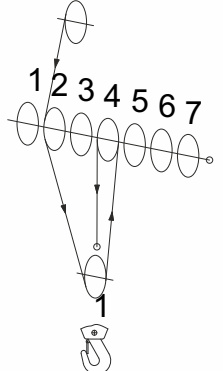
3.15 Reeving diagram

The reeving diagram provides the reeving potential to the pulley head of the telescopic boom for the available load hook and bottom hook block.

Load hook, maximum load bearing capacity 11023 lbs, rope diameter 0.63 in

 <p style="text-align: right; font-size: small;">01661</p>		
<p>1-string, 5 t (1023 lbs) load capacity</p>		

Load hook, maximum load bearing capacity 33069 lbs, rope diameter 0.63 in

 <p style="text-align: right; font-size: small;">01662</p>	 <p style="text-align: right; font-size: small;">01663</p>	 <p style="text-align: right; font-size: small;">01664</p>
<p>1-string, 5 t (1023 lbs) load capacity</p>	<p>2-string, 10 t (22046 lbs) load capacity</p>	<p>3-string, 15 t (33069 lbs) load capacity</p>

Technical data

Reeving diagram

3-sheave bottom hook block, maximum load bearing capacity 77162 lbs, rope diameter 0.63 in

<p style="text-align: right;">01665</p>	<p style="text-align: right;">01666</p>	<p style="text-align: right;">01667</p>
<p>1-string, 5 t (1023 lbs) load capacity</p>	<p>2-string, 10 t (22046 lbs) load capacity</p>	<p>3-string, 15 t (33069 lbs) load capacity</p>
<p style="text-align: right;">01668</p>	<p style="text-align: right;">01669</p>	<p style="text-align: right;">01670</p>
<p>4-string, 20 t (44092 lbs) load capacity</p>	<p>5-string, 25 t (55116 lbs) load capacity</p>	<p>6-string, 30 t (66139 lbs) load capacity</p>
<p style="text-align: right;">01671</p>		
<p>7-string, 35 t (77162 lbs) load capacity</p>		

6-sheave bottom hook block, maximum load bearing capacity 132277 lbs, rope diameter 0.63 in

<p style="text-align: right;">01672</p>	<p style="text-align: right;">01673</p>	<p style="text-align: right;">01674</p>
<p>2-string, 10 t (22046 lbs) load capacity</p>	<p>3-string, 15 t (33069 lbs) load capacity</p>	<p>4-string, 20 t (44092 lbs) load capacity</p>
<p style="text-align: right;">01675</p>	<p style="text-align: right;">01676</p>	<p style="text-align: right;">01677</p>
<p>5-string, 25 t (55116 lbs) load capacity</p>	<p>6-string, 30 t (66139 lbs) load capacity</p>	<p>7-string, 35 t (77162 lbs) load capacity</p>
<p style="text-align: right;">01678</p>	<p style="text-align: right;">01679</p>	<p style="text-align: right;">01680</p>
<p>8-string, 40 t (88185 lbs) load capacity</p>	<p>9-string, 45 t (99208 lbs) load capacity</p>	<p>10-string, 50 t (110231 lbs) load capacity</p>

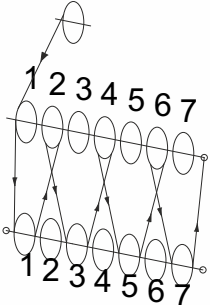
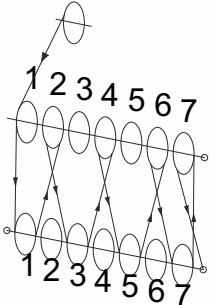
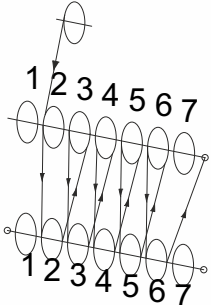
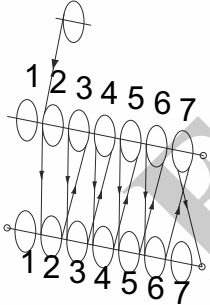
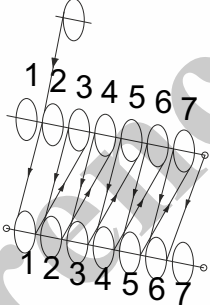
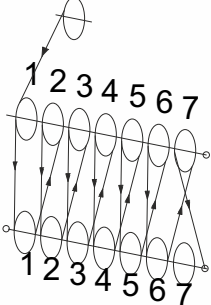
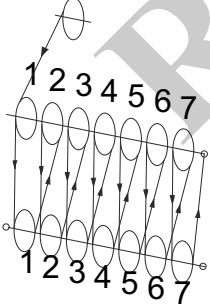
Technical data

Reeving diagram

<p style="text-align: right;">01681</p>	<p style="text-align: right;">01682</p>	
<p>11-string, 55 t (121254 lbs) load capacity</p>	<p>12-string, 60 t (132277 lbs) load capacity</p>	

7-sheave bottom hook block, maximum load bearing capacity 154324 lbs, rope diameter 0.63 in

<p style="text-align: right;">01683</p>	<p style="text-align: right;">01684</p>	<p style="text-align: right;">01685</p>
<p>2-string, 10 t (22046 lbs) load capacity</p>	<p>3-string, 15 t (33069 lbs) load capacity</p>	<p>4-string, 20 t (44092 lbs) load capacity</p>
<p style="text-align: right;">01686</p>	<p style="text-align: right;">01687</p>	<p style="text-align: right;">01688</p>
<p>5-string, 25 t (55116 lbs) load capacity</p>	<p>6-string, 30 t (66139 lbs) load capacity</p>	<p>7-string, 35 t (77162 lbs) load capacity</p>

 <p style="text-align: right;">01689</p>	 <p style="text-align: right;">01690</p>	 <p style="text-align: right;">01691</p>
<p>8-string, 40 t (88185 lbs) load capacity</p>	<p>9-string, 45 t (99208 lbs) load capacity</p>	<p>10-string, 50 t (110231 lbs) load capacity</p>
 <p style="text-align: right;">01692</p>	 <p style="text-align: right;">01693</p>	 <p style="text-align: right;">01694</p>
<p>11-string, 55 t (121254 lbs) load capacity</p>	<p>12-string, 60 t (132277 lbs) load capacity</p>	<p>13-string, 65 t (143300 lbs) load capacity</p>
 <p style="text-align: right;">01695</p>		
<p>14-string, 70 t (154324 lbs) load capacity</p>		

3.16 Load-bearing capacity

3.16.1 Explanation of the load lift charts



See applicable lifting capacities.

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

3.16.3 Load lift charts



See applicable lifting capacities.

For Reference Only

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 jewelery.
- 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:

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 bearing capacity and sufficient dimensions. This is the responsibility of the machine owner.

Machine with crawler undercarriage: Secure against slippage

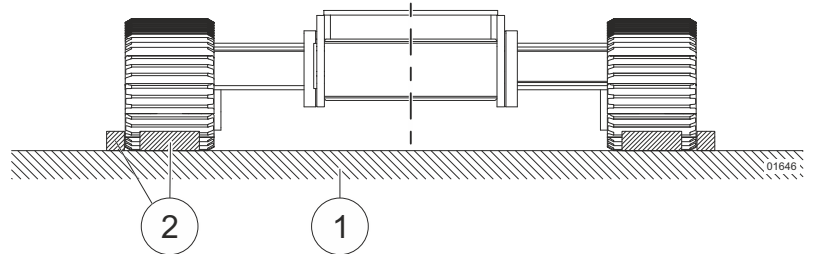


Fig. 18: Secure machine with stops.

- 1 Pontoon level
- 2 Stops

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

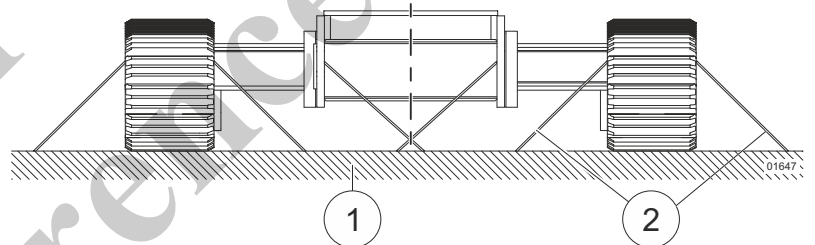


Fig. 19: Secure machine to the tethering points

- 1 Pontoon level
- 2 Lashing chains

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

Machine with mobile undercarriage: Secure against slippage

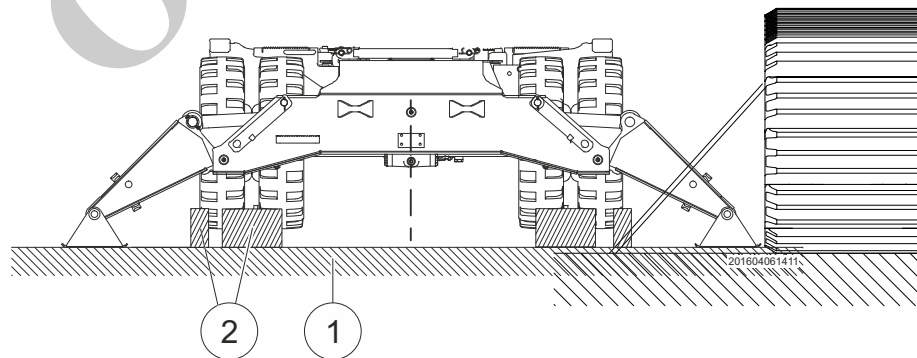


Fig. 20: Secure machine with stops.

- 1 Pontoon level
- 2 Stops

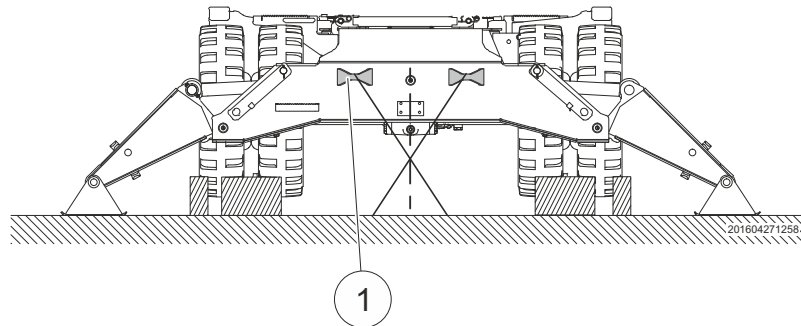


Fig. 21: Secure machine to the tethering points

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 offshore 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 Steps

⚠ WARNING

Danger of crushing due to moving machine parts!

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

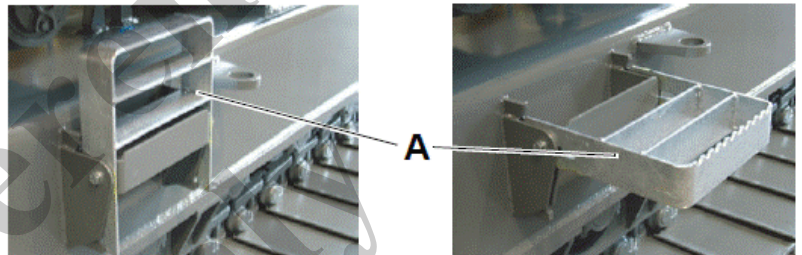
- Use a banksman for assistance.
- Ensure that no unauthorized persons are present in the danger zone during all work.
- Attach all safety bolts before using the machine in drive mode.

⚠ WARNING

Risk of injury due to slippery surface.

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

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



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

Folding out a step

1. → Pull the access ladder A upwards.
2. → Slowly lower the access ladder A until it rests in horizontal position.

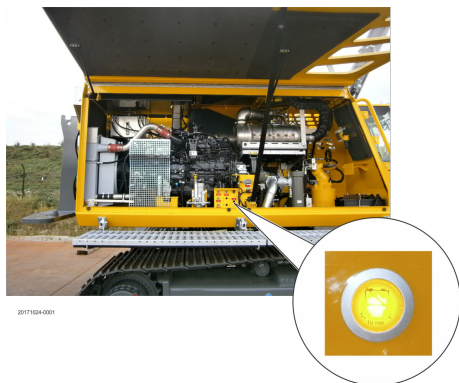
Stowing a step

1. → Lift the lowered access ladder A in until it is resting completely against the side wall.
2. → Pull the access ladder A upward and then lower it.

Make ready for operation

Initial start-up > Check machine and accessory equipment

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. 22: 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.

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 labels 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 terminals.
 - Check bolt of ballast locking for correct seat. The bolts (left and right) must be at least flush with the outer edge of the frame plate. Refer to the "Visual and function check of the machine" chapter found in the maintenance manual.

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.

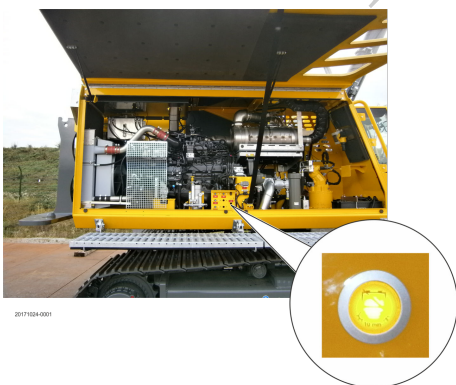
Ambient temperature	Warm-up time	maximum engine speed
up to 0 °C (32 °F)	approx. 15 min	Nominal speed - 250 min ⁻¹
-20 °C (-4 °F) to 0 °C (32 °F)	approx. 30 min	

- 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. 23: Battery disconnect switch

4.4.2 Check machine and accessory equipment

i See .

4.4.3 Machine start

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

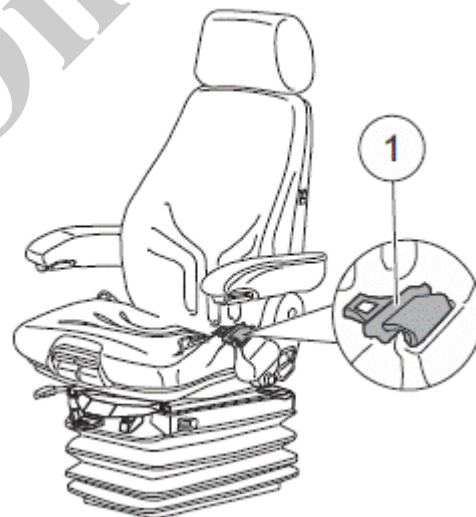
4.4.4 Fastening the seat belt

▲ WARNING

Risk of injury due to defective seat belt.

Collisions or sudden machine movements can throw personnel against parts of the cab, resulting in injury.

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



Closing the seat belt

- ➔ Insert the metal tongue (1) into belt buckle.
 - The belt buckle clicks into place.

4.4.5 Starting the diesel engine

⚠ 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.

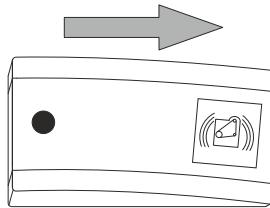
1. ▶ Turn the ignition key to the position I.
 - ⇒ The SENCON is switched on.

ⓘ The SENCON boots up after turning on the ignition. This procedure lasts about 30 seconds. Do not use the machine while the loading screen is present.

2. ▶ Set the setup status in the SENCON.
3. ▶ Activate the button 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. 24: SENCON loading screen



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**.

4.4.6 Opening setup status



See [Chapter 5.4.1](#) "Opening setup status" on page 95.

4.4.7 Bring machine up to operating temperature



See [Chapter 4.4.7](#) "Bring machine up to operating temperature" on page 79.

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.

i

- *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 battery terminal.
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.

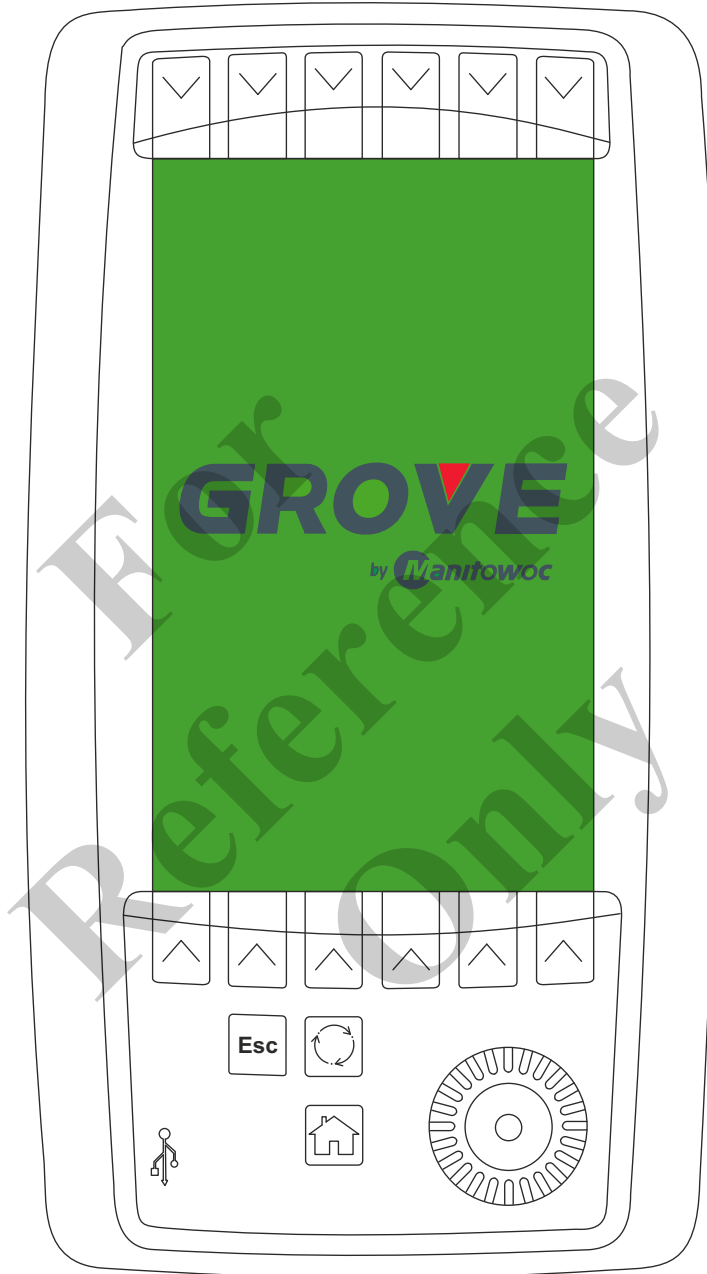
- Thoroughly clean and dry bare surfaces and bearing points. Then coat with a corrosion preventative. The protective film must cover the surface completely without any bare spots.
- Prop up mobile machines, the tires should not touch the ground. Coat the support cylinders with corrosion protection.
- 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).
- 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 a warning sign on the engine and cab.
- Close off all points of access to the machine.



Comply with the instructions specified in the warranty conditions.

5 SENCON 2.0

5.1 SENCON 2.0



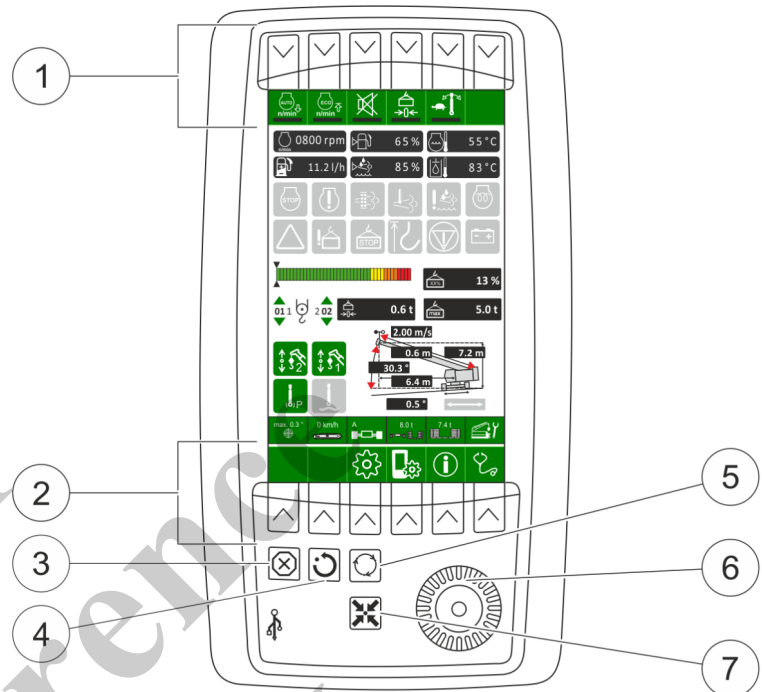
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Fig. 25: SENCON loading screen

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.

5.2 Controls overview

5.2.1 Overview



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Fig. 26: 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><input type="checkbox"/> On</p> <p><input type="checkbox"/> Off</p>
	EcoMode	<p>EcoMode reduces max. rpm. This saves fuel and protects the environment.</p> <p>Settings</p> <p><input type="checkbox"/> On</p> <p><input type="checkbox"/> 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><input type="checkbox"/> On</p> <p><input type="checkbox"/> 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><input type="checkbox"/> On</p> <p><input type="checkbox"/> Off</p>
	Uppercarriage slewing speed	<p>The slewing speed of the uppercarriage can be reduced for more precise movement.</p> <p>Settings</p> <p><input type="checkbox"/> On</p> <p><input type="checkbox"/> Off</p>

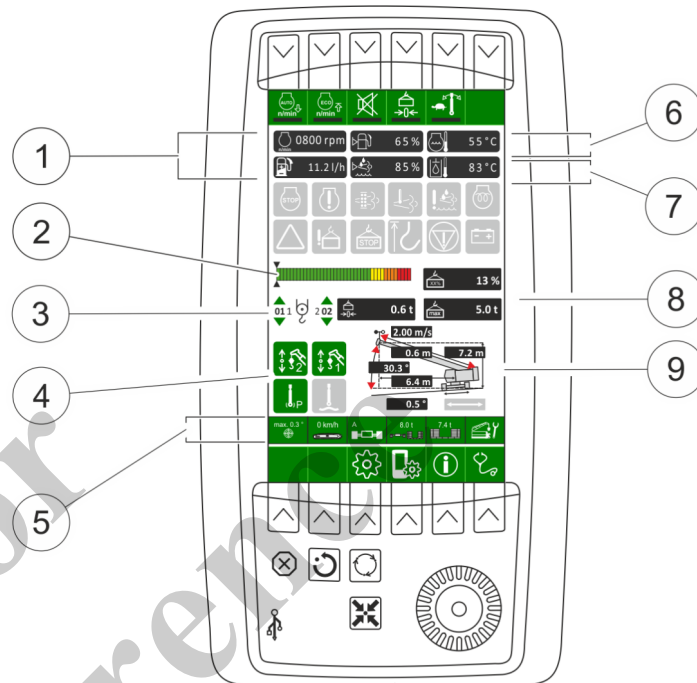
5.2.3 Menu icons

Icon	Name	Description
	Setup	Configure the LML 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. 27: 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



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

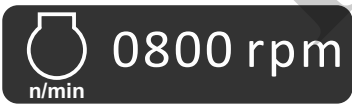



5.3.2 Operating status



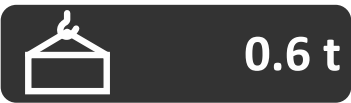



The display (1) shows the most frequent necessary values of the operating status in a single glance.

The operating status can appear in different colors:

- Gray: 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 machine immediately.
 - Take corrective action immediately.
 - Only operate machine once error has been corrected.

i 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.



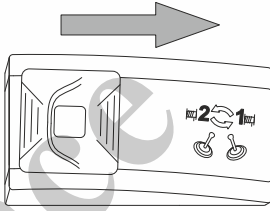

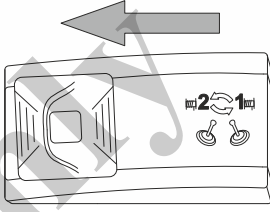








Icon	Description	Action
	Diesel engine speed	
	Diesel fuel level	Gray: ■ Diesel fill level normal. Orange: ■ Refuel as soon as possible. Red: ■ Refuel immediately.
	Coolant temperature	Gray: ■ Coolant temperature normal. Orange: ■ Reduce load on diesel engine. Red: ■ Lower attached loads. ■ Run diesel engine at idle speed.
	Current fuel consumption	

Icon	Description	Action
 37 %	DEF level	<p>Gray:</p> <ul style="list-style-type: none"> ■ DEF level normal. <p>Orange:</p> <ul style="list-style-type: none"> ■ Refill DEF tank at the next opportunity. <p>Red:</p> <ul style="list-style-type: none"> ■ Refill DEF tank immediately.
 65 °C	Hydraulic oil temperature	<p>Gray:</p> <ul style="list-style-type: none"> ■ Hydraulic oil temperature normal. <p>Orange:</p> <ul style="list-style-type: none"> ■ Lower attached loads. ■ Switch off the diesel engine. ■ Check combination cooler for soiling. ■ Clean soiled cooler. <p>Red:</p> <ul style="list-style-type: none"> ■ Lower attached loads. ■ Switch off the diesel engine. ■ Check combination cooler for soiling. ■ Clean soiled cooler.
 0.6 t	Actual load capacity, not tared	<p>Gray:</p> <ul style="list-style-type: none"> ■ Standard actual load capacity. <p>Red:</p> <ul style="list-style-type: none"> ■ The actual load capacity exceeds the maximum load capacity for the configured setup status.
 0.6 t	Actual load capacity, tared	<p>Gray:</p> <ul style="list-style-type: none"> ■ Standard actual load capacity. <p>Red:</p> <ul style="list-style-type: none"> ■ The actual load capacity exceeds the maximum load capacity for the configured setup status.
 20 %	Maximum load capacity for the configured setup status in per cent	
 5.0 t	Maximum load capacity for the adjusted setup state in tonnes	

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
		<p>Winch 1 is operated with the left joystick. Winch 2 is operated with the right joystick.</p> <p>Switch position:</p> 
		<p>Winch 2 is operated with the left joystick. Winch 1 is operated with the right joystick.</p> <p>Switch position:</p> 
		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.

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 the DEF tank. ■ Fill DEF.
	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 LML notification and warning icons

LML notification and warning icons

Icon	Possible statuses	Explanation
		Gray: <ul style="list-style-type: none"> ■ LML functioning properly.
		Orange: <ul style="list-style-type: none"> ■ LML error ■ Check error number in Diagnostics window. ■ Inform the manufacturer service partner.
		Red: <ul style="list-style-type: none"> ■ LML error ■ Check error number in Diagnostics window. ■ Inform the manufacturer service partner.
		Gray: <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.
		Red and strikethrough: <ul style="list-style-type: none"> ■ LML bypassed.
		Gray: <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.

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
		Gray: <ul style="list-style-type: none"> No error.
		Orange: <ul style="list-style-type: none"> Check error number in Diagnostics window. Inform the manufacturer service partner.
		Orange: <ul style="list-style-type: none"> Check error number in Diagnostics window. Inform the manufacturer service partner.
		Red: <ul style="list-style-type: none"> 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

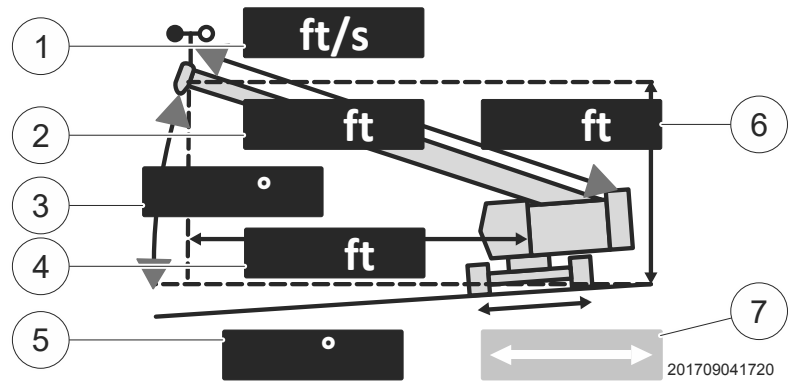

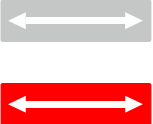



Fig. 28: Working diagram

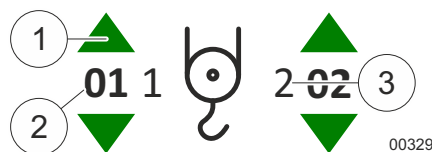
- 1 Wind speed (option)
- 2 Telescopic boom length
- 3 Telescopic boom angle
- 4 Working radius
- 5 Machine inclination
- 6 Telescopic boom height
- 7 Outrigger monitoring/track width monitoring

For Reference Only

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	<p>Grey:</p> <ul style="list-style-type: none"> Value not available. <p>Green:</p> <ul style="list-style-type: none"> Work equipment can be moved. <p>Red:</p> <ul style="list-style-type: none"> Work equipment cannot be moved. Limit switch engaged. <p>Strikethrough:</p> <ul style="list-style-type: none"> Limit switch bypassed.
	Track widths monitoring/Outrigger monitoring	<p>Grey:</p> <ul style="list-style-type: none"> Track width/outrigger permitted for the selected operating mode <p>Red:</p> <ul style="list-style-type: none"> Track width/outrigger not permitted for the selected operating mode
	Machine inclination	<p>Grey:</p> <ul style="list-style-type: none"> Machine is within the selected incline <p>Red:</p> <ul style="list-style-type: none"> Machine has exceeded the selected incline (no acoustic warning)

5.3.8 Winch parameters



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

Fig. 29: Winch parameters

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 SENCN starts.

Opening setup status



→ Press the **Setup** menu button.

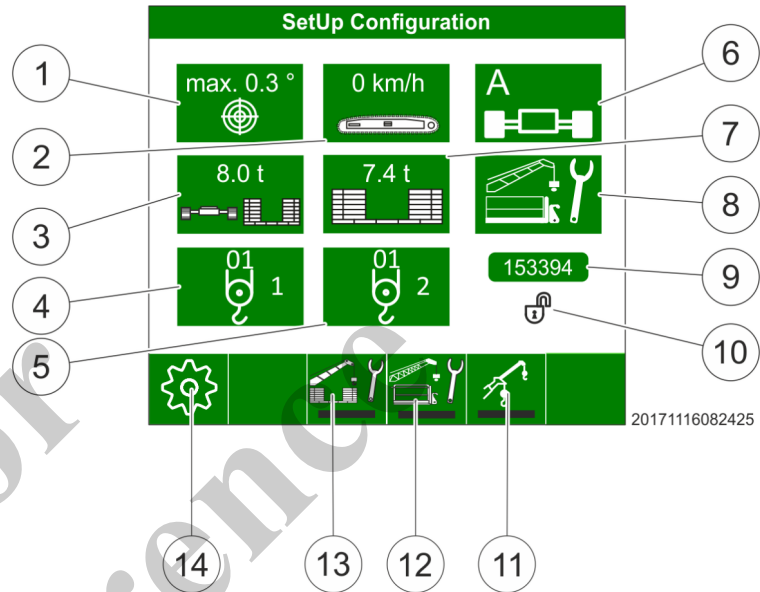


Fig. 30: Setup (example representation)

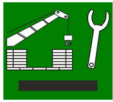








- 1 Machine inclination
- 2 Pick & Carry/Stationary Work switch (the function is inactive)
- 3 Undercarriage ballast (the function is inactive)
- 4 Winch 1 reeving
- 5 Winch 2 reeving
- 6 Track width
- 7 Counterweight
- 8 Attachments and setup program
- 9 Operating mode code
- 10 Load change lock
- 11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



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

i 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 ballast	Settings  Setup ballast is on.  Setup ballast is off.
	Setup equipment	Settings  On  Off
	Tilt-up panel lifting	Settings  On  Off

Reference Only

Virtual setup

Three softkeys for setup programs are available:

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

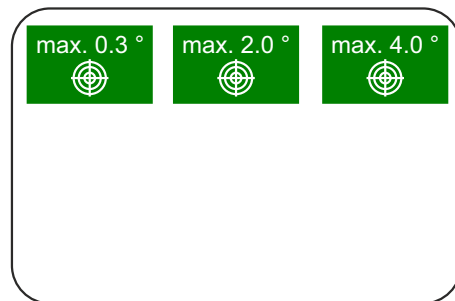
Select operating mode	Tasks
<p>"Setup ballast"</p> <p>The smallest approachable radius is 5.0 m (16.4 ft) for the setup work.</p>	<p>Reeve hook</p> <p>Cooperatively lifting the ballast</p> <p>Use low-bed trailer</p>
<p>"Setup equipment"</p> <p>Maximum track width and maximum counterweight are required</p>	<p>Setting up the fly boom</p> <p>Setup HAB</p> <p>Lubricating the boom</p>
<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>	<p>Two winch operation</p>

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 Entering the uppercarriage inclination

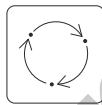
The maximum uppercarriage inclination while operating the machine is entered in the **Uppercarriage Inclination** window.



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Fig. 31: Uppercarriage inclination

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



5.4.3 Entering winch reeving

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

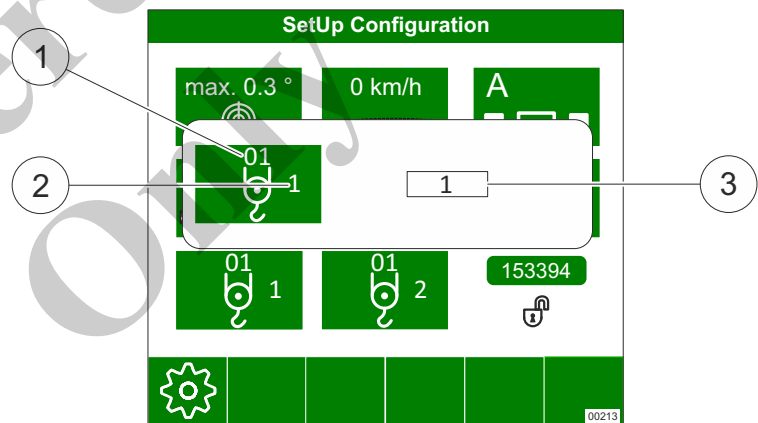
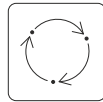


Fig. 32: Winch reeving

- 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.

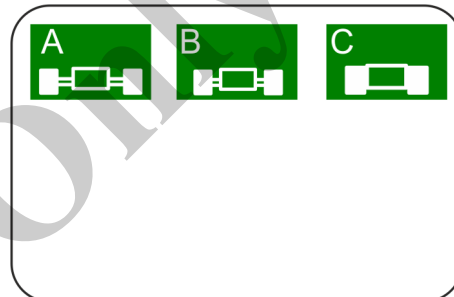
⚠ DANGER

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.

5.4.4 Configuring track width

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



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Fig. 33: Track width

- A Max. track width, or 100% supported;
- B Medium track width, or 50% supported;
- C Min. track width, or free-standing

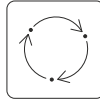
1. ➤ Press the SCROLL wheel.
 - ⇒ The selected RCL parameter is highlighted by a black frame.
2. ➤ Turn the SCROLL wheel until the **Track width** RCL parameter is selected.
3. ➤ Press the SCROLL wheel.
 - ⇒ The track width settings window opens.
4. ➤ Turn the SCROLL wheel to the desired setting.

5. ➔ Press the SCROLL wheel.

6. ➔ Configure other RCL parameters as needed.

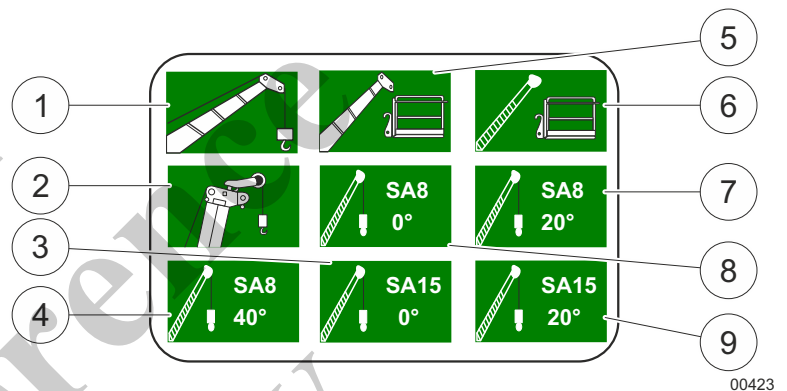
7. ➔ Press the SET button.

⇒ The RCL parameters are saved. The start screen reappears.

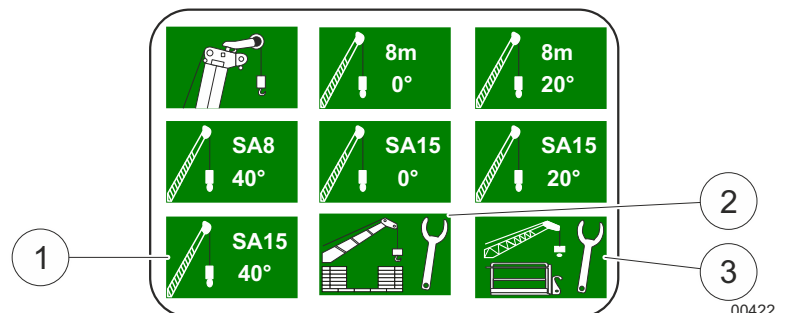


5.4.5 Specifying attachments and starting the setup program

The installed attachments and boom extensions to the machine are entered in the **Attachments and setup program** window.



- 1 Telescopic boom
- 2 Auxiliary jib
- 3 Fly boom, 15 m in 0° position
- 4 Fly boom, 8 m in 40° position
- 5 Telescopic boom with elevating work platform
- 6 Fly boom with elevating work platform
- 7 Fly boom, 8 m in 20° position
- 8 Fly boom, 8 m in 0° position
- 9 Fly boom, 15 m in 20° position

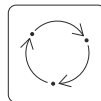


- 1 Fly boom, 15 m in 40° position
- 2 Setup ballast
- 3 Setup equipment

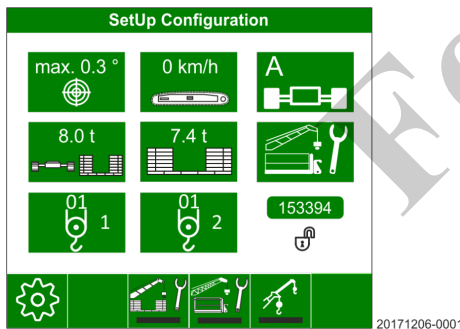
1. ➔ Press the SCROLL wheel.

■ 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.



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.

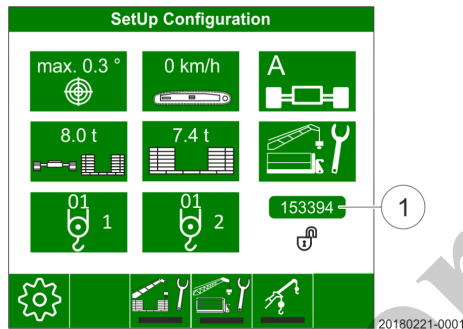
Pressing the "Attachment Equipment" menu icon immediately switches to the setup mode.

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

Softkey - setup ballast



Fig. 34: Setup ballast



The following set-up work can now be carried out:

- Reeve hook
- Use low-bed trailer
- Cooperatively lifting the ballast

➔ Press the softkey in the "home screen" window.

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



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



The minimum radius is limited to 5 m when selecting the "Setup Ballast" icon. If a minimum radius of less than 5 m is required for the set-up work, the "setup ballast" operating mode is carried out via the normal selection routine. See Chapter 7.4 "Setup mode" on page 224



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



For setup ballast, track width monitoring is active.

Softkey - setup attachment



The following set-up work can now be carried out:

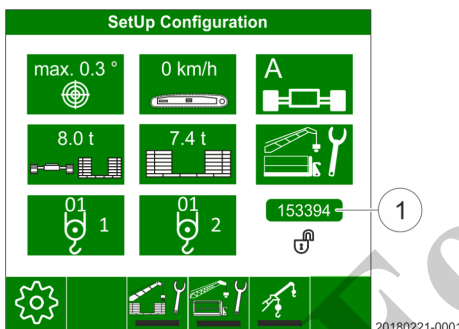
- Set-up the tip
- Setting up the elevating work platform
- Lubricating the boom

Only install the attachment if the following conditions are met:

- Maximum track width
- Maximum counterweight

→ Press the softkey in the "home screen" window.

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



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



For setup the tip, track width monitoring is active.



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




The operating mode "Set-up attachment" can also be carried out via the normal selection routine. See Chapter 7.4 "Setup mode" on page 224

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.

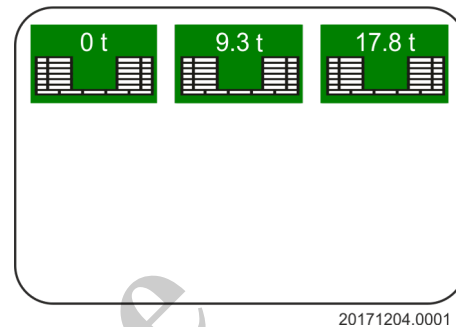
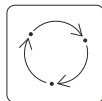


Fig. 35: Counterweight (example representation)

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 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.

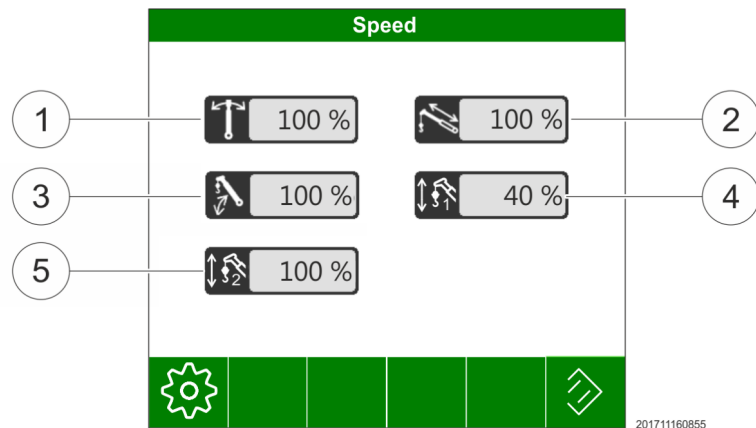


Fig. 36: Speed window

- 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**.

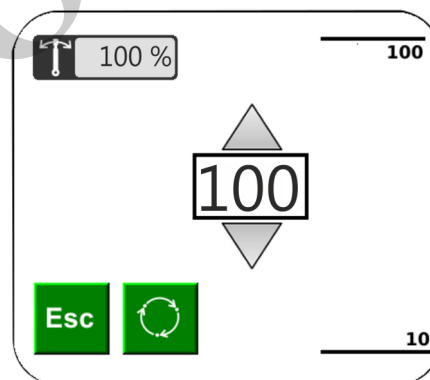
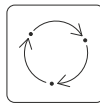


Fig. 37: Slewing the uppercarriage

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 **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**.

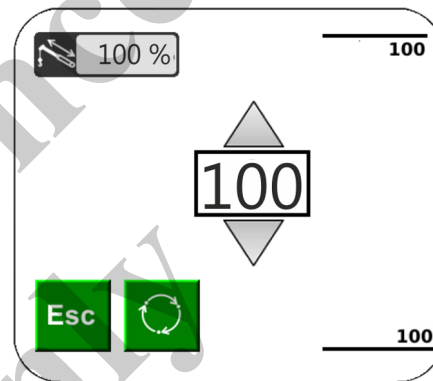
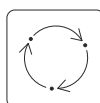


Fig. 38: Extending and retracting the telescopic boom

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**.

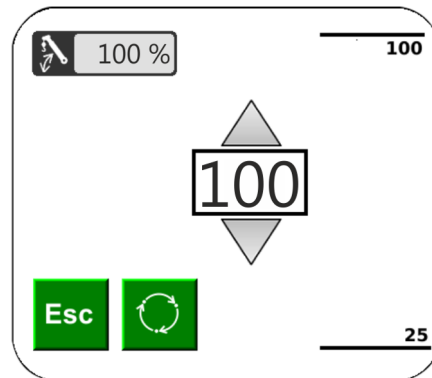
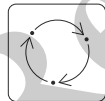


Fig. 39: Lifting and lowering the telescopic boom

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**.

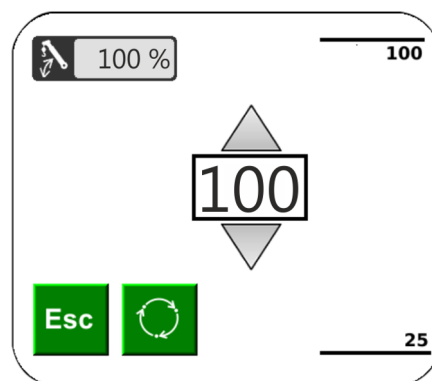
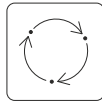


Fig. 40: Lift and lower loads

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 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.



5.6 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.

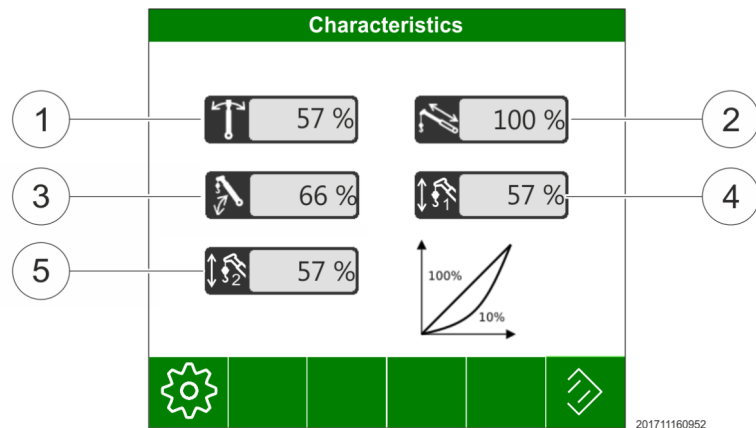


Fig. 41: Characteristics window

- 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**.

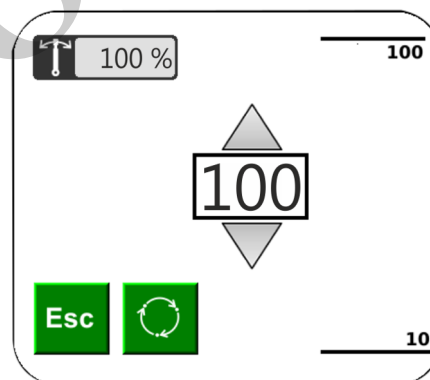
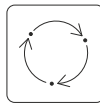


Fig. 42: Slewing the uppercarriage

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 **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**.

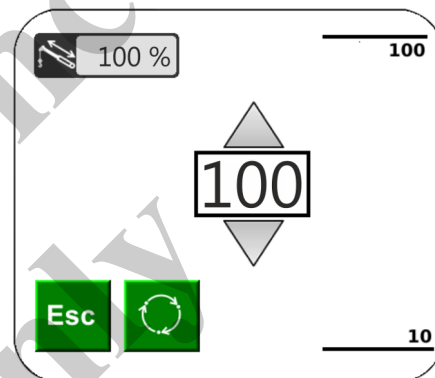
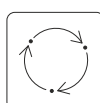


Fig. 43: Extending and retracting the telescopic boom

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**.

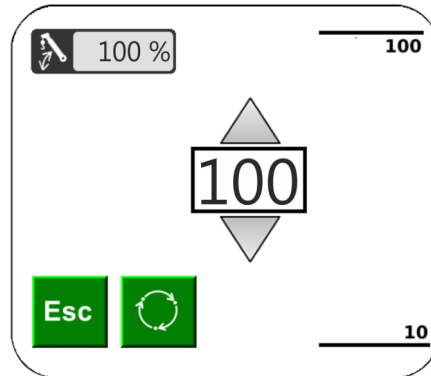


Fig. 44: Lifting and lowering the telescopic boom

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**.

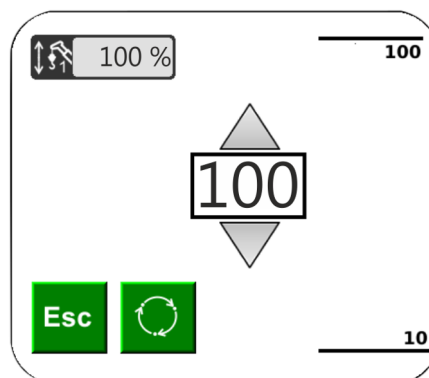
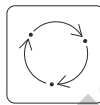


Fig. 45: Lift and lower loads

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.



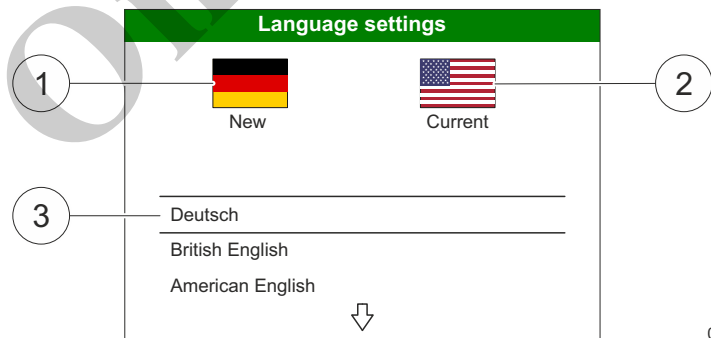
5.7 Setting the language

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

Opening the language settings



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



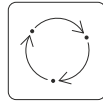
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Fig. 46: Language settings

- 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.

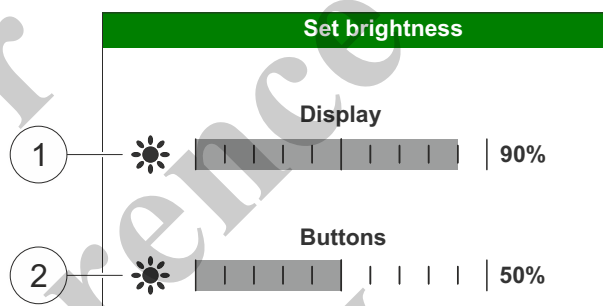
5.8 Setting brightness

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.



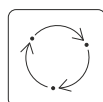
00074

Fig. 47: 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.

5.9 Setting date and time

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

Opening date and time settings



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

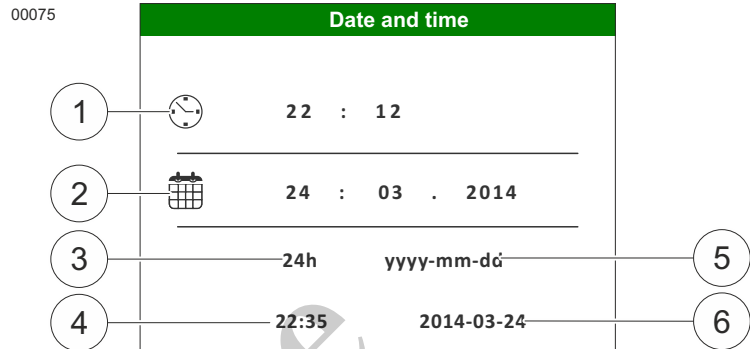
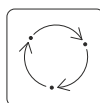


Fig. 48: Setting

- 1 Time setting
- 2 Date setting
- 3 Time format 12/24 hrs
- 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.

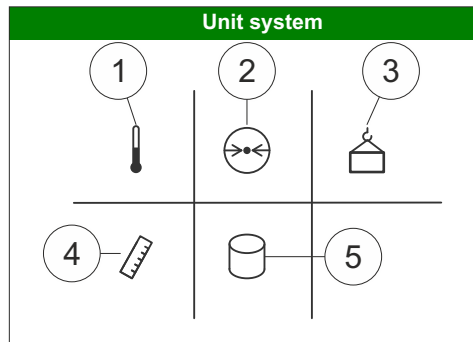
5.10 Setting units

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.



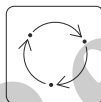
00076

Fig. 49: Unit system

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

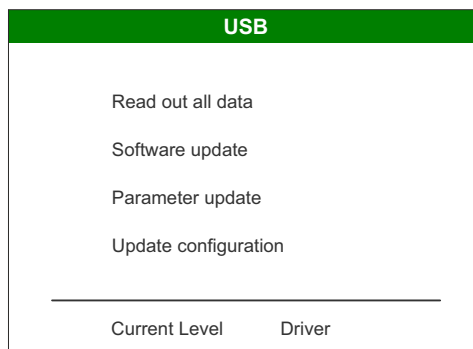
Setting units

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.



5.11 USB

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



00077

Fig. 50: USB

5.12 Request access

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

Request Access	
Machine Number:	835.0.2345
Access Time:	1 d
Requested Level:	service technician
Request Code:	Generate Pin
Password:	Enter Password

00078

Fig. 51: Request access

5.13 General information

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

Opening General information



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

General information		
machine	653.0.234	1
hw serial number	1234567BD	2
software version	2.0.2.3	3

00214

Fig. 52: General information

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

5.14 Registration information

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

registration information	
Name	
company	
current level	operator
remaining time	-

00081

Fig. 53: Registration information

5.15 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.

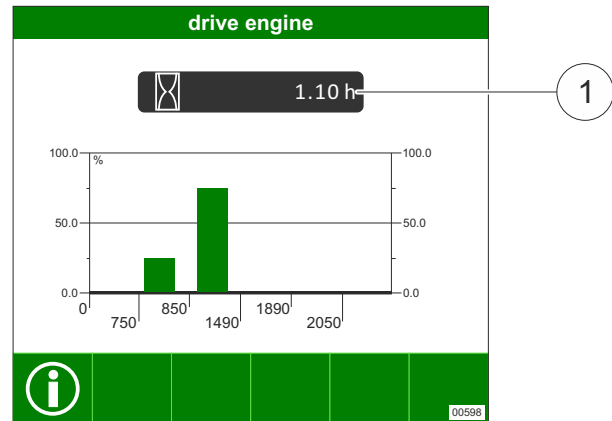


Fig. 54: Speed ranges of the diesel engine

- 1 Total diesel engine operating hours

5.16 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 (5.511 lbs to 27,557 lbs) line pull and 75% of the total operating time at 12.5 t to 25 t (27.557 lbs to 55,115 lbs) line pull.

Line pull is shown in decitons. The value **125** on the x-axle indicates a line pull of 12.5 t (27.557 lbs).

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.

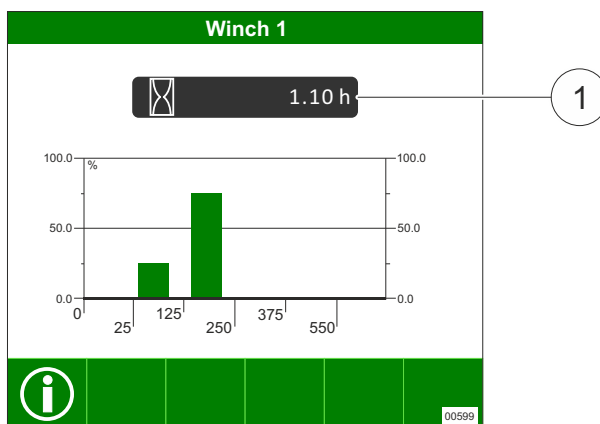


Fig. 55: Winch line pull 1 (example representation)

1 Total winch operating hours

For Reference Only

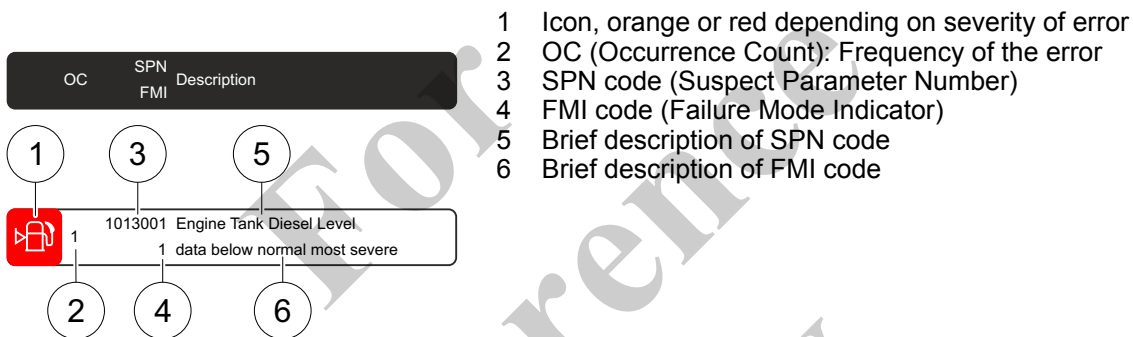
5.17 Diagnostics

5.17.1 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. Troubleshooting steps can be found in the overview of status messages on [Chapter 5.17.5 "Messages" on page 125](#).

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. 56: 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.

5.17.2 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.

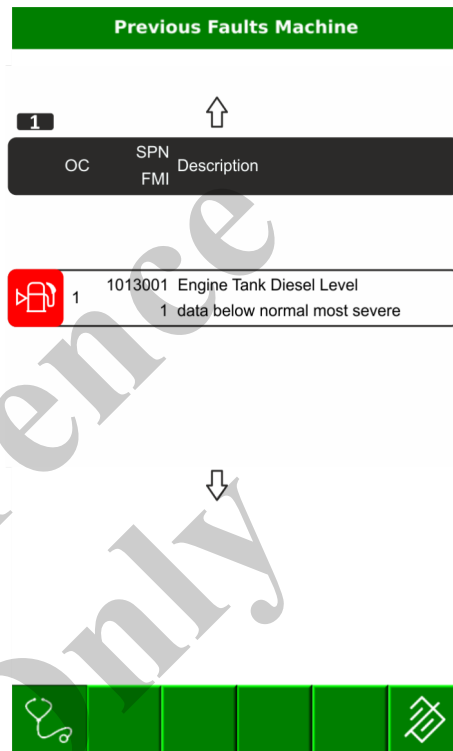


Fig. 57: Previous faults machine diagnostics window

Previous faults machine menu icons

Icon	Name	Description
	Acknowledging error memory	The errors are acknowledged.

5.17.3 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.

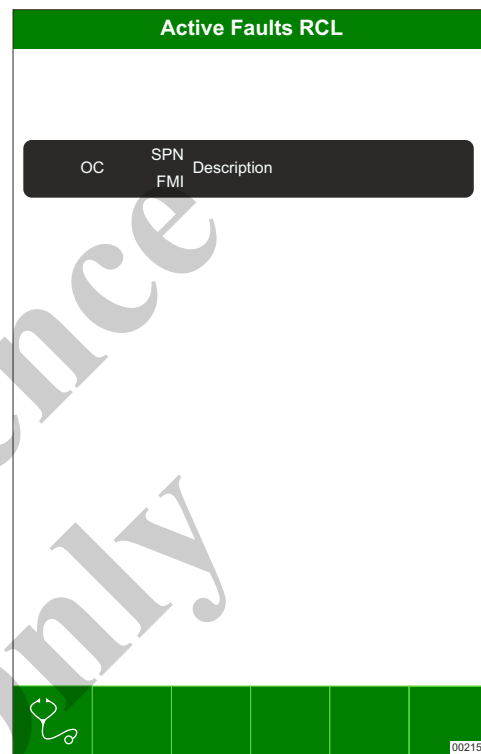


Fig. 58: Active Faults RCL diagnostics windows

5.17.4 Opening

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.

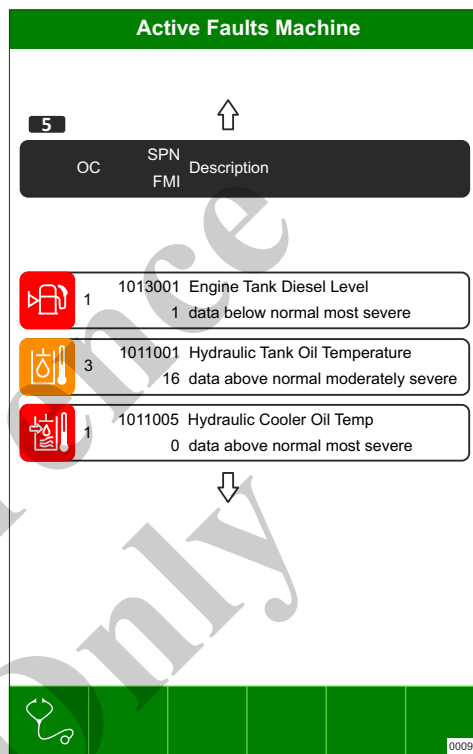







Fig. 59: Active Faults Machine diagnostics window

5.17.5 Messages

i 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 radiator 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 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.	<ul style="list-style-type: none"> Inform the manufacturer service partner.
	1013001	17 18	Fuel level too low	<ul style="list-style-type: none"> Refuel machine.
	1014000	15	Air filter contaminated Acknowledgment required!	<ul style="list-style-type: none"> Inform the manufacturer service partner.
		31	Wait-to-start-light on	<ul style="list-style-type: none"> Start engine once message is no longer displayed.
		1 17 18	Exhaust gas temperature too low Acknowledgment required!	<ul style="list-style-type: none"> Inform the manufacturer service partner.

For Reference Only

5.17.6 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.

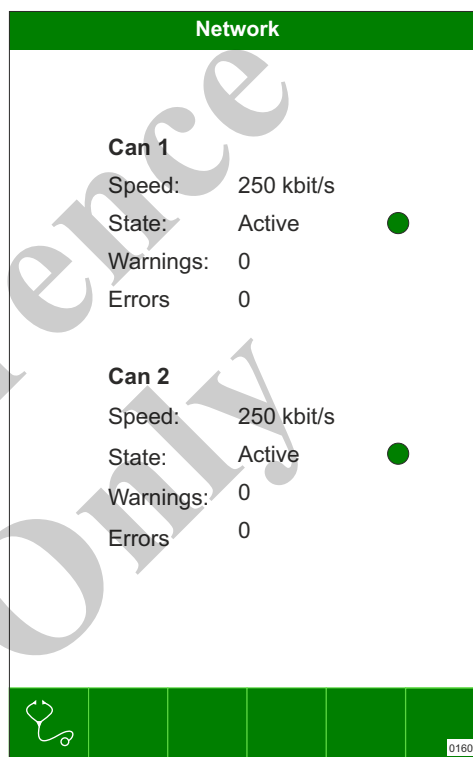
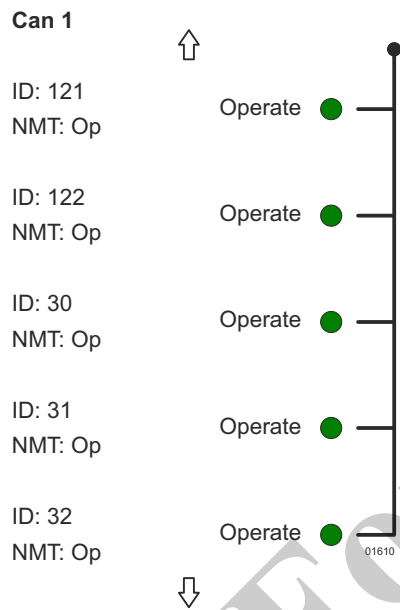


Fig. 60: Network diagnostics window

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. 61: Detailed view of CAN 1

For Reference Only

5.17.7 Incoming signals

The window **Input Vector CanOpen** shows the signals that the sensors and actuators send to the SENCON 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.

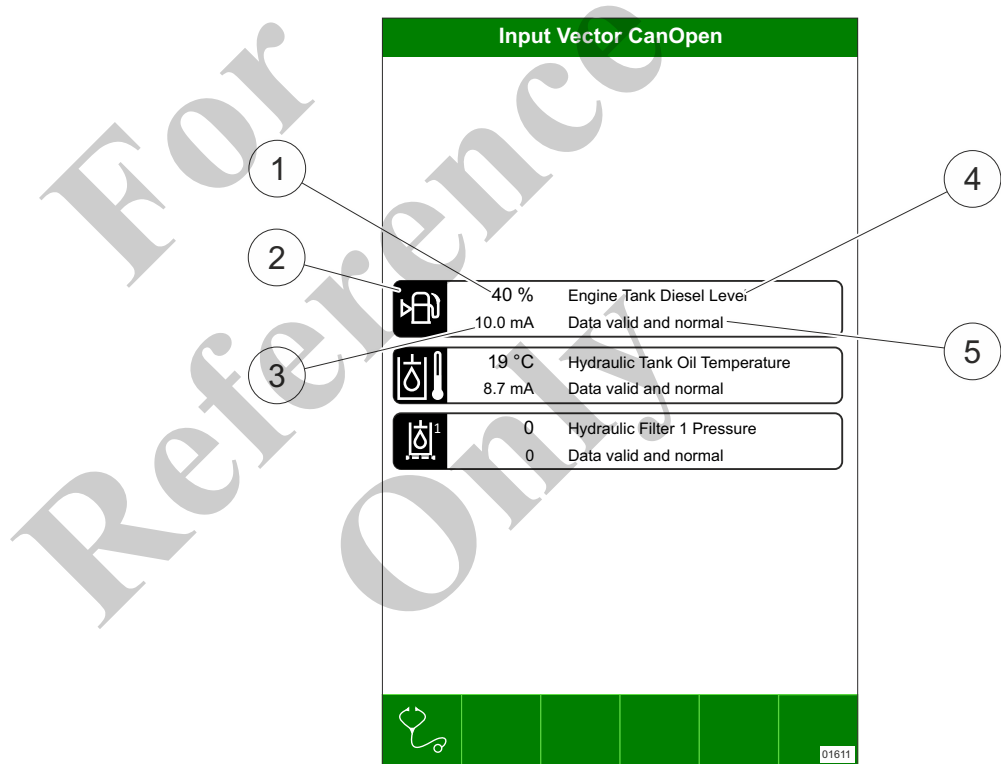


Fig. 62: Diagnostics window for incoming signals

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

5.17.8 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.

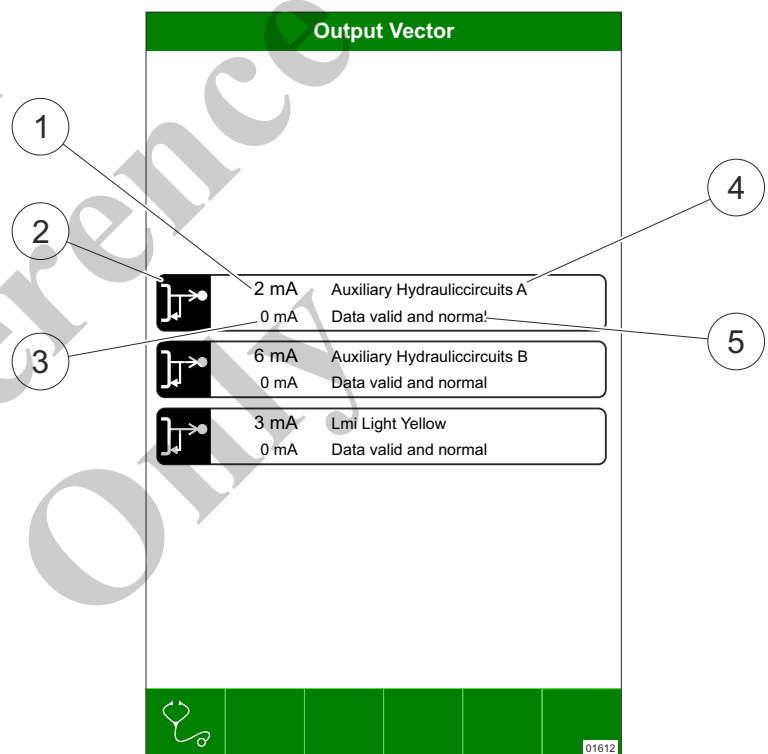


Fig. 63: Diagnosis window for outgoing signals

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

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*.
- Hand signals, see Section *Safety* these hand signals 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 Section ↪ *Chapter 2.9 "Personal protective equipment" on page 43*.
- 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 Section [↪ Chapter 6.38 "Parking the machine" on page 215.](#)

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.

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, people in the danger zone could be seriously injured.

⚠ WARNING

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

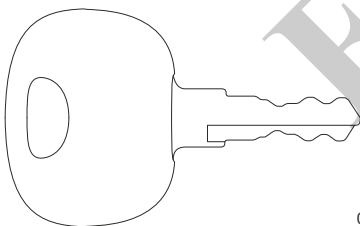
- Ensure that there is no one located in the danger zone of the machine before startup.

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

➔ Before start-up, carry out checks specified in *Check machine and accessory equipment*.

6.4 Machine key

Ignition key



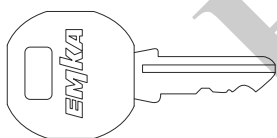
00526

Application

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

Fig. 64: Ignition key

Key for maintenance hood



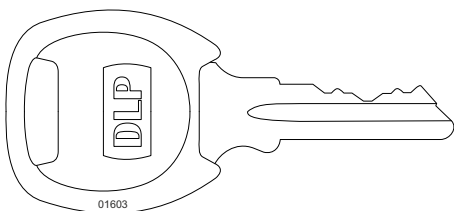
00019

Application

- Maintenance hood on uppercarriage

Fig. 65: Key for maintenance hood

Storage compartment key



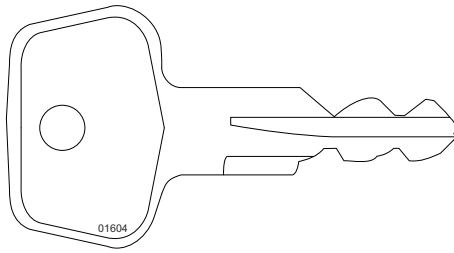
01603

Application

- Storage compartments on the undercarriage

Fig. 66: Storage compartment key

Tank cap key



Application

- tank cap

Fig. 67: Tank cap key

6.5 Enter the cab

⚠ WARNING

Risk of injury from falling.

- Only use the designated steps and handles.
- Clean soiled steps before use.
- Do not carry any objects by hand when climbing up or down.
- Always face the machine.
- Always make sure you have at least three points of contact with the steps and handles when climbing up or down. Two hands and one foot, or two feet and one hand must remain in contact with the steps and handles at all times.

If the steps and grip handles are not used properly or are soiled when climbing on or climbing off the machine, there is danger of injury.

Steps and walkways are attached to the machine for climbing on and climbing off.

1. → Unlock cab door and slide it sideways at the handle until it engages with the locking mechanism.
2. → Use steps and grip handle to enter the cab.

Closing the cab door from the inside

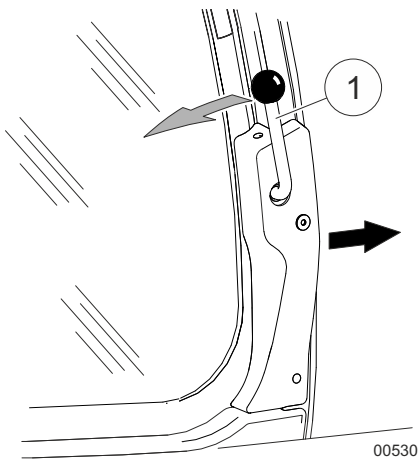


Fig. 68: Closing the cab door

1. ➤ Push the lever 1 backwards to release the cab door.
2. ➤ Push cab door forward at the lever until it engages with the locking mechanism.

6.6 Exit from the cab

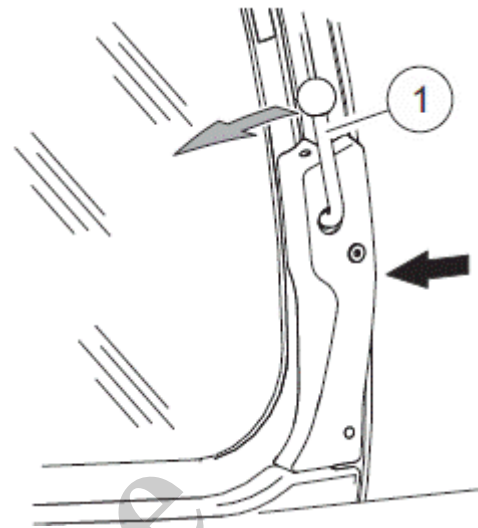
⚠ WARNING

Risk of injury from falling.

- Only use the designated steps and handles.
- Clean soiled steps before use.
- Do not carry any objects by hand when climbing up or down.
- Always face the machine.
- Always make sure you have at least three points of contact with the steps and handles when climbing up or down. Two hands and one foot, or two feet and one hand must remain in contact with the steps and handles at all times.

If the steps and grip handles are not used properly or are soiled when climbing on or climbing off the machine, there is danger of injury.

Opening the cab door from the inside



1. → Pull the lever (1) back to release the cab door.
2. → Continue pulling the lever (1) back to open the door until it locks into place.

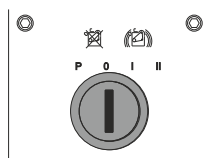
Emergency exit

In case of emergency, the machine can be exited via the side window panel or the windshield.

The emergency hammer is located behind the driver seat.

6.7 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 6.12 “Switching on the battery disconnect switch” on page 147. The ignition switch cannot function when the battery disconnect switch is off.



00532

Fig. 69: Ignition switch

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

6.8 Adjusting the driver seat

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



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 while moving or operating the machine.
- 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.

CAUTION

Damage to health due to improperly adjusted driver seat!

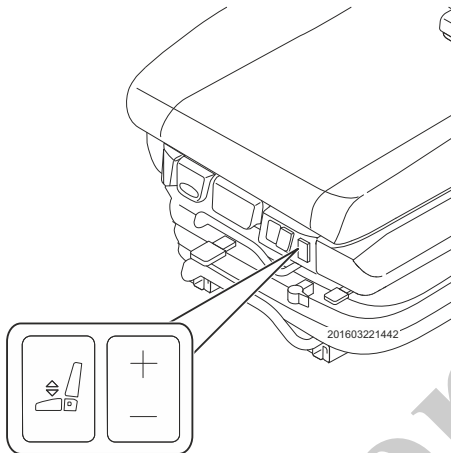
- Adjust the driver seat before starting up the machine or when switching operators.

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.

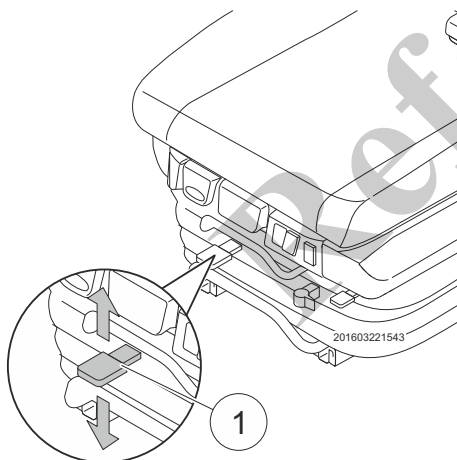


1. Turn the ignition key to the position I.
2. Put the full weight of your full body on the seat.
3. Push the switch down or up to set the desired seat height and the desired operator weight.

Fig. 70: 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. 71: Adjusting the shock absorbance

Adjusting the position of the seat surface

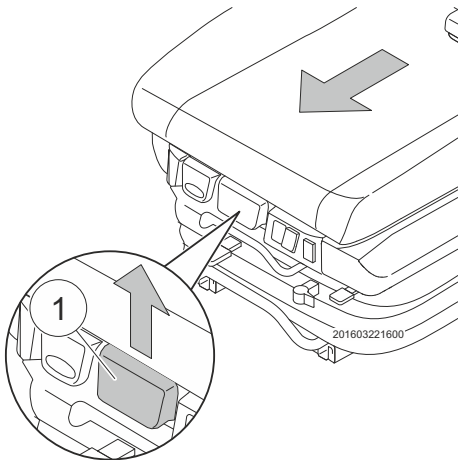


Fig. 72: Adjusting the position of the seat surface

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.

Length adjustment of the driver seat

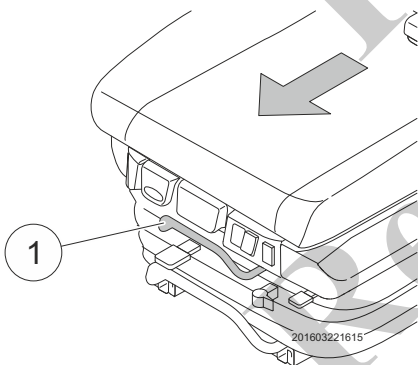


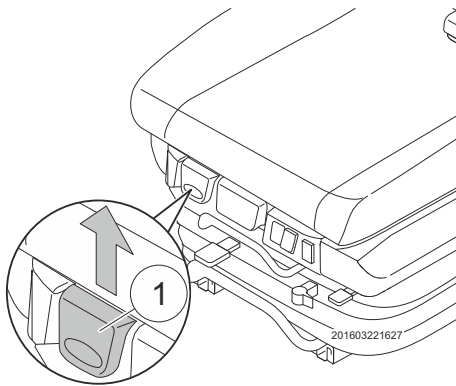
Fig. 73: Adjusting the seat position

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.

Adjusting the inclination of the seat surface



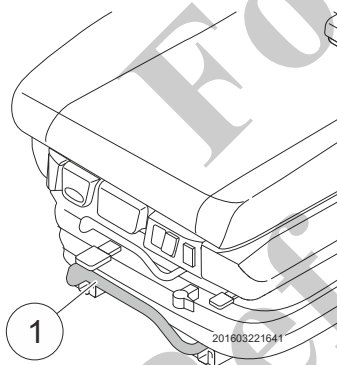
1. ➔ Push lever (1) upwards.
2. ➔ Adjust the desired inclination by increasing or decreasing your weight on the front or back of the seat surface.
3. ➔ Release the lever.

⇒ The seat surface must audibly engage.

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

Fig. 74: 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.

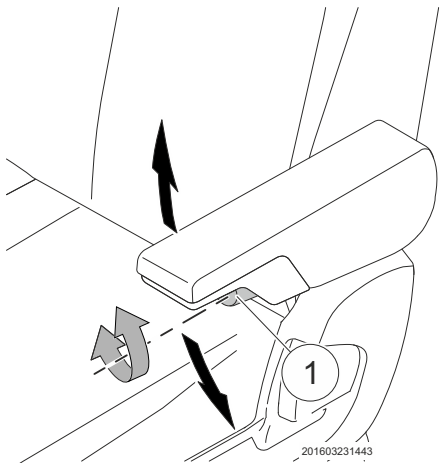
1. ➔ Pull the handle (1) up and push the driver seat with the brackets back or forwards.
2. ➔ Release the handle.

⇒ The driver seat with the brackets must audibly engage.

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

Fig. 75: Adjusting the seat position with the brackets

Adjusting the inclination of the arm rests



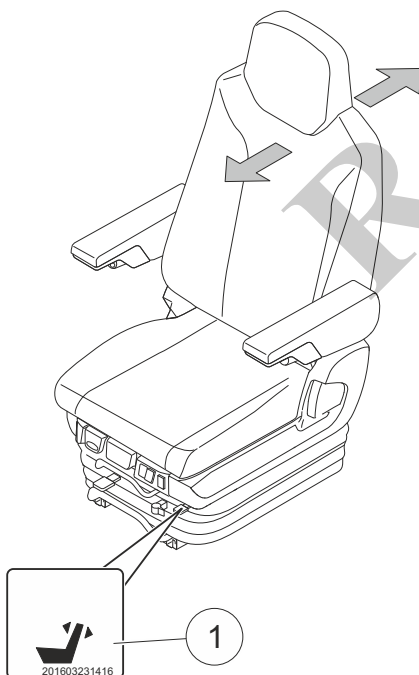
1. Turn the handwheel (1) outwards.
⇒ The arm rest is raised.
2. Turn the handwheel inwards.
⇒ The arm rest is lowered.

Fig. 76: 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. 77: Adjusting the backrest inclination

Adjusting the height of the headrest

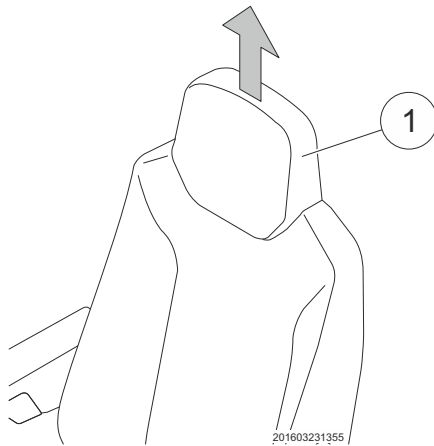


Fig. 78: Adjusting the headrest

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



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.

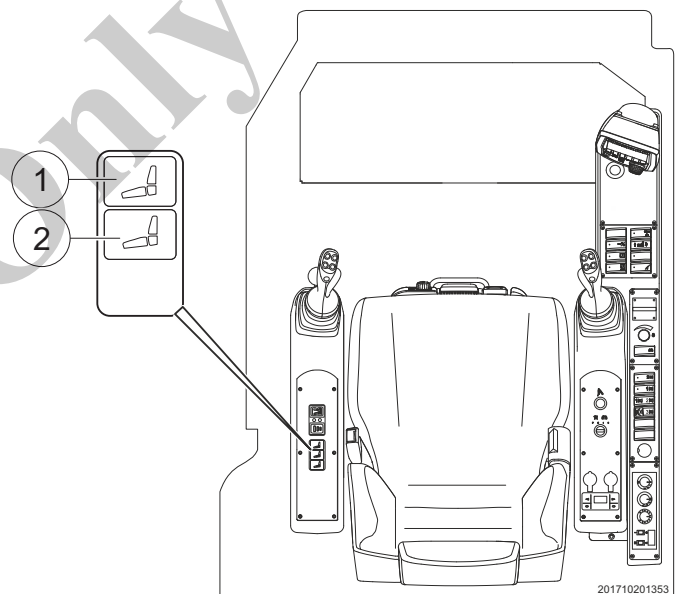
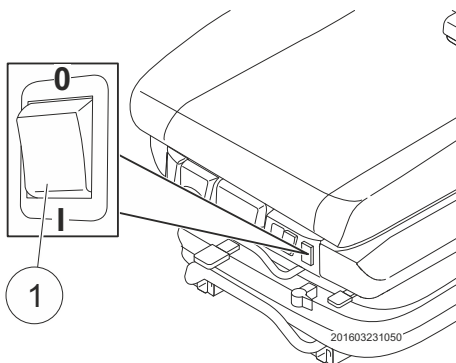


Fig. 79: Adjusting the lumbar support

- 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.

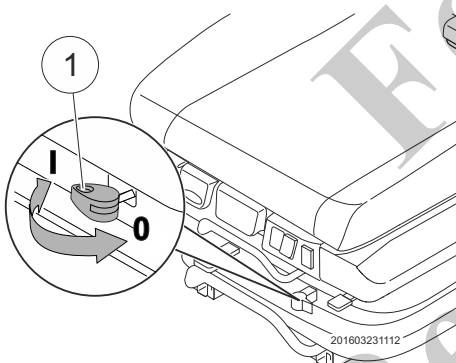
Switching the seat heater on and off



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

Fig. 80: 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.

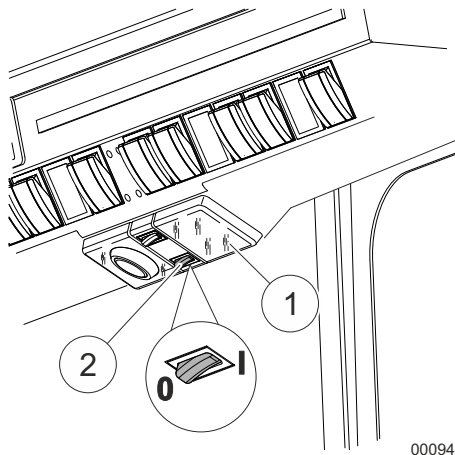
After locking, the horizontal suspension must not move anymore.

Fig. 81: Horizontal suspension

6.9 Cab lighting

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

Turning the inside light on and off



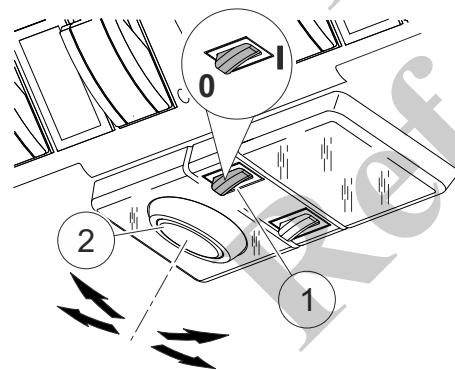
1. ➤ The inside light (1) in turns on when the cab door is opened.
2. ➤ Closing the cab door or turning the switch (2) to **0** turns off the inside light.

Fig. 82: Interior light



The inside light is only turned on and off by the cabin 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.

00095

Fig. 83: Spotlight



The beam can be moved by adjusting the reading light.

6.10 rearview mirror

Adjusting the rearview mirror

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

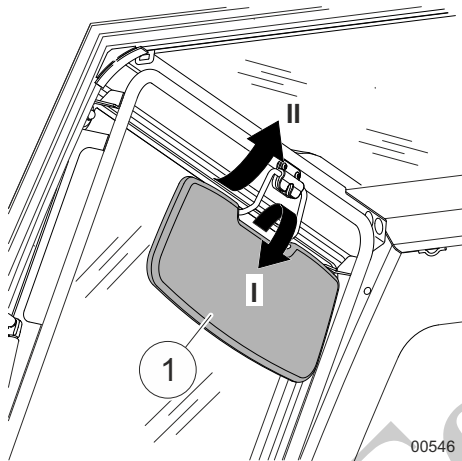
If necessary, call a second person for support.

Clean rearview mirror before startup if dirty.

6.11 Sun visor and roller shade

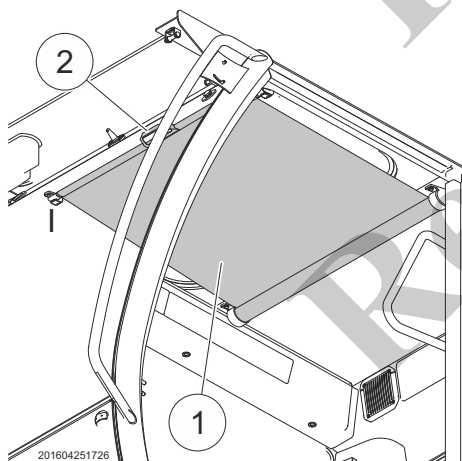
The cab is equipped with a sun visor and a sun shade.

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.

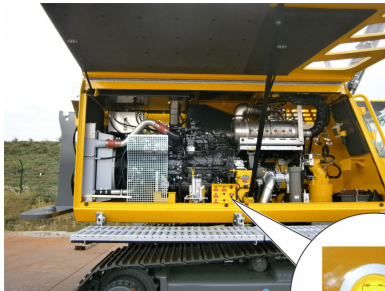
Fig. 84: Sun visor



1. ➤ Grasp roller shade (1) on the handle (2) and hook into position I.
2. ➤ To roll up the sun shade, hold onto the grapple, unhook, and return to initial position.

Fig. 85: Roller shade

6.12 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. 86: Battery disconnect switch

6.13 Turning off the 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.

Fig. 87: Battery disconnect switch

⚠ 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.

6.14 Windshield

6.14.1 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.

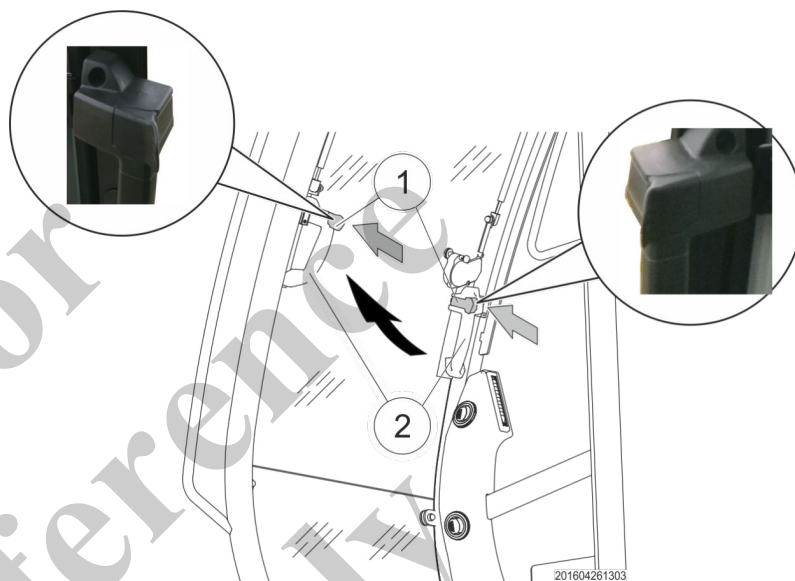


Fig. 88: Opening the windshield

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

6.14.2 Closing front windshield

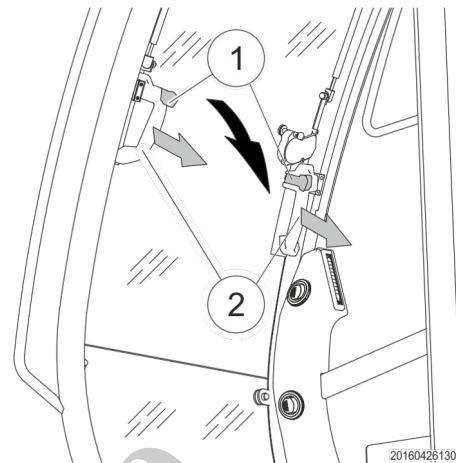
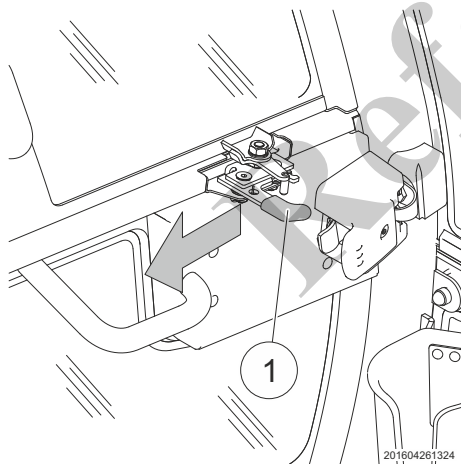


Fig. 89: Windshield

→ Raise grapple (2).

⇒ Make sure the windshield audibly locks into both locking mechanisms (1).

6.15 Opening the door windows



→ Pull the locking mechanism of the door window (1) back and open the window.

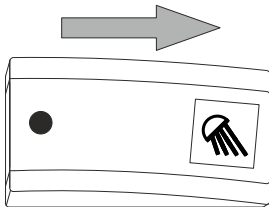
Fig. 90: Opening the door windows

6.16 Machine lighting

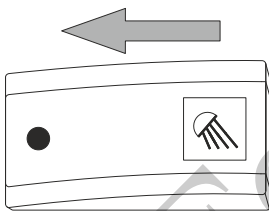
6.16.1 Switching the work lights on and off

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.



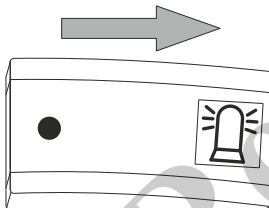
3. ➤ Turn the **Work lights** switch to the left.
⇒ Work light turns off.



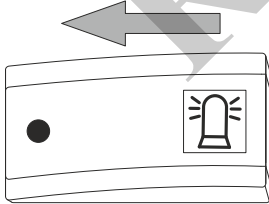
6.16.2 Switching the beacon on and off (option)

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.



6.17 Radio

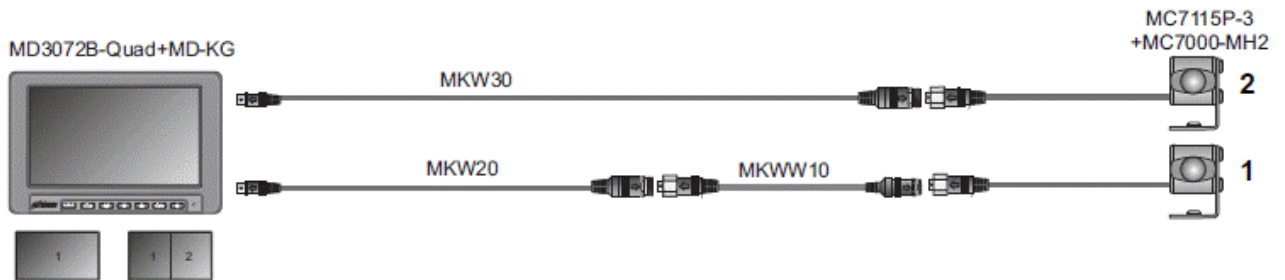
The radio is located in the right control panel.



Information

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

6.18 Camera system



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

- Each camera has a 115° image angle

Camera 1	For viewing the machine when reversing
Camera 2	For monitoring the work area to the right of the machine
Camera 3	For the winches



Information

See the included camera system documentation for more information.

6.19 Windshield wiper and windshield washer system

6.19.1 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.

6.19.2 Windshield wiper and windshield washer system

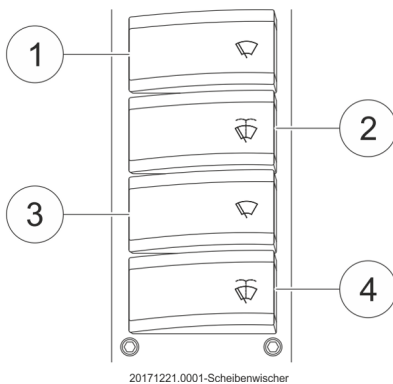
The switches for the windshield wipers and the windshield washer system are on the upper control panel.

The windshield wiper switch has three settings.

Operation

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

Overview of windshield wiper switches



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

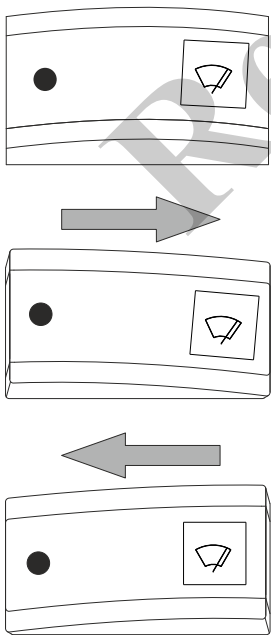
Fig. 91: Windshield washer system

Switching windshield wiper on and off

NOTICE

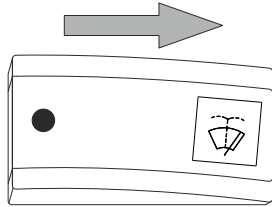
Damage to windshield wiper arm due to incorrect operation.
– Never activate the windshield wiper with the windshield open.

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.

Switching the windshield washer system on and off



1. → Turn the ignition key to the position I.
2. → Keep switch depressed.
 - ⇒ Washer fluid sprays on the windshield. The windshield wiper wipes a few times.
3. → Release the switch.
 - ⇒ The windshield washer system is off.

6.20 Control panel for climate control system

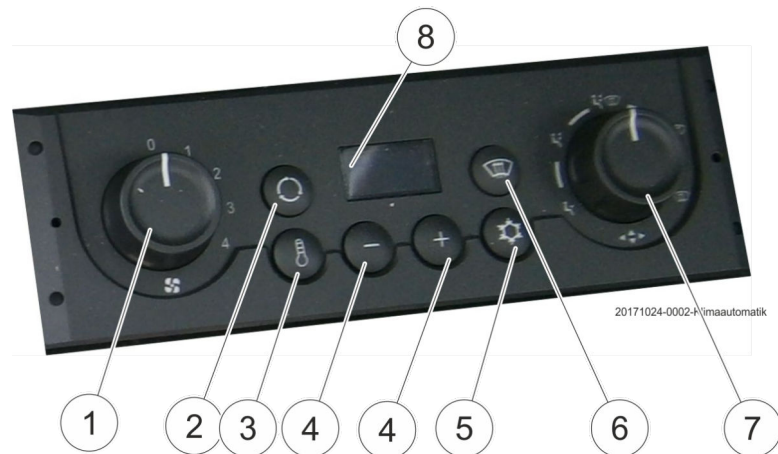
The machine is equipped with climate control system that enables exact heating or cooling.

Safety instructions

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

Operation

Control panel for climate control system



- 1 Fan speed selector switch
- 2 Recirculating-air mode
- 3 Show outside temperature
- 4 Temperature regulator
- 5 Climate control system on/off
- 6 Fresh-air mode
- 7 Air flow selector switch
- 8 Temperature display (°C or °F)

i Information

The climate control system can be operated with outside air or circulating air.

i Information

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

i Information

Keep windows and cab door closed to ensure effective air conditioning. The climate control system regulates the temperature depending on the ambient temperature.

Outside air mode (6)

When windows are fogged up, to dehumidify the cab.

Circulating air mode (2)

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

Switching on the climate control system (5)

1. ➤ Start the diesel engine.
2. ➤ Turn on the blower (1) on the right control panel.
3. ➤ Open the air vents in the cab to prevent the evaporator from icing up.

4. → Press the climate control system button (5) in on the control panel.
5. → Set the desired temperature by pressing buttons (4) on the control-panel.



Information

Switch on the climate control system regularly. This greatly contributes to the unit being ready for operation. Switch on the climate control system once a month for at least 30 minutes at maximum fan speed, keeping windows and doors open during the process.

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



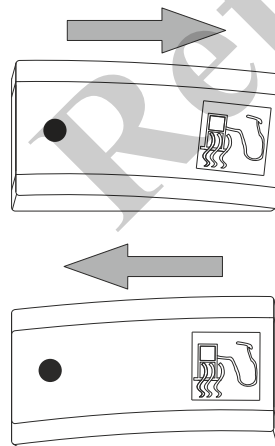
1. → Press the switch (3) for longer than 5 s.
2. → Temperature indication changes (°C <--> °F).

6.21 Turning on the diesel filter heating

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

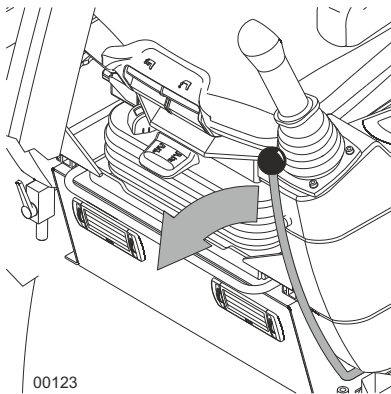


If the coolant temperature drops below 5 °C, the manufacturer recommends turning the diesel heater on. The coolant temperature is displayed on the SENCON.



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.

6.22 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. 92: Safety lever positions

6.23 Activate coolant preheating

Electrical coolant preheating

To activate the coolant preheating in the coolant tank, the power socket in the left-hand storage compartment of the machine must be connected to the mains. The power socket is protected by the fuse box.

Only the plug, not the cable for the power supply to the power socket is included!

The cable must only be connected by a trained specialist!

⚠ WARNING

Maintenance and repair work must only be executed by trained specialists.



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

6.24 Starting / stopping / jump-starting the diesel engine

6.24.1 Starting the diesel engine

⚠ 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.

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 procedure lasts about 30 seconds. Do not use the machine while the loading screen is present.*

2. → Set the setup status in the SENCON.

3. → Activate the button on the right joystick.

⇒ The horn must sound.

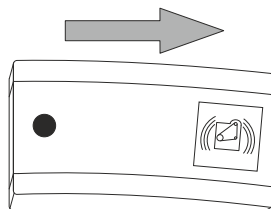
4. → Check SENCON for potential faults and warning messages.

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

5. → Turn the ignition key to position II.



Fig. 93: SENCON loading screen



i

*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.*

6.24.2 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.*

6.24.3 Jump starting diesel engines

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

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.

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

Materials: ■ Bridging cable with minimum cross-section 70 mm²

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

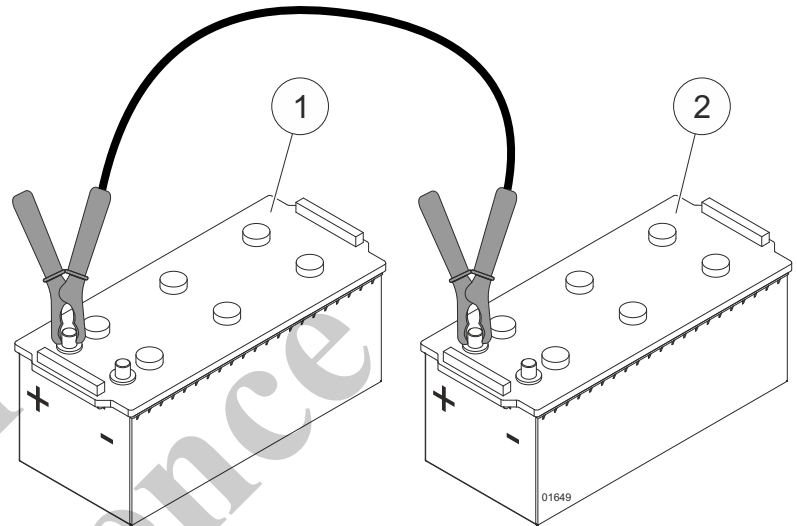


Fig. 94: Connect positive pole

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

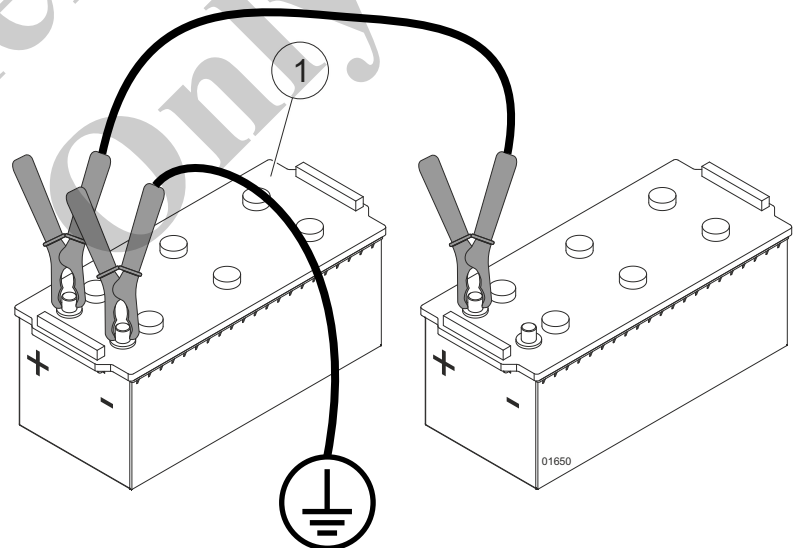


Fig. 95: Connect the donor battery's negative pole with the machine

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.
10. ▶ Loosen the jump cable on the negative pole.
11. ▶ Replace the battery cover.

6.25 Load moment limitation (LML)

6.25.1 Safety instructions

- The load moment limitation (LML) is a safety device.
- Before working on and with the machine, set the LML operating mode.
- The LML settings must correspond with the setup status of the machine and the activity to be carried out.
- The LML may only be bypassed in case of emergency or in the event of component failure to shut down the machine in a safe condition.
- 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.

6.25.2 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 (LML) > Mode of operation

RCL display on the outside of the machine

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

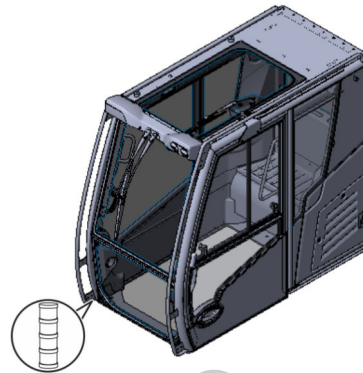



Fig. 96: RCL light

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 - pressed up button bypass boom

Load capacity	Speed reduction up to 25 %	Date display	Visual	Acoustic
< 90%	No	No	Green light	-
90% to 100%	No	No	Yellow light	-
100% to 125%	No	Yes	Red light	Interval honking disengageable after 5 s
		Press and hold the Raise boom button.		

Display of the lights - activate RCL emergency operation on SENCON

Load capacity	Speed reduction up to 25 %	Date display	Visual	Acoustic
90% to 100%	Yes	Yes	Yellow light	-
100% to 110%	Yes	Yes	Flashing yellow light	-
> 110%	Yes	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

6.25.3 Set-up status

The LML 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 95.



6.25.4 Operation

The RCL is operated and adjusted via the SENCON.

6.25.5 Operating mode selection

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



Information

- *Make sure the operating parameters configured on the SENCON match the setup of the machine.*
- *The rope reeving number (strand number) on the machine must correspond to the reeving number on the SENCON.*
- *The lifting capacities are programmed in accordance with ASME B30.5.*
- *The weight of the load handling devices must be subtracted from the maximum safe working loads. Load-handling devices are:*
 - *Suspension gear*
 - *Traverses*
 - *Hook*
 - *Bottom hook blocks*
 - *Hoisting ropes between bottom hook block and pulley head*

For
Reference
Only

6.25.6 Operating modes table

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

Incline [°]	Track width	Rear ballast [t (lbs)]	Main boom / Attachment	Offset [°]	Config code
0.3°	A	17.8 t (39242 lbs)	HA-HAB	0°	153213
0.3°	B	17.8 t (39242 lbs)	HA-S	0°	152231
0.3°	B	9.3 t (20502 lbs)	HA-S	0°	152331
0.3°	A	0	HA-S	0°	153131
0.3°	A	17.8 t (39242 lbs)	HA-S	0°	153231
0.3°	A	9.3 t (20502 lbs)	HA-S	0°	153331
2.0°	B	17.8 t (39242 lbs)	HA-S	0°	252231
2.0°	B	9.3 t (20502 lbs)	HA-S	0°	252331
2.0°	A	17.8 t (39242 lbs)	HA-S	0°	253231
2.0°	A	9.3 t (20502 lbs)	HA-S	0°	253331
4.0°	B	17.8 t (39242 lbs)	HA-S	0°	352231
4.0°	B	9.3 t (20502 lbs)	HA-S	0°	352331
4.0°	A	17.8 t (39242 lbs)	HA-S	0°	353231
4.0°	A	9.3 t (20502 lbs)	HA-S	0°	353331
0.3°	B	17.8 t (39242 lbs)	HA	0°	152201
0.3°	B	9.3 t (20502 lbs)	HA	0°	152301
0.3°	A	0	HA	0°	153101
0.3°	A	17.8 t (39242 lbs)	HA	0°	153201
0.3°	A	9.3 t (20502 lbs)	HA	0°	153301
2.0°	B	17.8 t (39242 lbs)	HA	0°	252201
2.0°	B	9.3 t (20502 lbs)	HA	0°	252301
2.0°	A	17.8 t (39242 lbs)	HA	0°	253201
2.0°	A	9.3 t (20502 lbs)	HA	0°	253301
4.0°	B	17.8 t (39242 lbs)	HA	0°	352201
4.0°	B	9.3 t (20502 lbs)	HA	0°	352301
4.0°	A	17.8 t (39242 lbs)	HA	0°	353201
4.0°	A	9.3 t (20502 lbs)	HA	0°	353301
0.3°	A	17.8 t (39242 lbs)	Boom setup	0°	153299
0.3°	C	0	Boom setup	0°	151198
0.3°	A	17.8 t (39242 lbs)	SA15	0°	153251
0.3°	A	17.8 t (39242 lbs)	SA15	20°	153252
0.3°	A	17.8 t (39242 lbs)	SA15	40°	153253
0.3°	A	17.8 t (39242 lbs)	SA8	0°	153241
0.3°	A	17.8 t (39242 lbs)	SA8	20°	153242
0.3°	A	17.8 t (39242 lbs)	SA8	40°	153243
0.3°	A	17.8 t (39242 lbs)	SA-HAB	0°	153225
0.3°	B	17.8 t (39242 lbs)	SLS	0°	152235
0.3°	B	17.8 t (39242 lbs)	SLS	20°	152236
0.3°	B	17.8 t (39242 lbs)	SLS	40°	152237

Operation

Load moment limitation (LML) > Operating modes table

Incline [°]	Track width	Rear ballast [t (lbs)]	Main boom / Attachment	Offset [°]	Config code
0.3°	B	9.3 t (20502 lbs)	SLS	0°	152335
0.3°	B	9.3 t (20502 lbs)	SLS	20°	152336
0.3°	B	9.3 t (20502 lbs)	SLS	40°	152337
0.3°	A	17.8 t (39242 lbs)	SLS	0°	153235
0.3°	A	17.8 t (39242 lbs)	SLS	20°	153236
0.3°	A	17.8 t (39242 lbs)	SLS	40°	153237
0.3°	A	9.3 t (20502 lbs)	SLS	0°	153335
0.3°	A	9.3 t (20502 lbs)	SLS	20°	153336
0.3°	A	9.3 t (20502 lbs)	SLS	40°	153337
2.0°	B	17.8 t (39242 lbs)	SLS	0°	252235
2.0°	B	17.8 t (39242 lbs)	SLS	20°	252236
2.0°	B	17.8 t (39242 lbs)	SLS	40°	252237
2.0°	B	9.3 t (20502 lbs)	SLS	0°	252335
2.0°	B	9.3 t (20502 lbs)	SLS	20°	252336
2.0°	B	9.3 t (20502 lbs)	SLS	40°	252337
2.0°	A	17.8 t (39242 lbs)	SLS	0°	253235
2.0°	A	17.8 t (39242 lbs)	SLS	20°	253236
2.0°	A	17.8 t (39242 lbs)	SLS	40°	253237
2.0°	A	9.3 t (20502 lbs)	SLS	0°	253335
2.0°	A	9.3 t (20502 lbs)	SLS	20°	253336
2.0°	A	9.3 t (20502 lbs)	SLS	40°	253337
4.0°	B	17.8 t (39242 lbs)	SLS	0°	352235
4.0°	B	17.8 t (39242 lbs)	SLS	20°	352236
4.0°	B	17.8 t (39242 lbs)	SLS	40°	352237
4.0°	B	9.3 t (20502 lbs)	SLS	0°	352335
4.0°	B	9.3 t (20502 lbs)	SLS	20°	352336
4.0°	B	9.3 t (20502 lbs)	SLS	40°	352337
4.0°	A	17.8 t (39242 lbs)	SLS	0°	353235
4.0°	A	17.8 t (39242 lbs)	SLS	20°	353236
4.0°	A	17.8 t (39242 lbs)	SLS	40°	353237
4.0°	A	9.3 t (20502 lbs)	SLS	0°	353335
4.0°	A	9.3 t (20502 lbs)	SLS	20°	353336
4.0°	A	9.3 t (20502 lbs)	SLS	40°	353337

Abbreviation	Explanation	Abbreviation	Explanation
HA	Main boom	SA15	Fly jib (15 m (49.2 ft))
HA-S	Auxiliary jib	A	extended (4.4 m (14.4 ft))
HA- / SA-HAB	Main boom / fly boom with elevating work platform	B	middle (3.5 m (11.5 ft))
SA8	Fly jib (8.0 m (26.2 ft))	C	retracted (2.6 m (8.6 ft))
SLS	heavy-duty jib		

6.25.7 Bypass LML

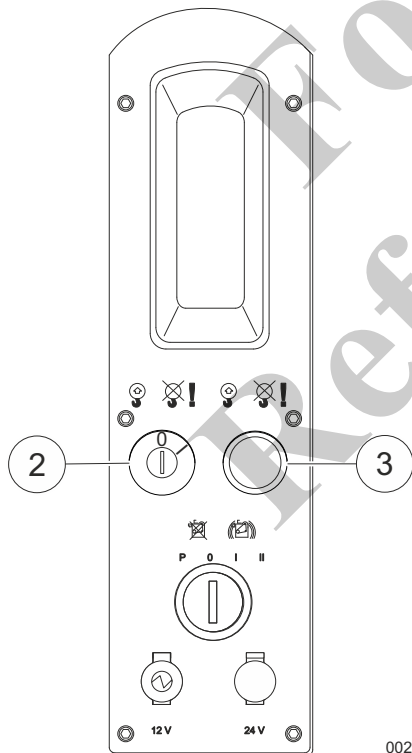
Safety instructions

- The key switch for bypassing the LML must only be activated by authorized personnel in the event of an emergency or component failure.
- In the case of bypassed LML, a shutdown does not take place as soon as the machine arrives in an unauthorized operating area.
- In the case of bypassed LML, 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 LML following a shutdown due to overload. The LML is bypassed via a key switch.

Bypass LML

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.
 - ⇒ LML 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.



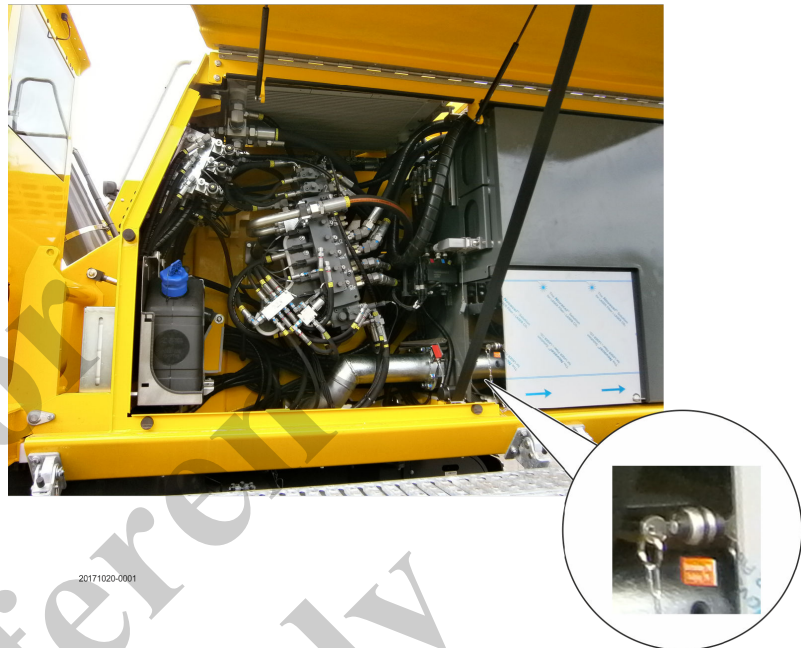
Activate LML after bypass

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

6.25.8 Bypassing the load moment limitation (RCL)

In *setup mode* or in *crane mode* it may be necessary to bypass the RCL following a shutdown due to overload. To do this, you will find a SET UP key in the RCL menu of the SENCON and a bypass switch outside of the cab.

Bypass button outside the cab




The key switch is located on the electrical switch cabinet in the uppercarriage, left.

Safety instructions

The key switch for bypassing the RCL, located outside the cab must only be activated by authorized personnel in the event of an emergency or component failure/fault!

1. Turn the key switch to the right
 - ⇒ All crane functions are available, but remember:
 - The RCL can no longer shut down the machine
 - All limit switches are bypassed
 - The lifting limit switch does not work
 - There is no shutdown at the radius limit
 - There is no shutdown in the event of faults
 - ⇒ All crane functions will be performed at only 15% of normal speed

- ⇒  A visual (SENCON) and acoustic warning that cannot be switched off is activated inside and outside the cab. If fault messages occur (SENCON), rectify the fault immediately.
- ⇒ The bypass is always switched on after 30 minutes or when the engine is shut off or when the key switch is turned to the right again.

6.25.9 Safety components

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

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



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

Operation

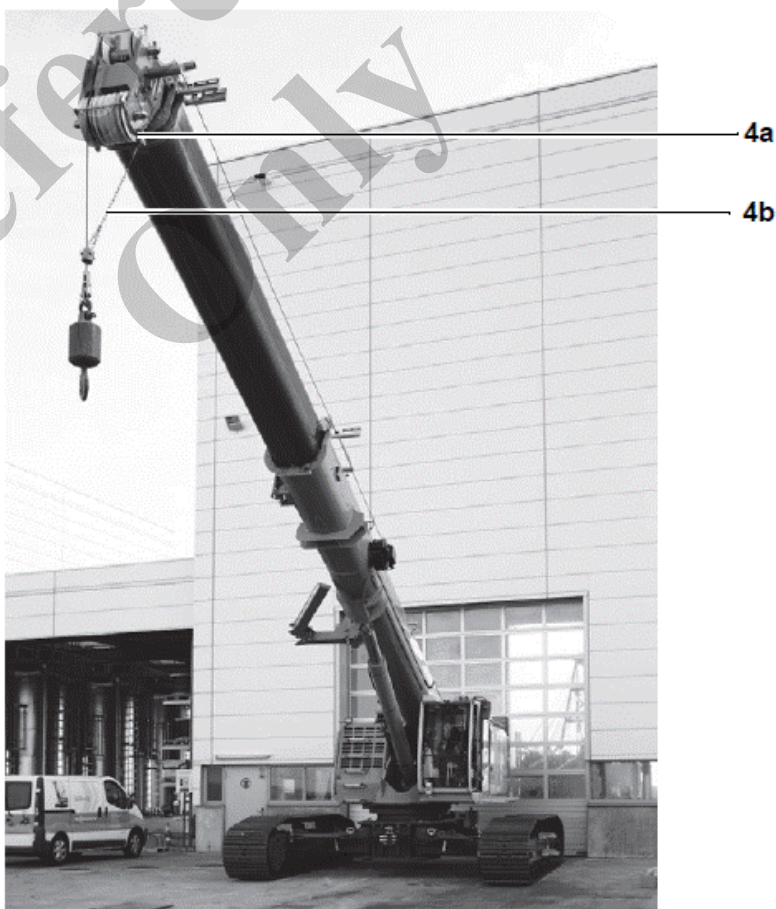
Load moment limitation (LML) > Safety components

Length and angle transmitter/ spring cable drum (3)



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

Lifting limiter (4)



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

The lifting limit switch (4a) is activated by the weight suspended on the chain (4b). The length of the chain depends on the speed of the load hook and the system shutdown response time. It cannot be reduced, because the bottom hook block will otherwise be pulled against the boom head. This can cause severe damage.

NOTICE

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

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

- **Do not shorten the chain of the lifting limit switch under any circumstances.**

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

Lifting limit switch - fly boom (5 - optional)



Cable connection

After installing the fly boom, insert the connecting cable of the lifting limit switch of the fly boom onto the main boom head.

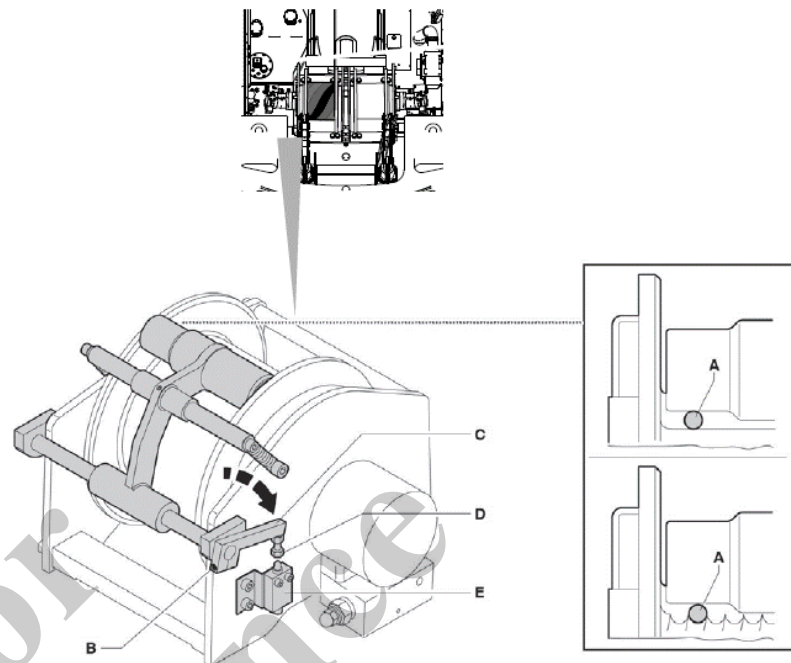
Load moment limitation (RCL)

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

Operation

Warm-up the machine

Lowering limit switch/rope end limiter (E)



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

Adjusting the rope end limit switch

Make sure the rope is completely unreeled.

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

6.26 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.

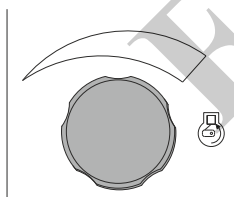
Before operating the machine at full speed, the following temperature values must be shown on the SENCON display:

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

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.



6.27 Roatate engine speed

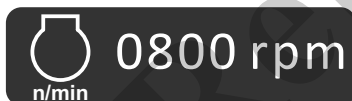


00571

Fig. 97: Speed governor

The speed governor is located on the lower right-hand panel.

1. ➔ Turn the speed governor to the right.
⇒ The speed is increased.
2. ➔ Turn the speed governor to the left.
⇒ The speed is decreased.



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

6.28 Exhaust aftertreatment system

DEF

⚠ CAUTION

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

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.

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	Gray: <ul style="list-style-type: none"> ■ DEF level normal. Orange: <ul style="list-style-type: none"> ■ Refill DEF tank at the next opportunity. Red: <ul style="list-style-type: none"> ■ Refill DEF tank immediately.

For Reference Only

6.29 Check and refill the DEF level (For Tier 4f engines)

NOTICE

Risk of machine damage from contact with DEF.

DEF can damage machine parts, especially hoses and cables, beyond repair.

- Do not pour DEF on hoses or cables.
- Immediately remove any spilled DEF.
- Have damaged hoses or cables replaced before starting up the machine.

SENCON parameter field DEF fill level

The level in the DEF tank is monitored by the SENCON. The following icon indicates the DEF level on the SENCON:



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



Information

DEF can be added at ambient temperatures down to 12.2 F (-11 °C).

Capacity:

DEF tank	Approximately 30 l (7.9 gal)
----------	------------------------------

Refilling DEF

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



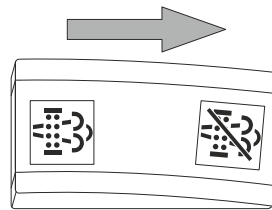
6. → Check the DEF[®] tank for soiling. Clean as needed.
7. → Carefully open the lid of the DEF tank.
8. → Refill the DEF tank with the DEF filling unit. Always supervise the refilling process.
9. → Close the lid.

6.30 Suppressing exhaust aftertreatment system regeneration

Exhaust aftertreatment system regeneration starts automatically. It can be suppressed manually and manually restarted at a later point.

Suppressing the regeneration makes sense, if higher exhaust gas temperatures present a danger when using the machine (e.g. if the machine is near flammable materials).

The exhaust aftertreatment system must be regenerated soon after use.



→ Push the switch on the upper control panel to the right.



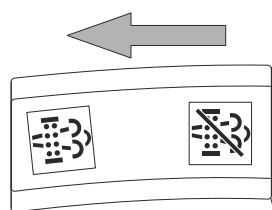
⇒ The symbol displays that the regeneration has been suppressed.

6.31 Starting the exhaust aftertreatment system regeneration manually

Safety instructions

- Park the machine on secure ground.
- Select ground that cannot burn or melt under high exhaust temperatures. For example, do not run regeneration on grass or asphalt.
- Materials and substances that can burn, melt or explode must be at least 2 m (6.6 ft) away from the exhaust port.
- Objects must be at least 1 m (3.3 ft) away from the exhaust port.
- No gases or vapors in the vicinity that can burn, explode or help start a fire.
- Set down attached loads and lower the boom.
- Set up a secure ventilation area. If the machine is inside a building, set up an exhaust duct. The duct must be able to withstand an exhaust temperature of at least 1562 °F (850 °C).
- Keep a working fire extinguisher on hand.
- Check the surfaces of the exhaust system. Make sure nothing is on or near the exhaust system.

In order to be able to carry out the regeneration, the engine speed must be lowered to 800 rpm.



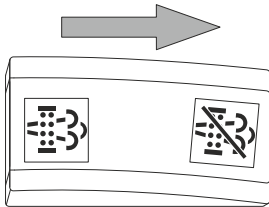
→ Push the switch on the upper control panel to the left.



⇒ The symbol displays that the regeneration has been started.

The symbol goes out when the regeneration has been completed.

6.32 Stopping manual exhaust aftertreatment system regeneration



→ Push the switch on the upper control panel to the right.

6.33 Refuel the machine

The machine can be refueled in two ways:

- Manual refueling
- Using a fuel pump (option)

⚠ WARNING

Risk of damage to health and the environment from escaping fuel.

Contact with fuel can be seriously harmful your health. Fuel seeping into the soil or bodies of water can seriously harm the environment.

- Smoking or handling open flames is strictly prohibited.
- Park the machine on a solid, level ground.
- Only refuel when the engine is shutdown.
- Determine the fuel level before filling.
- Always make sure not to overfill.
- When refueling from a tanker, do not exceed the maximum filling rate of 120 l/min (32 gpm).
- Constantly supervise the refueling process.

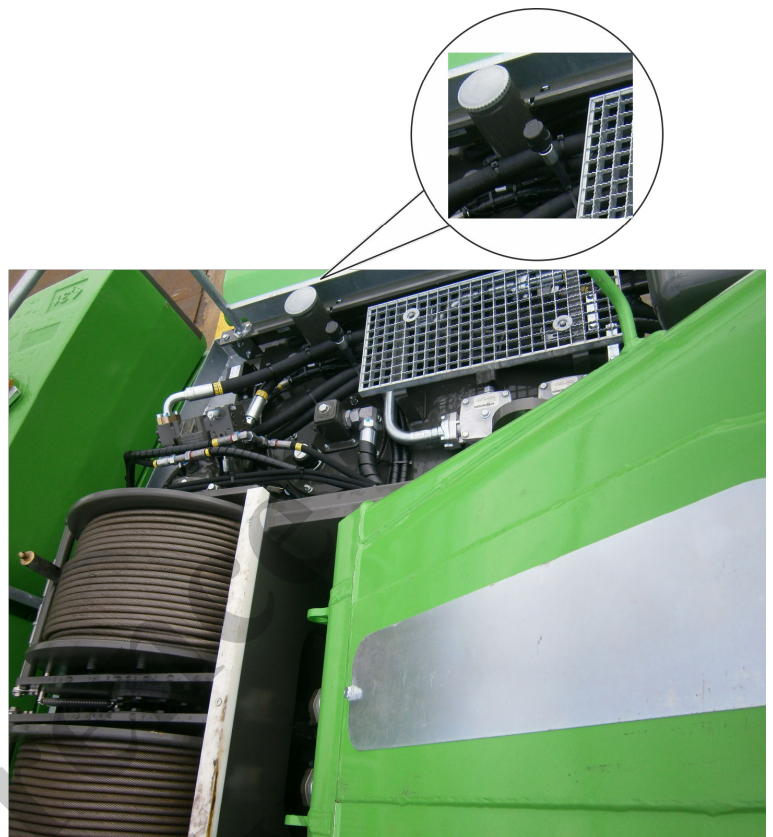


Information

Also observe the notes on the fuel system in the operating manual of the engine manufacturer.

Manual refueling

1. → Lower attached loads to the ground.
2. → Switch off the diesel engine.



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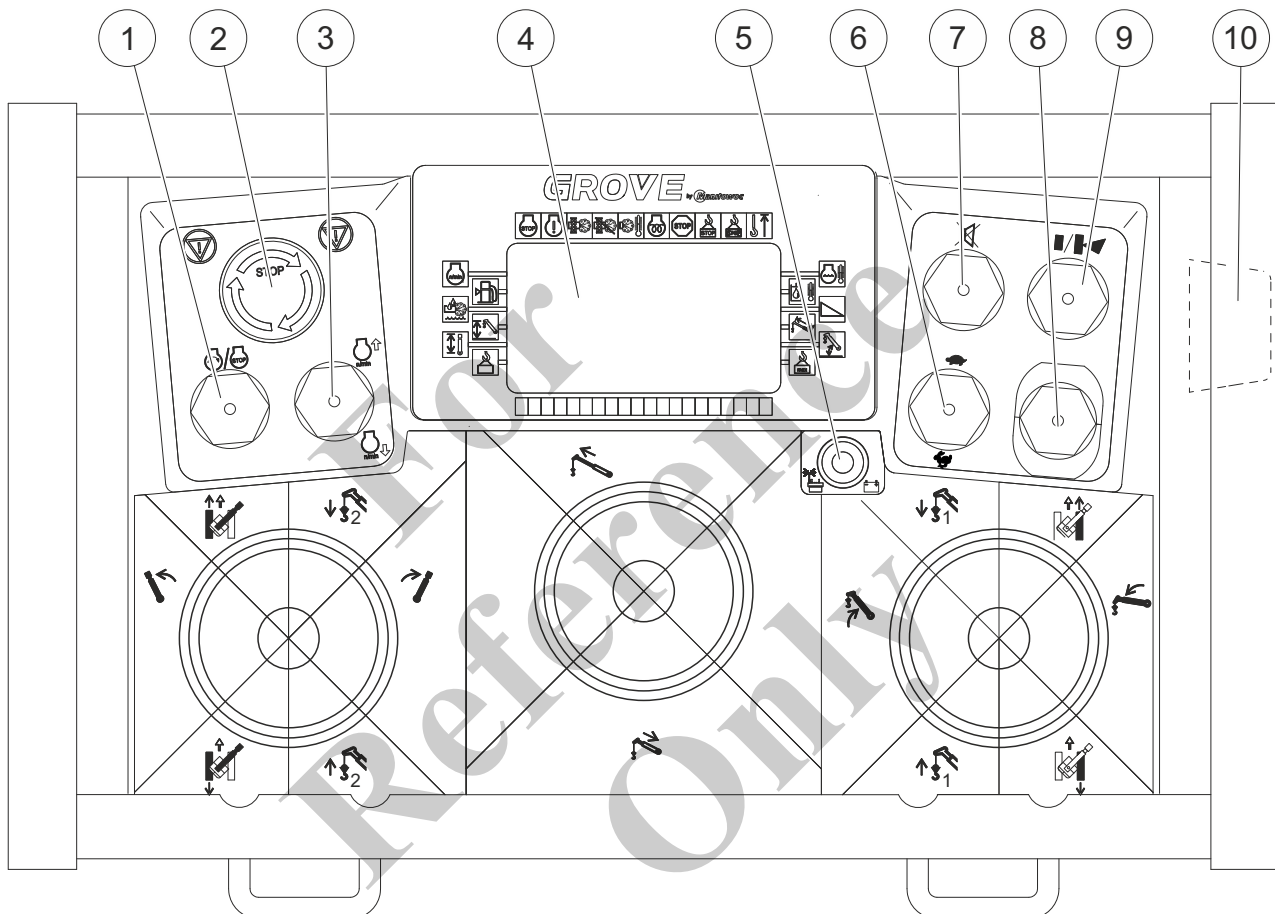
3. ➔ Open the lid of the fuel filler neck.
4. ➔ Clean the strainer.
5. ➔ Insert the funnel into the filler neck.
6. ➔ Carefully pour the fuel in through the funnel.
7. ➔ Close the filler neck lid.

6.34 Remote radio control

Control elements



The reach of the remote control is 100 m (328.1 ft) in free field. The antenna is located in the direction of travel on the rear left of the uppercarriage.



00449

Fig. 98: 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	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. The radio remote control of traveling drive is disabled when the lifting working platform is attached.

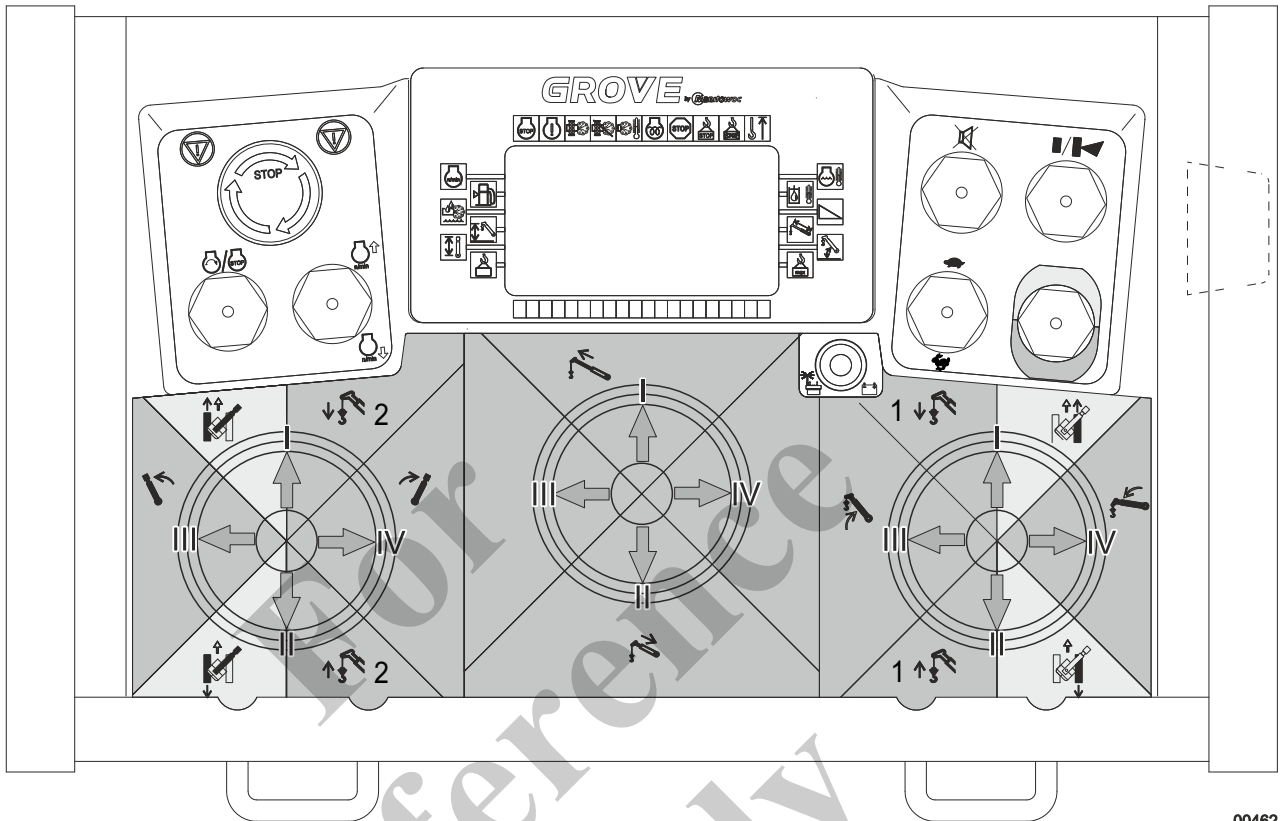
No.	Function	Description
9	Horn/remote start	Sound the horn to release the remote radio control. Sounding the horn is necessary before starting tasks because the operator could be far away from the machine due to the remote radio control, and may possibly not be aware that other persons are in the danger 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.

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.

For Reference Only

Joystick assignment

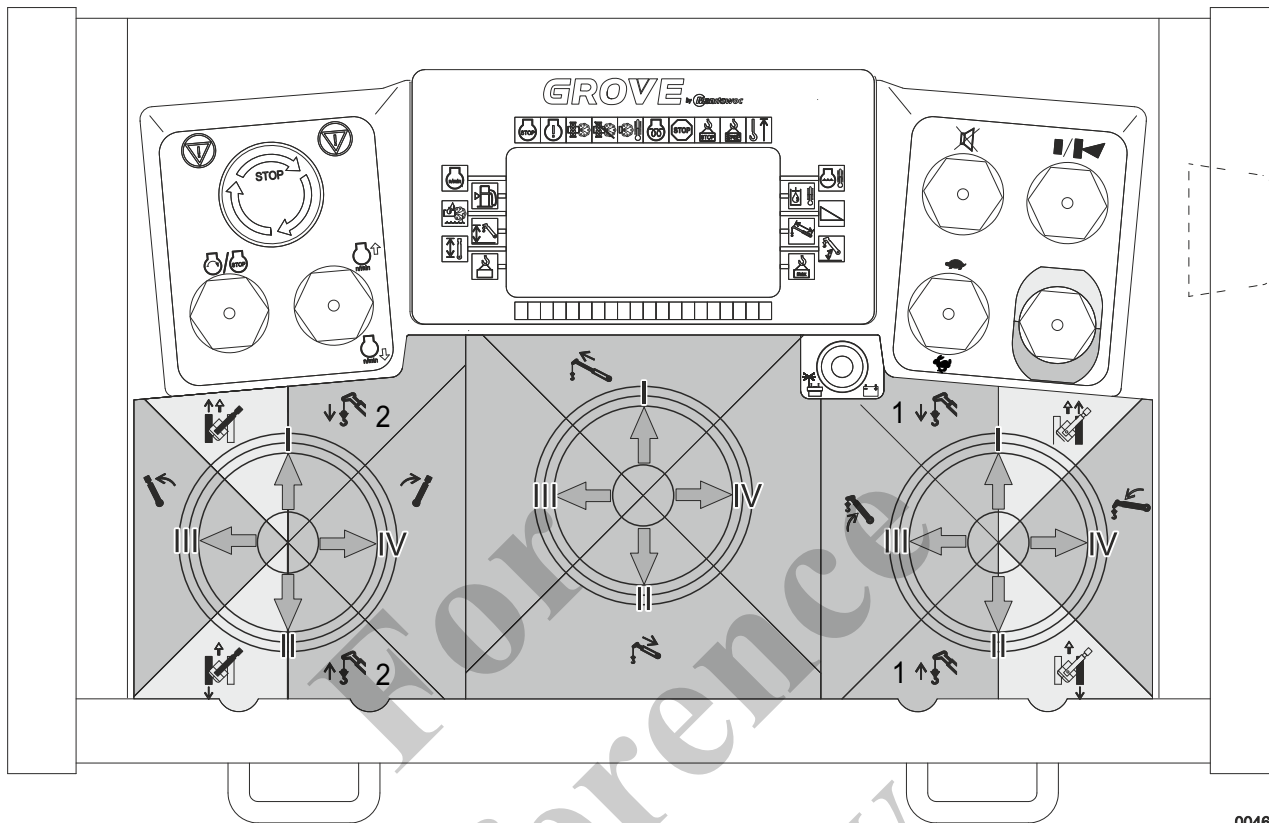


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Fig. 99: Joystick assignment of remote radio control

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

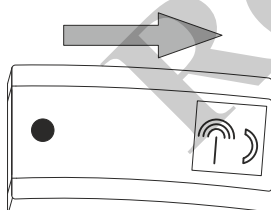
i The switches **Changeover switch rock/telescope boom** and **Changeover winch 1 - winch 2** on the control panel in the cab are non-functional when the remote radio control is in use. The radio remote control of traveling drive is disabled when the lifting working platform is attached.



00462

Fig. 100: Joystick assignment of remote radio control

Enabling the remote radio control



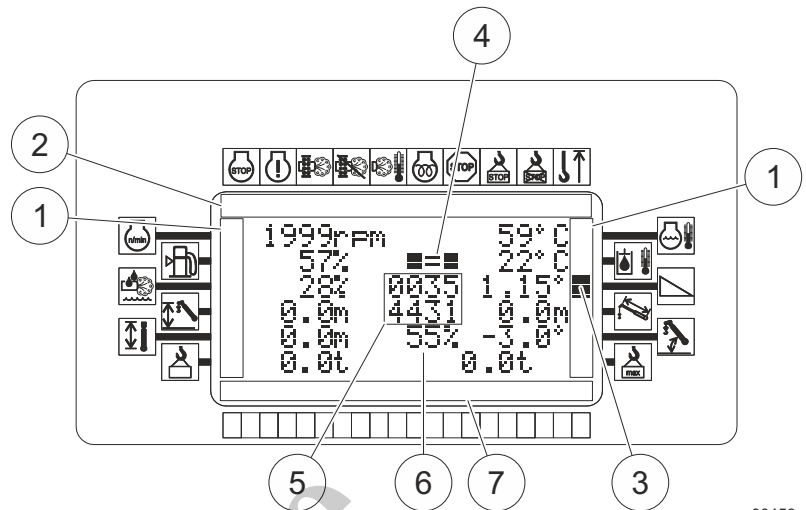
1. ➤ Switch on the ignition.
2. ➤ Push the switch **radio operation on/off** above the control panel to the right.
3. ➤ Exit the cab.
4. ➤ Sound the horn on the remote radio control.
5. ➤ Start the diesel engine with the switch **diesel engine start/stop** on the remote radio control.
6. ➤ Perform the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



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

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:



00459


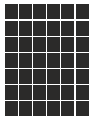
Fig. 101: Display of the machine data on the remote radio control

- 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.

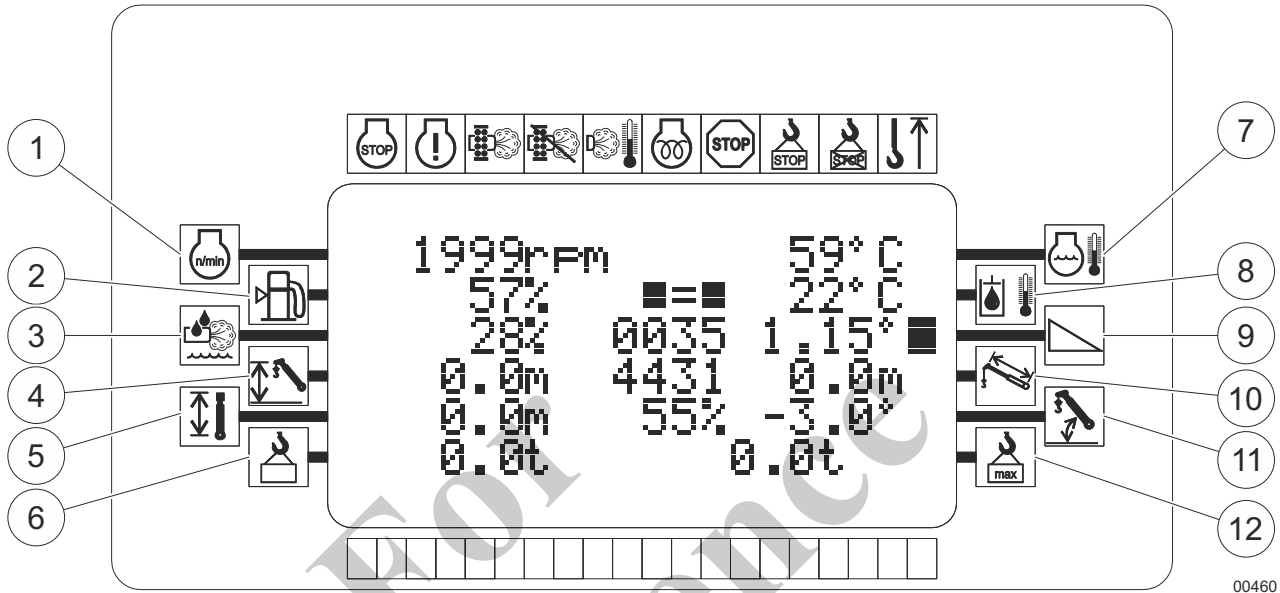


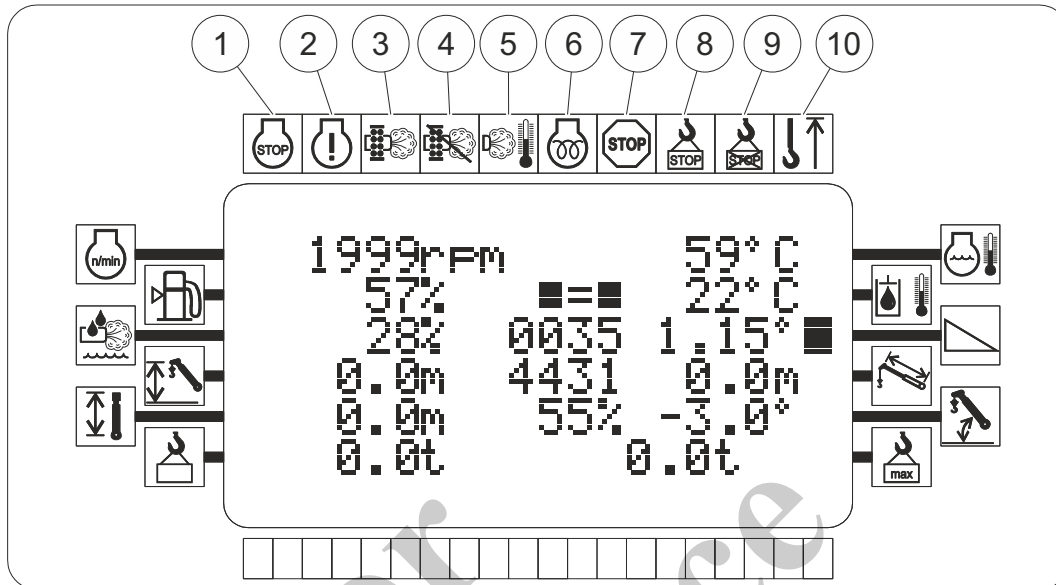
Fig. 102: Operating status display on the remote radio control

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	

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.



00461

Fig. 103: 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.

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

6.35 Assignment of the joysticks and pedals

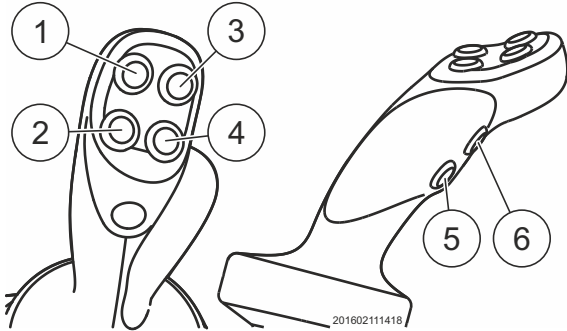
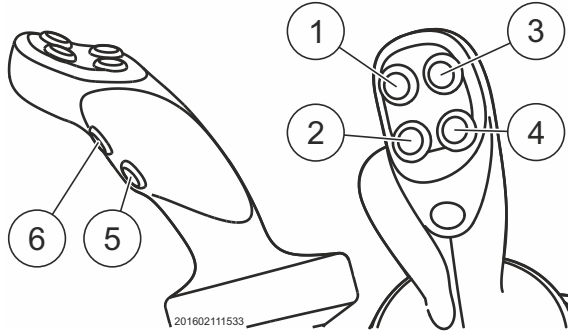
NOTICE

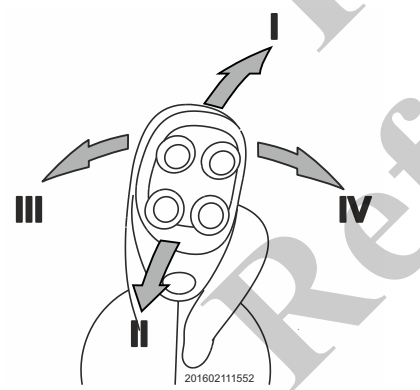
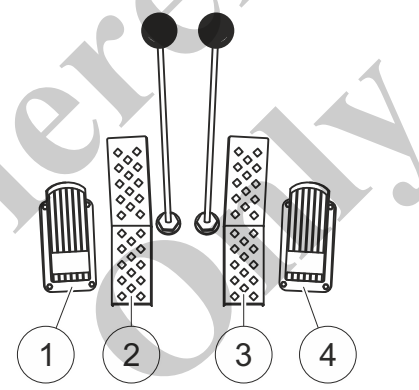
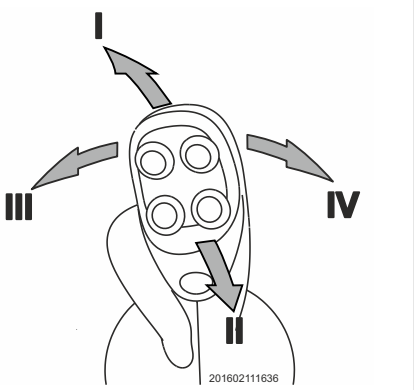
Risk of machine damage due to improper handling of slewing gear brake.

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

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

For Reference Only

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	Wind indicator on/off

					
I	Lower winch 2	1	Slewing gear service brake	I	Lower winch 1
II	Lift winch 2	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)

6.36 Travelling

6.36.1 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.

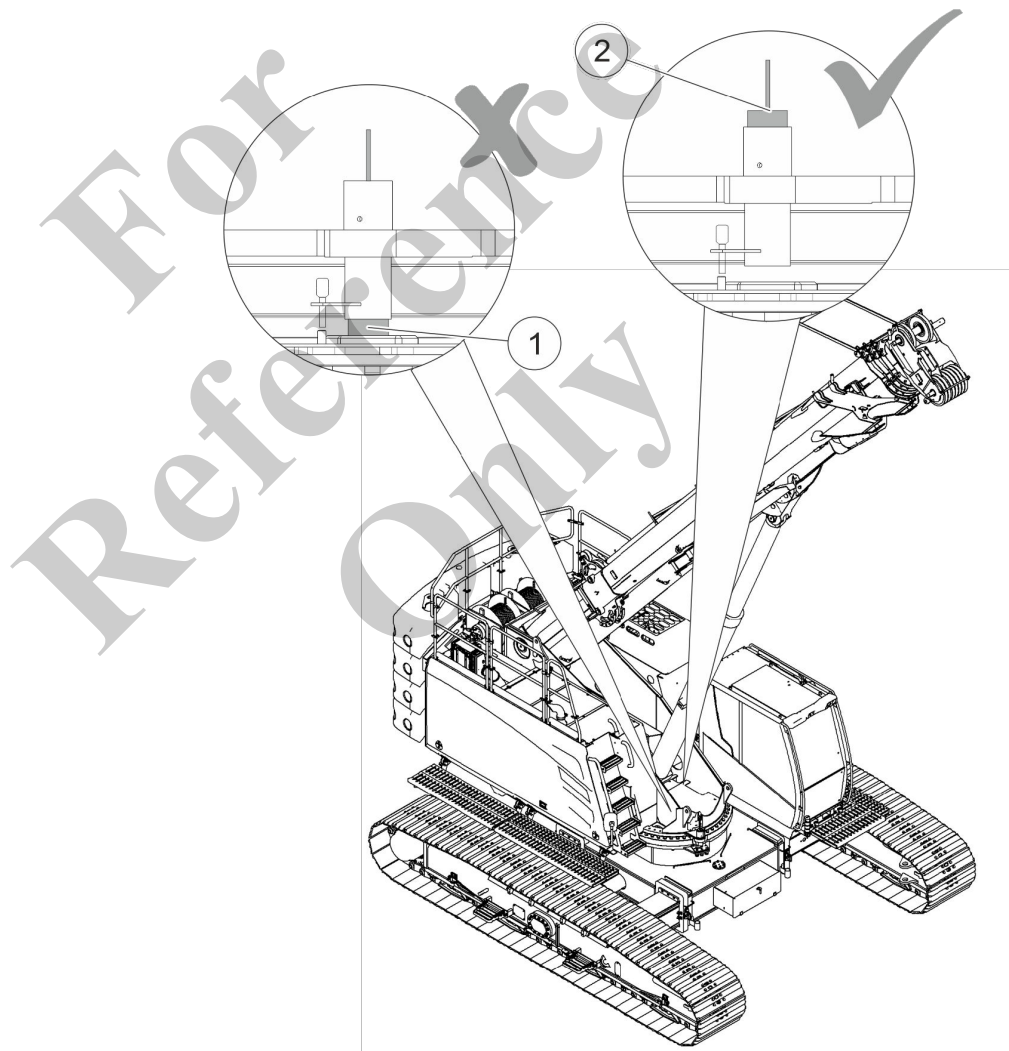


Fig. 104: Extended (2) and retracted (1) locking bolt (exemplary representation)

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.

6.36.2 Secure the bottom hook block on the uppercarriage

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.

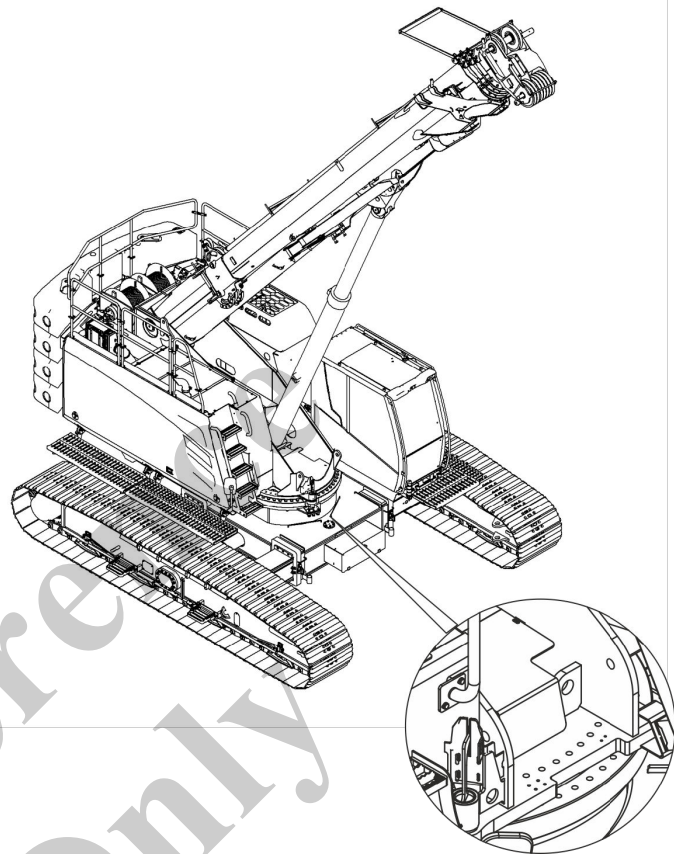


Fig. 105: Secure the bottom hook block on the uppercarriage

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. ➤ Mount the provided lifting harness onto the lifting lugs of the uppercarriage.
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.

6.36.3 Moving 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.



A red control arrow is located on the inner and outer side. 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. 	

Operation

Travelling > Moving the machine

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

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

6.36.4 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.

Reduced load capacity when traveling at a speed above 0.1 m/s over level ground

At speeds over 0.1 m/s (0.2 mph) a maximum of 90% of the permissible load capacity may be moved. At least 1 t (2204.62 lbs) or 500 kg (1102.31 lbs), depending on the machine model, must be deducted from the permissible load capacity. See table below.

Machine model	The reduced load capacity at speeds above 0.1 m/s (0.2 mph) is calculated from:
GHC 30	At least 500 kg (1102.31 lbs) must be deducted from the permissible load capacity and the reduced load capacity may not be more than 90% of the permissible load capacity.
GHC 55, GHC 75, GHC 130	At least 1 t (2204.62 lbs) must be deducted from the permissible load capacity and the reduced load capacity may not be more than 90% of the permissible load capacity.

6.36.5 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°
Max. boom length movable for the respective inclination	36 m (118.1 ft)	36 m (118.1 ft)	16.6 m (54.5 ft)	Moving with load is not permitted
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 4° table)	
Reeving	Same as at 100% load capacity			

i **Load capacity at 6° incline** The load capacity lessens to 25% of the corresponding 4° main boom table.

6.37 Work mode

6.37.1 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 travelling 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.
 - Activate parking brake.
 - 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 LML.

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

6.37.2 Tilting the cab

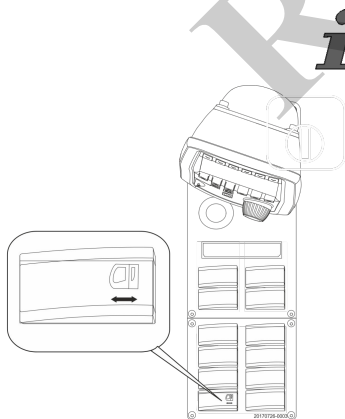
⚠ WARNING

Life-threatening danger of shearing and crushing with a tilted cab!

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

Persons can be crushed between the cab and the undercarriage.

The maximum backward cab tilt is 20°.



1. ➤ Start the diesel engine.
2. ➤ Configure the setup status of the machine on the SENCON.
3. ➤ Push the safety lever forward.
4. ➤ Increase the vehicle speed with the **Throttle adjustment** knob on the right of the control panel.
5. ➤ To increase the tilt, **lift - lower the cab tilts** press the switch down to the left.
6. ➤ To increase the tilt, **lift - lower the cab tilts** press the switch down to the right.

Fig. 106: Tilting the cab

6.37.3 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.



Uppercarriage slewing speed

The uppercarriage slewing speed depends on:

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



The uppercarriage slewing speed can be reduced on SENCON for precise work. The setting **uppercarriage slewing speed** is located on the speed dialing bar. The following settings are possible:

-  Reduced slewing speed.
-  Normal slewing speed.

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

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 with the function "slewing gear holding brake" on the left joystick.
 - ⇒ The slewing gear holding break is thereby unlocked.

Slewing the uppercarriage

1. ➤ Start the diesel engine.
2. ➤ Unlock the slewing gear holding brake.
3. ➤ Push the left joystick to the left.
 - ⇒ The uppercarriage is slewed to the left.
4. ➤ Push the left joystick to the right.
 - ⇒ The uppercarriage is slewed to the right.

i Releasing the joystick to the center position when the slewing gear freewheel is engaged and the uppercarriage is slewing allows the uppercarriage to continue slewing without losing speed. The slewing gear freewheel protects the slewing gear from excessive strain, such as can occur with swinging loads. 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).

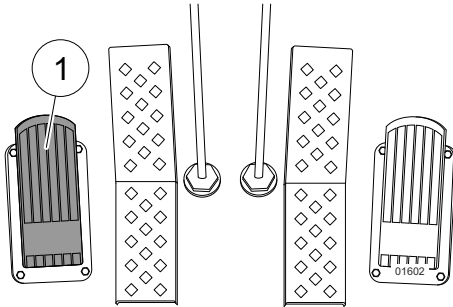


Fig. 107: Slewing gear service brake

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

Slewing gear freewheeling

i 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, such as can occur with swinging loads.

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 freewheel 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 freewheel cannot be engaged.

Powering the slewing gear freewheel on and off



1. Start the diesel engine.
2. Disengage the slewing gear holding brake.
3. Step on the slewing gear brake pedal and press the button with the function "slewing gear freewheel" 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 again with the function "slewing gear freewheel" on the left joystick.
 - ⇒ The slewing gear freewheel is on. The gray **Slewing gear freewheel disengaged** icon appears on the SENCON.

6.37.4 Lift and lower loads



- 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.



- 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.

Safety instructions

- Use approved sling gear that is suitable for the load and the application.
- Check sling gear before each use.

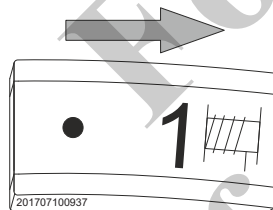
- Check the cable exit protection before each use.
- Subtract the weight of the sling gear from the maximum safe working load.
- Observe permissible wind speeds.
- Pay attention to the correct RCL settings.
- Make sure the rope has no slack.
- At low temperatures under 0°C (32°F) run the hoisting gear 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.

Lifting and lowering the bottom hook block

The bottom hook block on winch 1 is lifted and lowered by the right joystick.

The bottom hook block on winch 2 is lifted and lowered by the left joystick.

The raising and lowering speed depends on the speed of the diesel engine and the deflection of the joystick.



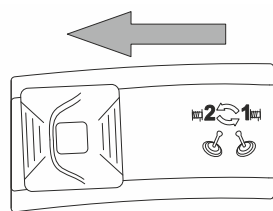
1. → Turn the **Activate winch** switch to the right.
2. → Push the right joystick forward.
 - ⇒ The bottom hook block will be lowered.
3. → Pull the right joystick back.
 - ⇒ The bottom hook block will be lifted.



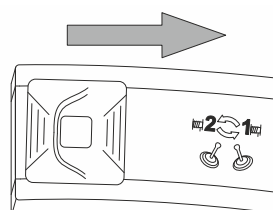
The lifting speed depends on the:

- 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.
 - ⇒ Winch 2 is operated with the left joystick.
 - Winch 1 is operated with the right joystick.



2. → Unlock the **Changeover winch 1-2** switch and turn it to the right.
 - ⇒ Winch 1 is operated with the left joystick.
 - Winch 2 is operated with the right joystick.

6.37.5 Operate with two winches

6.37.5.1 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 6.37.5.3 “Lift with two winches” on page 207 \(A\) and \(B\)](#). Any other working methods are prohibited, see [Chapter 6.37.5.3 “Lift with two winches” on page 207 \(C\) 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.

6.37.5.2 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.

6.37.5.3 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.

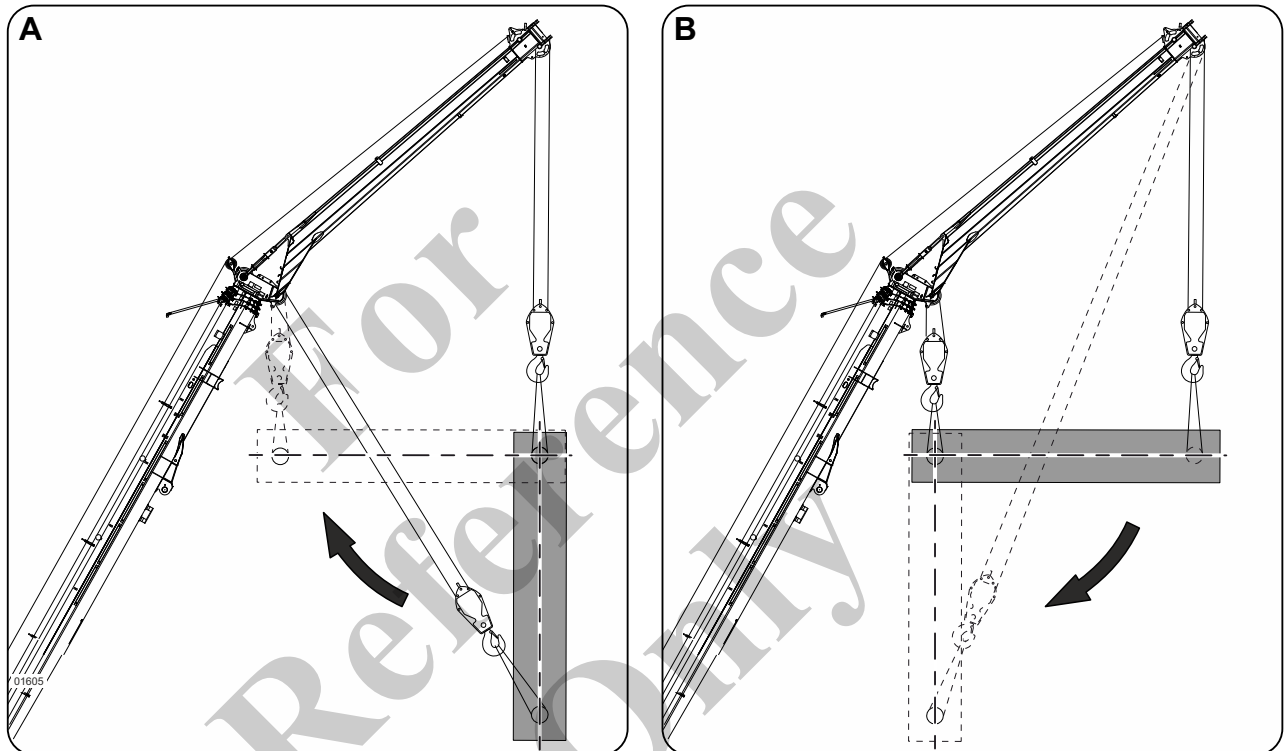


Fig. 108: Permitted operation methods when working with 2 winches

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.

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

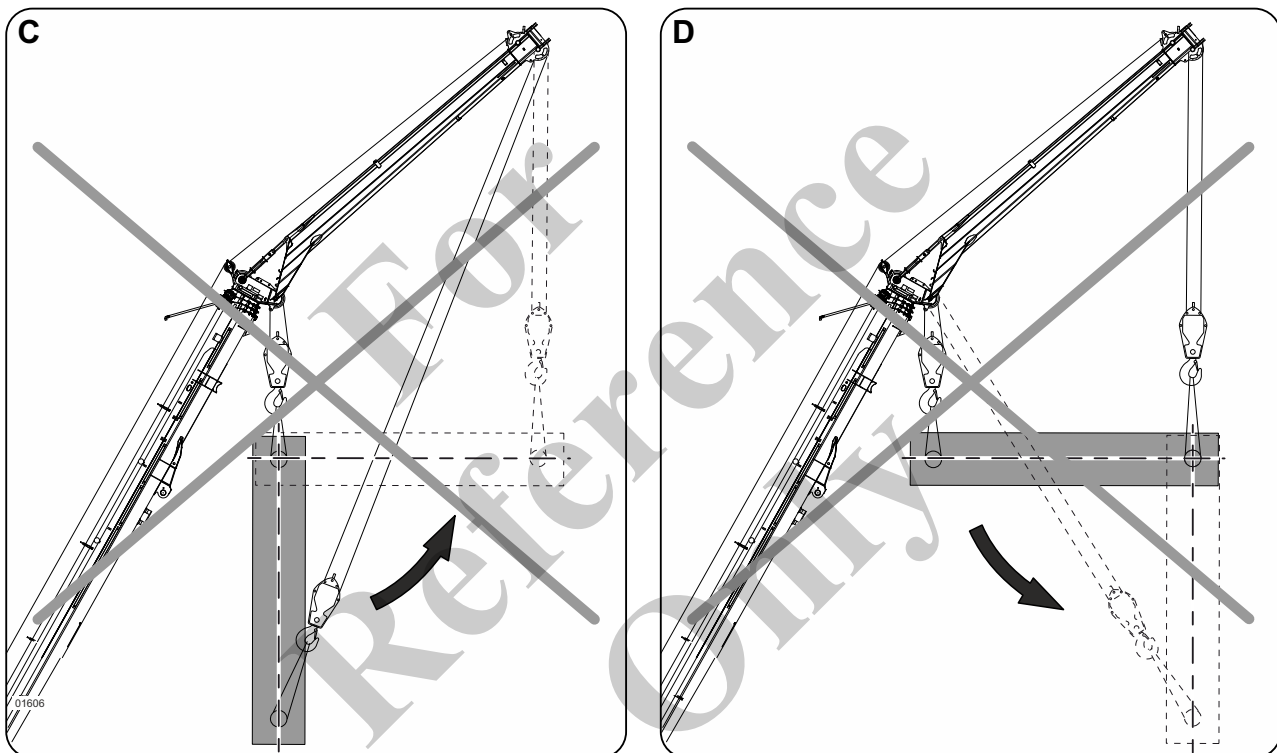



Fig. 109: Prohibited operation methods when working with 2 winches

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.

6.37.5.4 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.

Using the subject crane to perform tilt-up panel lifting with two hoist lines poses new and different hazards than does normal lifting use. Therefore, the following additional precautions must be taken if it is necessary for the crane to be used to perform tilt-up panel lifting using a crane equipped with two hoists:

- The crane must be set up and operated in accordance with Grove's instructions in the Operator and Safety Handbook, Load Capacity Chart, and decals affixed to the crane.
- The wire rope from the main hoist shall be reeved over the main boom nose reeved for two parts of line.
- The wire rope from the auxiliary hoist shall be reeved over the auxiliary boom nose reeved for one part of line.
- The load shall be connected with the main hoist line connected to the end closest to crane and the auxiliary hoist line connected to the end farthest from the crane.
- The anti-two block system shall be installed and inspected to confirm that it is active to monitor both hoist lines.
- The RCL hoist selection shall be set to main hoist and two parts of line.
- The wire rope and sheaves shall be inspected prior to and following the lifting operations for chaffing or scrubbing.
- The total gross load shall not exceed 80% of the standard load chart. The operator shall be responsible to control this as the RCL does not have a feature to set reduced lifting limits.
- The auxiliary hoist line shall be considered part of the deducts to determine net allowable load.
- The panel shall be lifted so that the hoist lines are in line with the crane.
- The load shall be controlled to prevent rotation of the load and to ensure the load stays in line with the boom.
- The load must be balanced with the auxiliary: load line not taking more than half the load at any time during the lift. The RCL will not be providing coverage for the line pull of the auxiliary hoist line.

- The effect of wind loads on the crane and panel shall be taken into consideration. Operations shall be halted if the wind can cause a loss of control in handling the load.
- The main hoist line shall be used to raise the panel into the vertical position.

Ensure that all personnel working on and around the crane are properly trained and thoroughly familiar with operational functions of the crane and safe operating and work practices. Personnel should be thoroughly familiar with regulations and standards governing cranes and their operation.

Work practices may vary slightly between government regulations, industry standards, local and job-site rules and employer policies so a thorough knowledge of and compliance with all relevant work rules is necessary.

6.37.6 Lifting and lowering the telescopic boom

▲ WARNING

Danger of personal injury and danger of machine damage due abrupt 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.

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 6.25.7 "Bypass LML" on page 167*

6.37.7 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

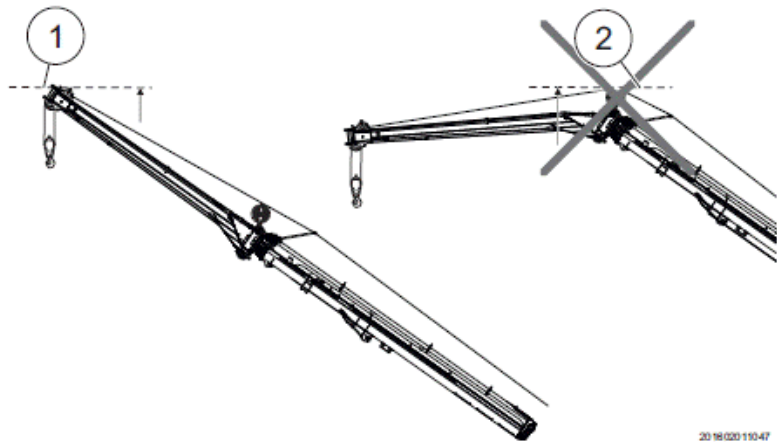
1. → Push the right joystick forward.
⇒ The telescopic boom is extended.
2. → Pull the right joystick back.
⇒ The telescopic boom is retracted.

6.37.8 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.



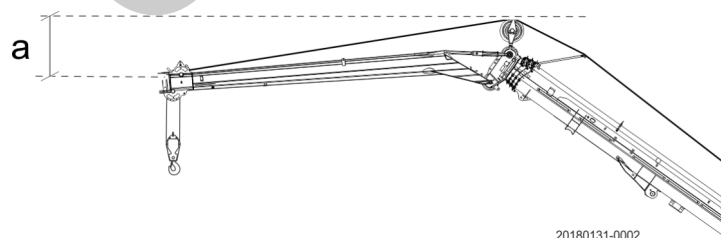
NOTICE

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)

6.37.9 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 LML 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.

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 LML 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

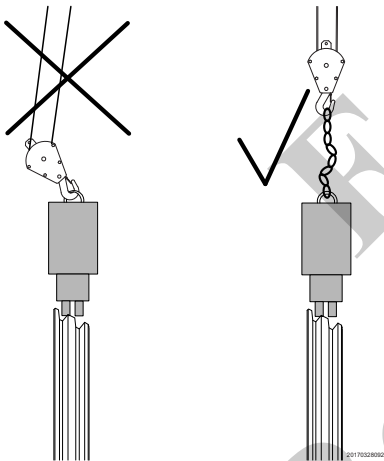


Fig. 110: Avoiding rope slack when driving pile elements

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

6.38 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. → Turn off the battery disconnect switch.
11. → Secure the work tool.
12. → Lock undercarriage.

6.39 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 bearing capacity at the attachment points.
 - Make sure no one is under suspended loads when performing setup tasks.
 - Observe applicable accident prevention regulations when working with load suspension equipment.
 - 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 Steps

⚠ WARNING

Risk of crushing due to moving machine parts.

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

- Have a banksman help you.
- Make sure no unauthorized persons are in the danger zone while working.
- Attach all locking bolts prior to moving the undercarriage.

⚠ WARNING

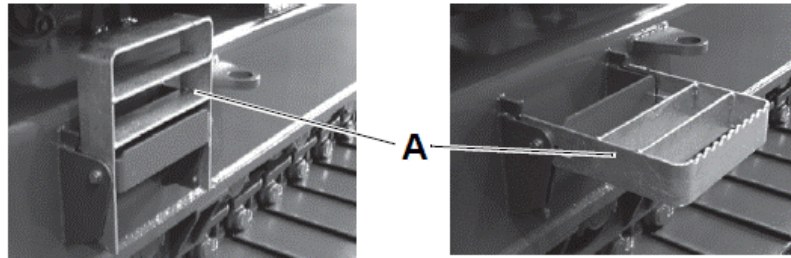
Risk of injury due to slippery surface.

Persons can slip on dirty steps and injury themselves.

- Clean the steps immediately of mud, oil, lubricating grease or snow.
- Always wear shoes that meet the requirements specified in the applicable accident prevention regulations in the country where the machine is operated.

Setup

Track widths > Track width markings



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

They must also be folded out while the machine is being transported. To fold out the steps, proceed as follows:

Folding out a step

1. ➤ To unlock the arrested access ladder (A) pull it upward.
2. ➤ Slowly lower the step (A) until it is completely horizontal.

Stowing a step

1. ➤ Lift the lowered step (A) until it is completely against the side wall.
2. ➤ Pull the locking mechanism upward and let it lower.

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.

Safety instructions

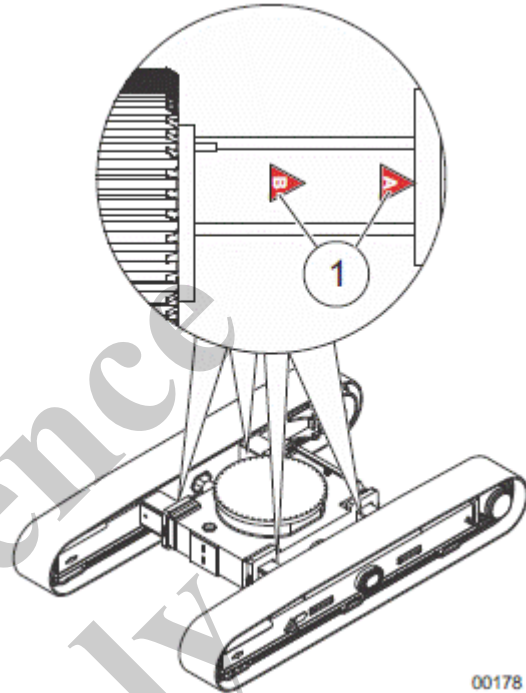
- Before extending, align the uppercarriage with the undercarriage and apply the slewing gear brake to prevent twisting.
- Do not slew the uppercarriage while retracting.

7.3.2 Track width markings

The undercarriage has arrows (1) 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	4.4 m (14.4 ft)
B	3.5 m (11.5 ft)
Undercarriage fully retracted	2.6 m (8.6 ft)



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7.3.3 Increasing the track width

NOTICE

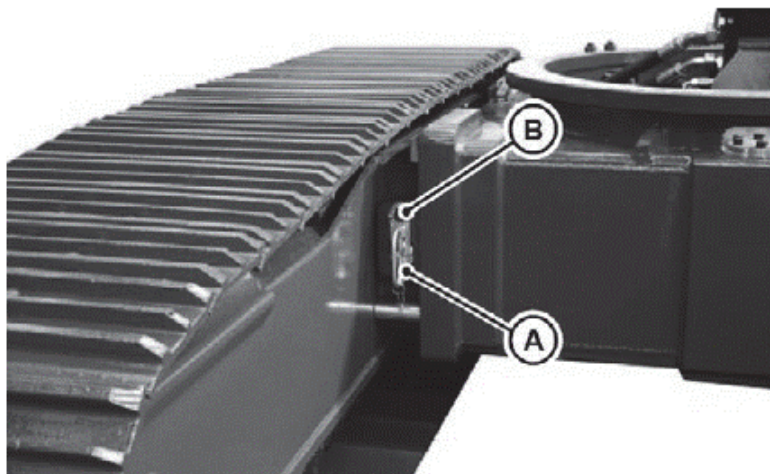
Risk of damage to the machine.

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

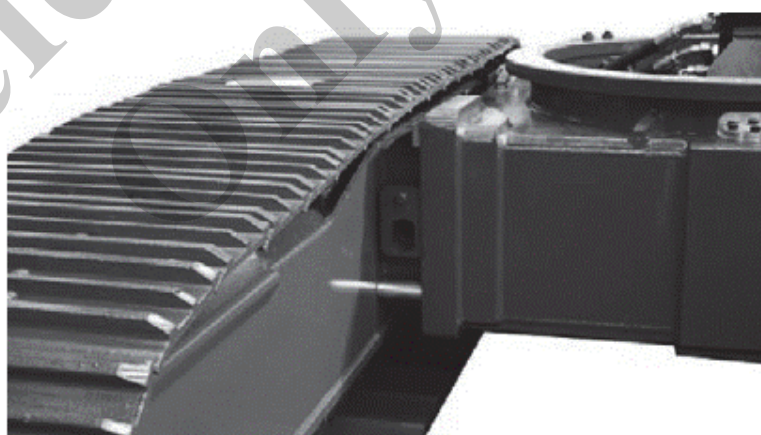
- **Never drive in obstructed bolts with hammers or mallets.**

Setup

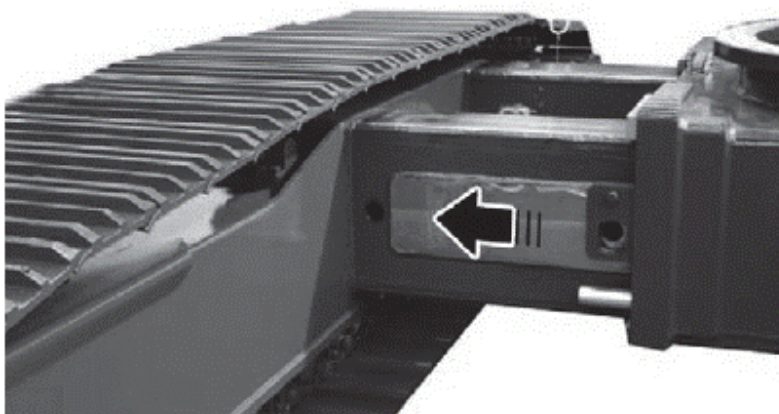
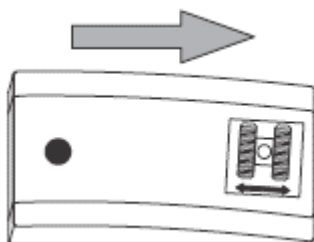
Track widths > Increasing the track width



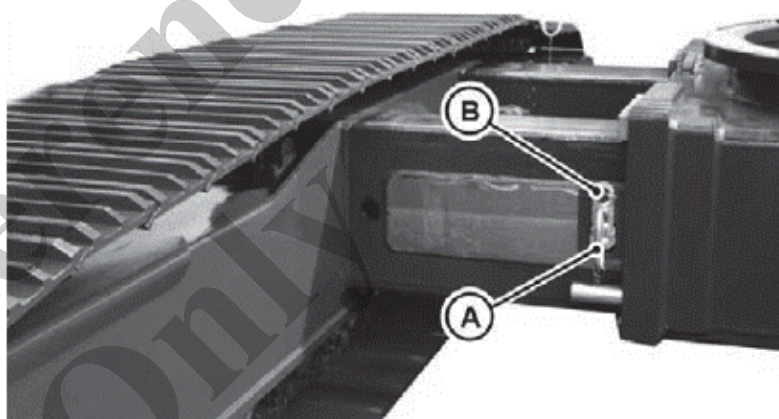
1. ➤ Prepare a clean collection container for the bolts.
2. ➤ Go to the front area of the undercarriage.
3. ➤ Remove the latch pins (B) on both bolts (A).
4. ➤ Pull out bolts (A) and place them in the container prepared for this purpose.
5. ➤ Go to the rear area of the undercarriage.
6. ➤ Remove the latch pins (B) on both bolts (A).
7. ➤ Pull out bolts (A) and place them in the container prepared for this purpose.



8. ➤ Press the **Release undercarriage telescoping** button on the right control panel to the right and hold it until the travel gear has reached the required track width.



9. → Reinsert all bolts (A).
10. → Reattach all latch pins (B).



7.3.4 Decreasing the track width

⚠ WARNING

Risk of death due to machine tipping over.

When retracting the track width, the following conditions must be met before the uppercarriage is swung over the side.

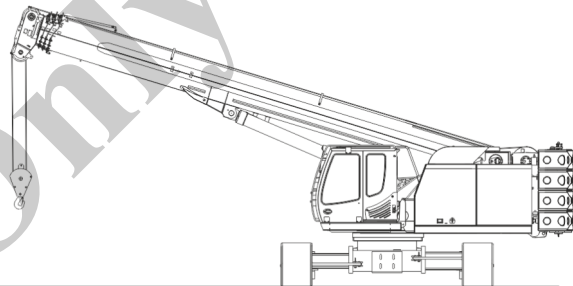
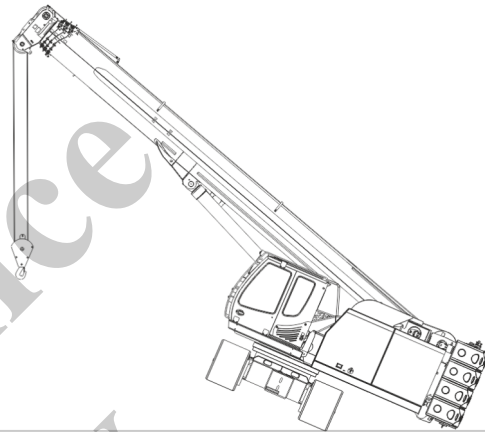
- With full counterweight - the radius must be at least 9.14 m (30 ft) and the boom length must be 13.7 m (45.3 ft).
- Without counterweight - the boom must be fully retracted and the radius should be 7.6 m (25 ft) and the boom angle should be at 30°.

⚠ WARNING

Risk of death due to machine tipping over.

Slewing the uppercarriage with maximum counterweight and undercarriage fully retracted can cause the machine to tip over. This can cause death or serious injury.

- In work mode, when performing maintenance on or setting up the machine with full counterweight, never work with the undercarriage fully retracted.
- Before retracting, align the uppercarriage with the undercarriage in the direction of travel and secure it.
- Do not slew the uppercarriage while retracting.







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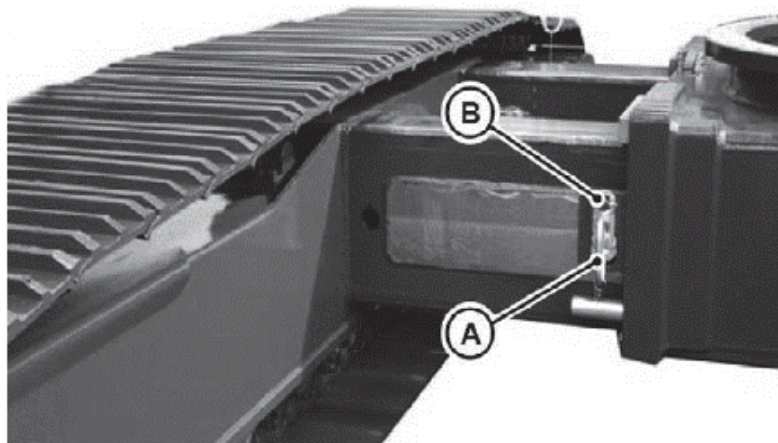
NOTICE

Risk of damage to the machine.

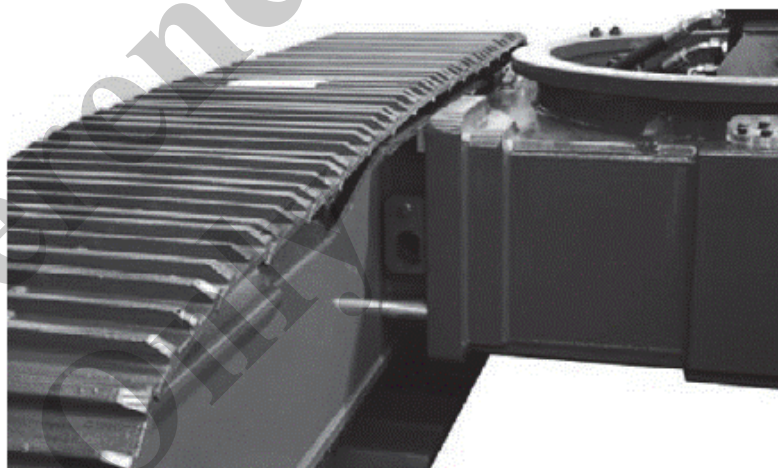
Undercarriage and bolts will be damaged due to improper bolt insertion.

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

1.  Prepare a clean collection container for the bolts.
2.  Go to the front area of the undercarriage.
3.  Remove the latch pins (B) on both bolts (A).
4.  Pull out bolts (A) and place them in the container.



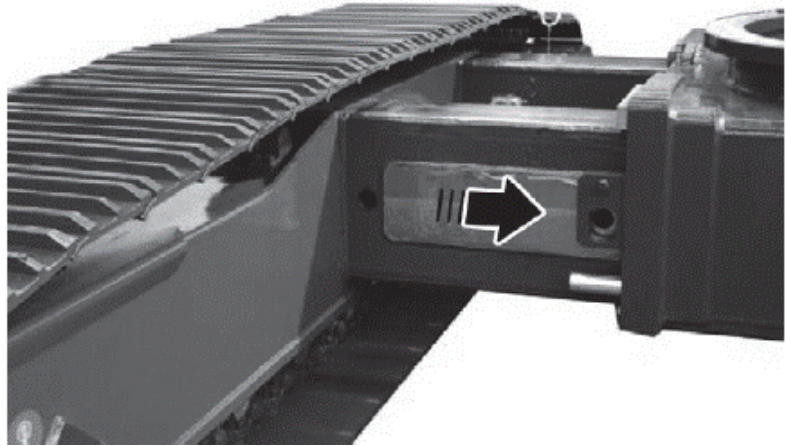
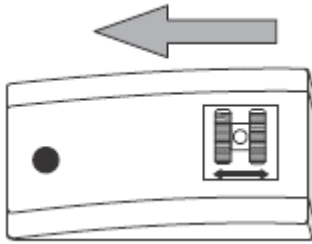
5. → Go to the rear area of the undercarriage.
6. → Remove the latch pins (B) on both bolts (A).
7. → Pull out bolts (A) and place them in the container.



8. → Press the **Release undercarriage telescoping** button on the right control panel to the left and hold it until the travel gear has reached the required track width.

Setup

Setup mode



9. ▶ Reinsert all bolts (A).
10. ▶ Reattach all latch pins (B).

7.4 Setup mode

Operating modes are selected on the SENCON.

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

- Reeving
- Stacking the counterweight (support bracket and ballast blocks)
- Attaching the undercarriage ballast
- Setting up the auxiliary jib

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

- Setting up the fly boom (SA8/SA15)
- Setting up the elevating work platform
- Lubricating the boom

Certain operating parameters must be configured on the SENCON in order to use operating modes **Setup Ballast** and **Setup Equipment**.

The **Setup Ballast** operating parameters do not affect the current machine configuration. The **Setup Equipment** operating parameters must correspond to the current machine configuration.

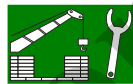
Once setup is complete, the operating parameters must be set according to the machine configuration.

NOTICE

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

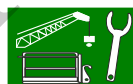
The lifting limit switch is bypassed when the boom angle is less than 25°. If the load hook is lifted too quickly while the lifting limit switch is bypassed or if the safety distance to the boom head is not maintained, the load hook can strike the boom head. This can cause severe damage to the machine.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

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



Required operation parameters for Setup Ballast

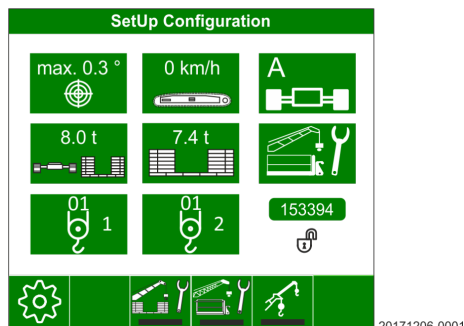
Name	Value to be applied	Icon display in SENCON
Uppercarriage inclination	2°	max. 2.0°
Track width	A 14.4 m (4.5 ft)	A
Counterweight	0 t (0 lbs)	0 t
Select operating mode	Setup ballast	



Required operation parameters for Setup Equipment

Name	Value to be applied	Icon display in SENCON
Uppercarriage inclination	0.3°	max. 0.3°
Track width	A 14.4 m (4.5 ft)	A
Counterweight	17.8 t (39 242 lbs)	17.8 t
Select operating mode	Setup equipment	

7.5 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" or "Setup Ballast" softkey immediately switches to the respective setup mode.

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

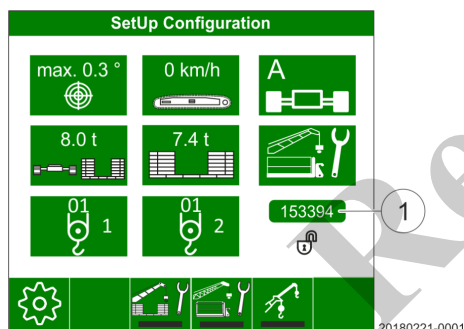
Softkey - setup ballast



Fig. 111: Setup ballast

The following set-up work can now be carried out:

- Reeve hook
- Use low-bed trailer
- Cooperatively lifting the ballast



→ Press the softkey in the "home screen" window.

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

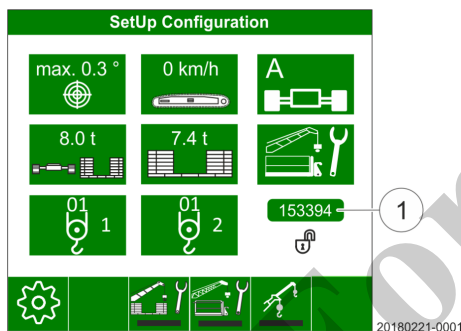
i The lifting limit switch is automatically bridged from a boom angle below 20°.

i The minimum radius is limited to 5 m when selecting the "Setup Ballast" icon. If a minimum radius of less than 5 m is required for the set-up work, the "setup ballast" operating mode is carried out via the normal selection routine. See Chapter 7.4 "Setup mode" on page 224

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

i For setup ballast, track width monitoring is active.

Softkey - setup attachment



The following set-up work can now be carried out:

- Set-up the tip
- Setting up the elevating work platform
- Lubricating the boom

Only install the attachment if the following conditions are met:

- Maximum track width
- Maximum counterweight

➔ Press the softkey in the "home screen" window.

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



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

For setup the tip, track width monitoring is active.


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

The operating mode "Set-up attachment" can also be carried out via the normal selection routine. See Chapter 7.4 "Setup mode" on page 224

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).



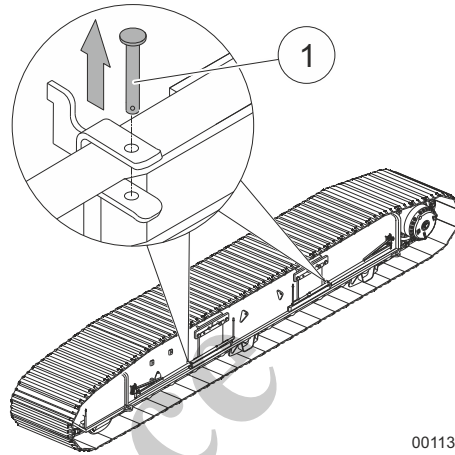
Once the ignition is switched off, the strand count is reset to the initial value.

NOTICE

Further precautions and requirements follow to ensure secure operation.

7.6 Set up the swing barrier protection (option)

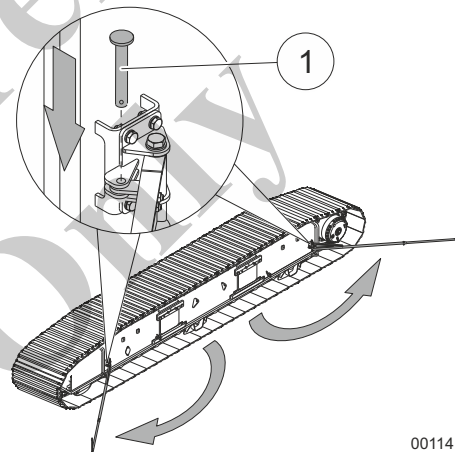
The swing barrier protection indicates the swing range of the uppercarriage in work mode. When in work mode, all persons must stay clear of the swing range.



00113

Fig. 112: Unlocking the swing barrier protection

1. → Pull the locking bolt (1) in out of the swing barrier protection.



00114

Fig. 113: 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.

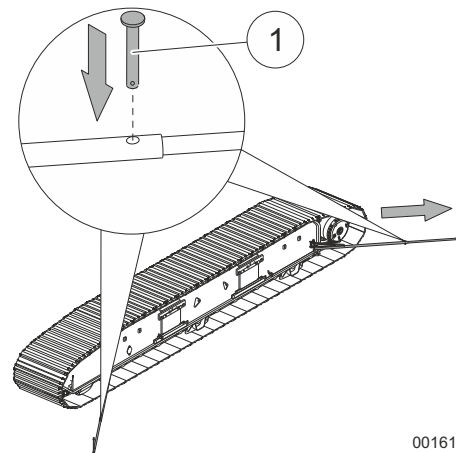


Fig. 114: Pulling out the swing barrier protection

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.

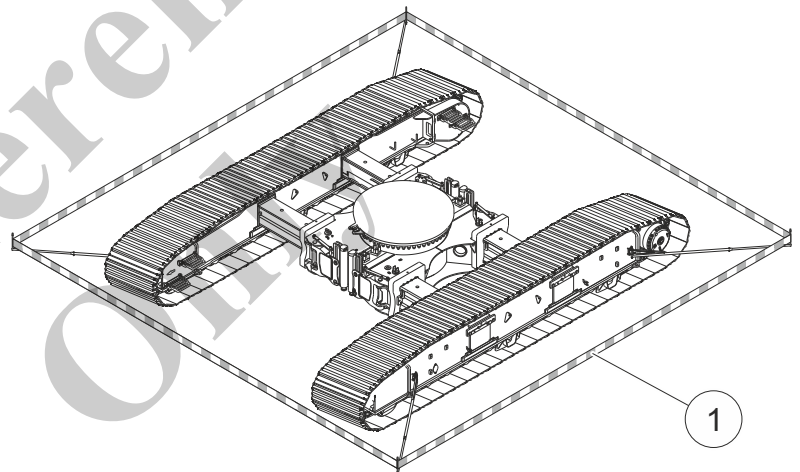


Fig. 115: Applying barrier tape

6. → Apply barrier tape (1).

7.7 Installing the counterweight

7.7.1 Counterweight components

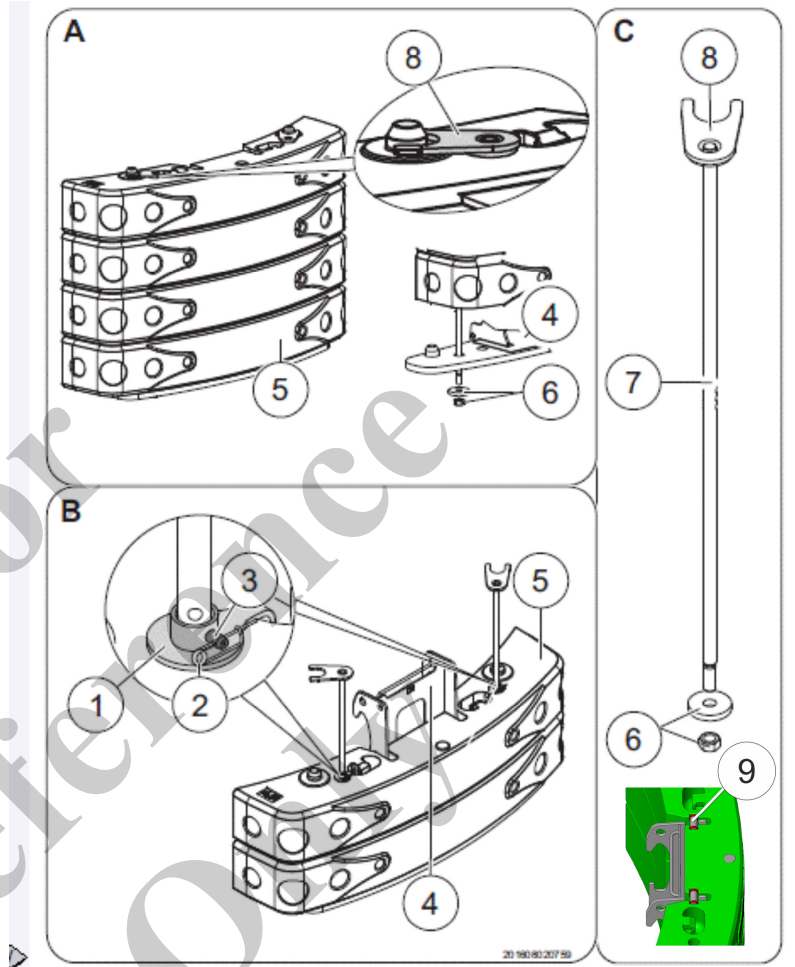


Fig. 116: Components of the counterweight

- A Variant A: Counterweight, 17.8 t (39242 lbs)
- B Variant B: Counterweight, 9.3 t (20502 lbs)
- C Ballast rod with welded anti-twist device
- 1 Locking mechanism
- 2 Retaining spring
- 3 Pin
- 4 Ballast bracket
- 5 Ballast blocks, 4 pc. (individual weight: 4.3 t (9,479 lbs))
- 6 Hex nut, washer
- 7 Ballast rod
- 8 Anti-twist device (welded)
- 9 Steel bolts, 2 pieces

7.7.2 Safety instructions

- Always use a banksman when removing the counterweight.
- Eye contact between the crane operator and the banksman must be maintained.
- Make sure no one is in the danger zone when installing or removing the counterweight.
- Do not change the setup mode in the SENCON while installing or removing the counterweight.
- Wear personal protective equipment.
- Do not move the machine while installing or removing the counterweight.

The counterweight is installed in three stages:

- Attaching the ballast support.
- Lifting the counterweight onto the ballast support.
- Lifting the counterweight onto the uppercarriage.

7.7.3 Attaching ballast support

Safety instructions

- Make sure that no person is on or under the ballast support.
- Only use the suspension gear and shackles that came with the machine.
- Do not allow the suspension gear to become twisted and be sure to keep it even on both sides.

To detach the counterweight, the ballast support must be present. If necessary, attach the ballast support. See Section [Chapter 7.7.3 "Attaching ballast support" on page 231](#)

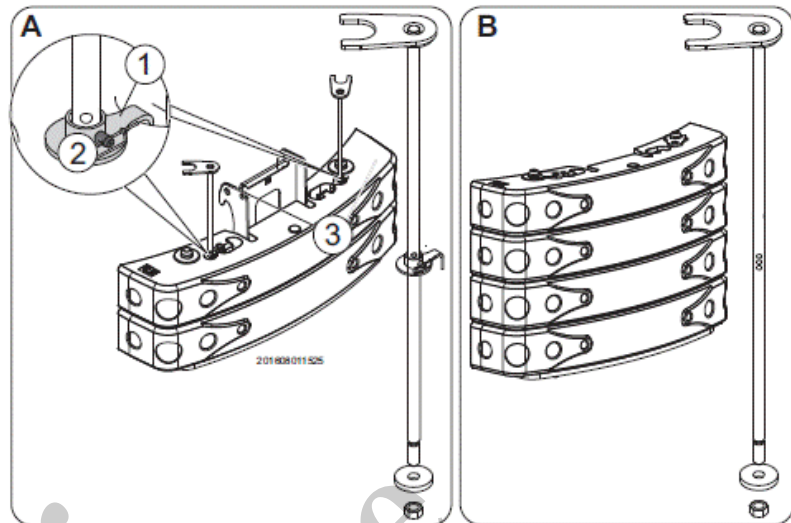
7.7.4 Lifting counterweight onto ballast support

Safety instructions

- Only lift one single ballast block of the counterweight onto the bracket at a time.
- Make sure no one is on or under the counterweight.
- Only use the suspension gear and shackles that came with the machine.
- Do not allow the suspension gear to become twisted and be sure to keep it even on both sides.
- Make sure the counterweight components do not collide with the machine.

Setup

Installing the counterweight > Lifting counterweight onto ballast support

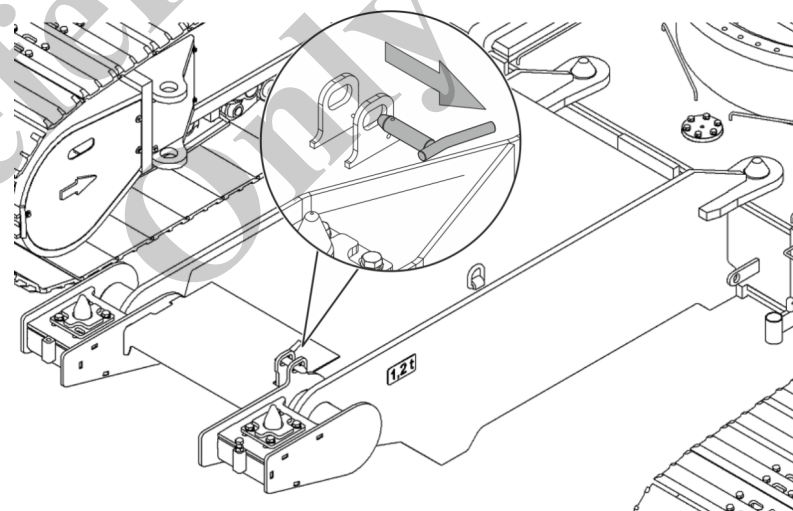


A: Variant: Counterweight, 9.3 t (20,502 lbs)

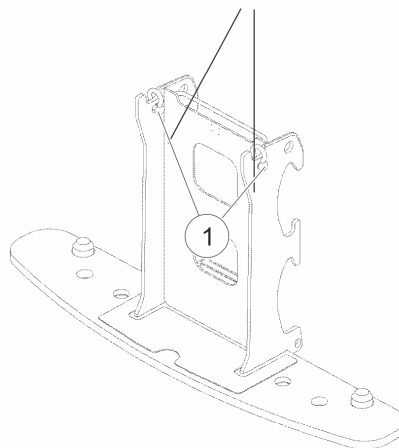
B: Variant: Counterweight, 17.8 t (39,242 lbs)

1. Position the lowbed trailer for the ballast blocks and ballast bracket near the machine.

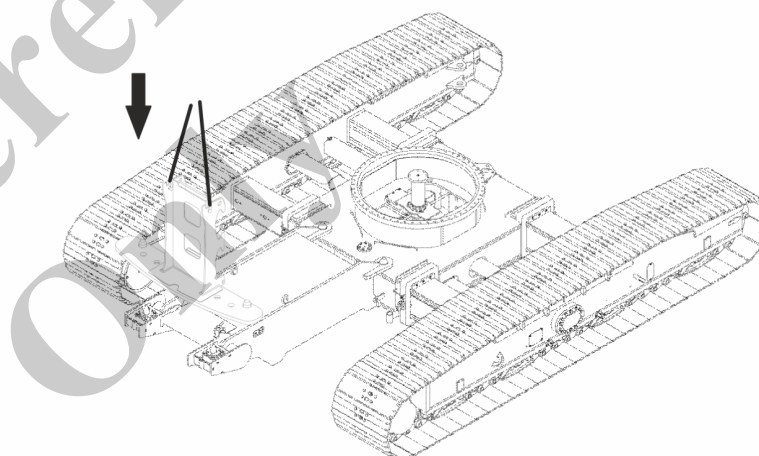
i Components (1) and (2) are not used at max. ballast. Make sure that components (1) and (2) are stored safely in the toolbox.



2. Position the stops on the ballast rods.
 - show the setting for 9.3 t (20,502 lbs) counterweight.
3. Remove the bolts from the top of the ballast support.



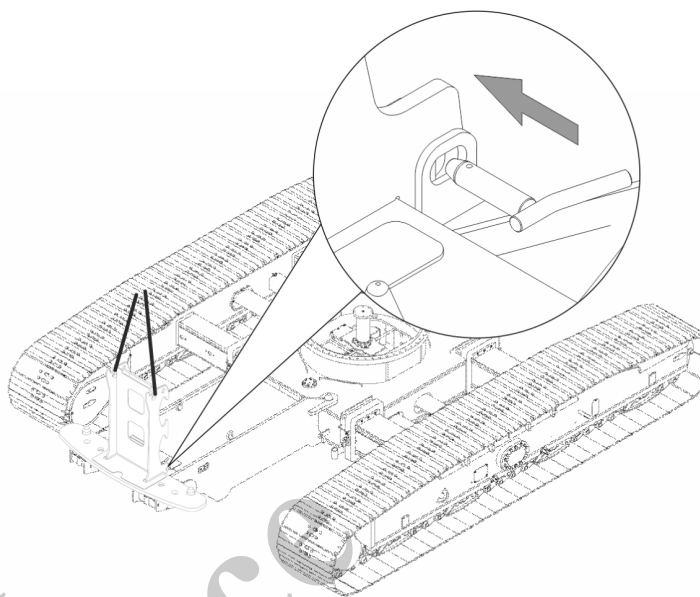
4. → Attach a load hook to the suspension gear that came with the machine, attach the other end of the load hook to the lifting points (1) on the ballast bracket, then tension slightly.



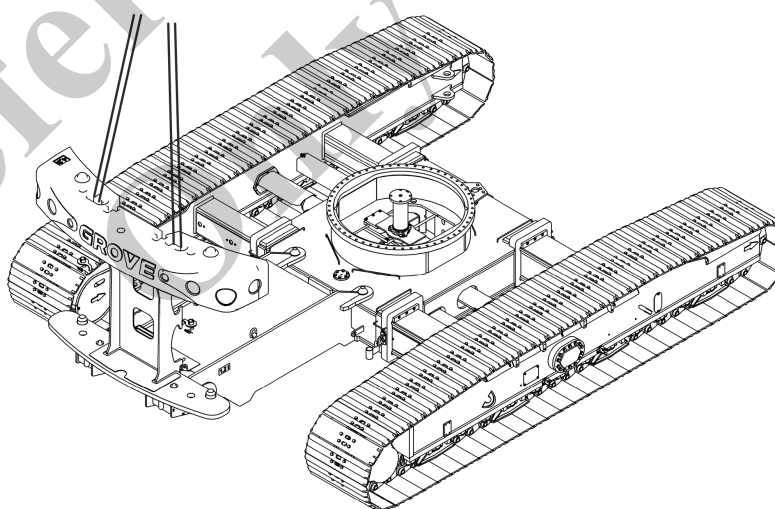
5. → Lift the ballast bracket onto the ballast support and set it in the bracket.

Setup

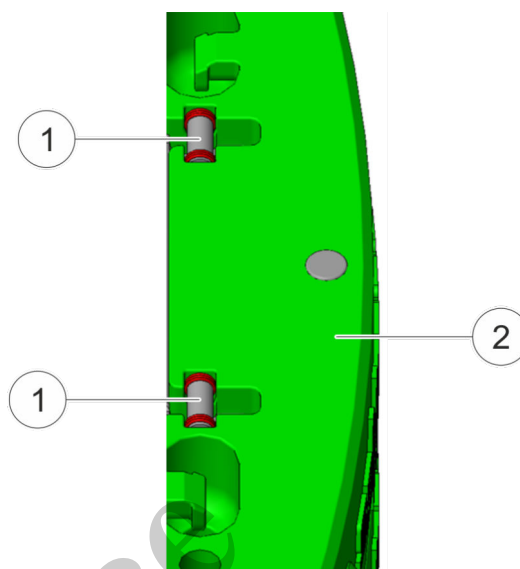
Installing the counterweight > Lifting counterweight onto ballast support



6. → Fasten the ballast bracket to the ballast support and secure it with retaining springs.
7. → Detach the suspension gear.



8. → Attach a load hook to the suspension gear that came with the machine, attach the other end of the load hook to the lifting points of a ballast block, then tension slightly. Perform the process with each ballast block.
9. → Carefully lift two ballast blocks one after the other onto the ballast bracket.



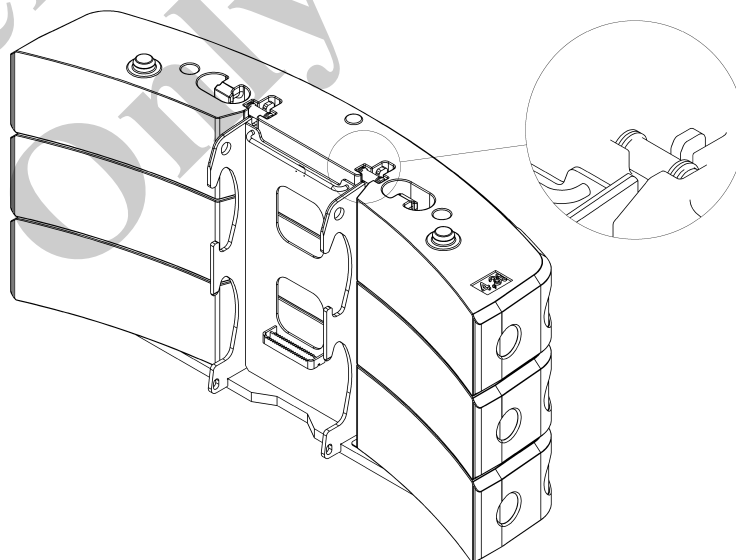
20171025-0002

Fig. 117: Ballast stone

- 1 Steel bolts
- 2 Ballast stone

10. Place the steel bolts in the third ballast block.

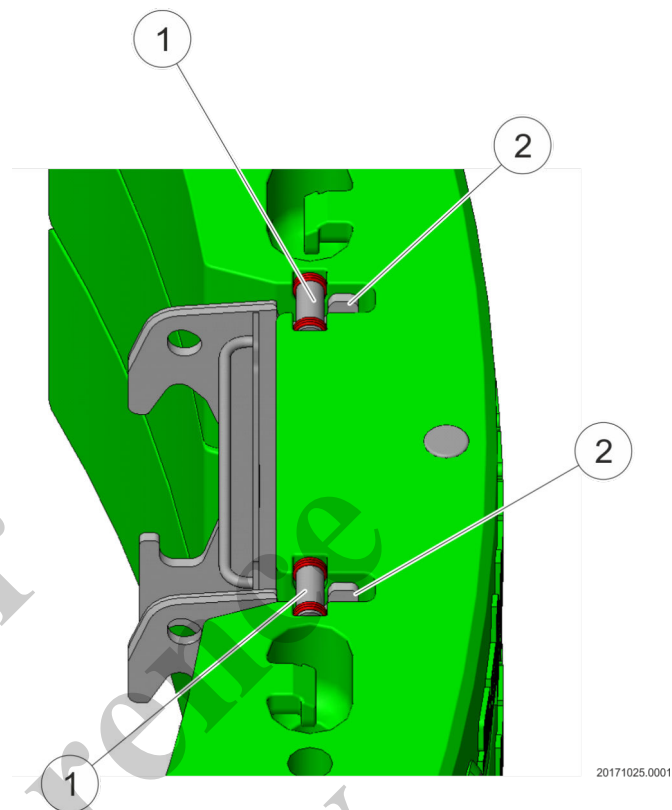
i The steel bolts serve as an additional safety measure



11. Use the steel bolts as the third ballast block to lift the ballast stone onto the ballast bracket.

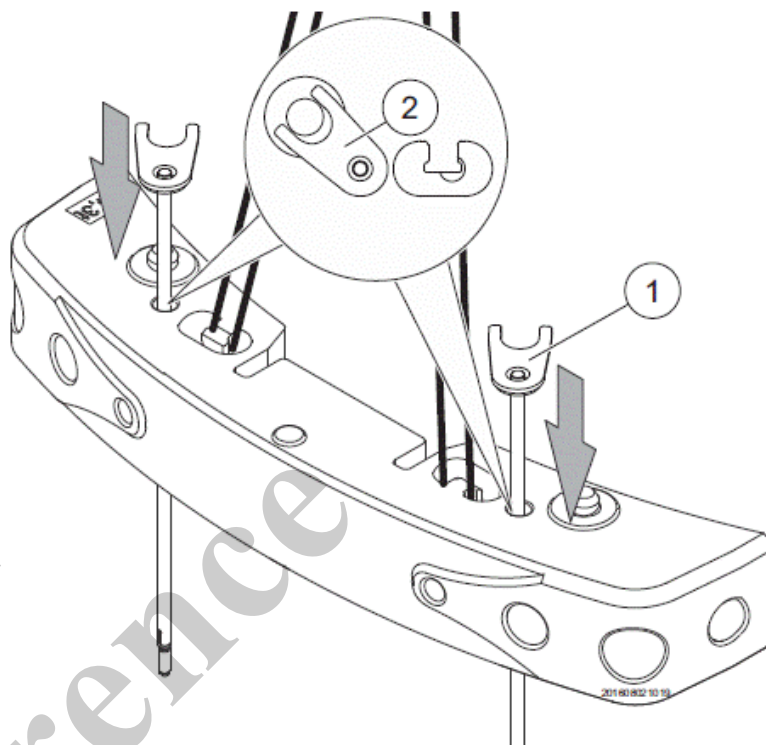
Setup

Installing the counterweight > Lifting counterweight onto ballast support



- 1 Steel bolts
- 2 Tabs of the ballast bracket

12. Make sure the two bolts are correctly in the pouches and behind the tab of the ballast bracket.

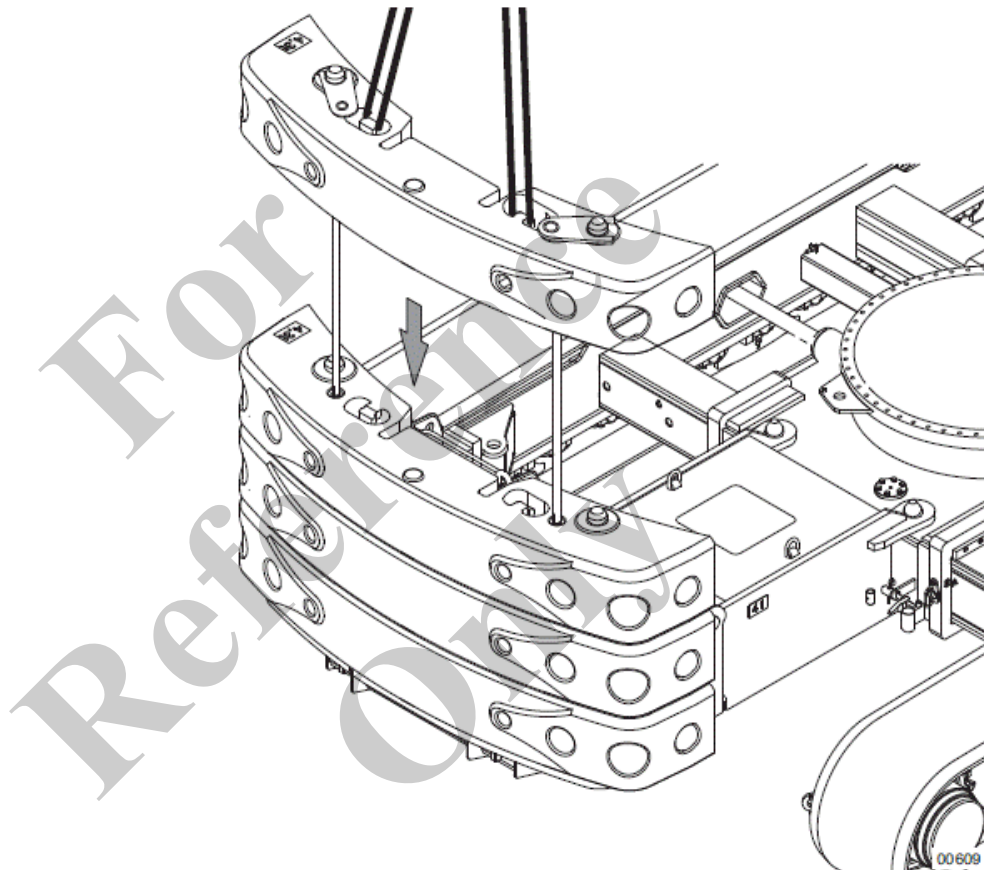


13. Attach the ballast rods (1) to the last ballast block at position (2).
14. Carefully lift the ballast block onto the stacked ballast bracket.

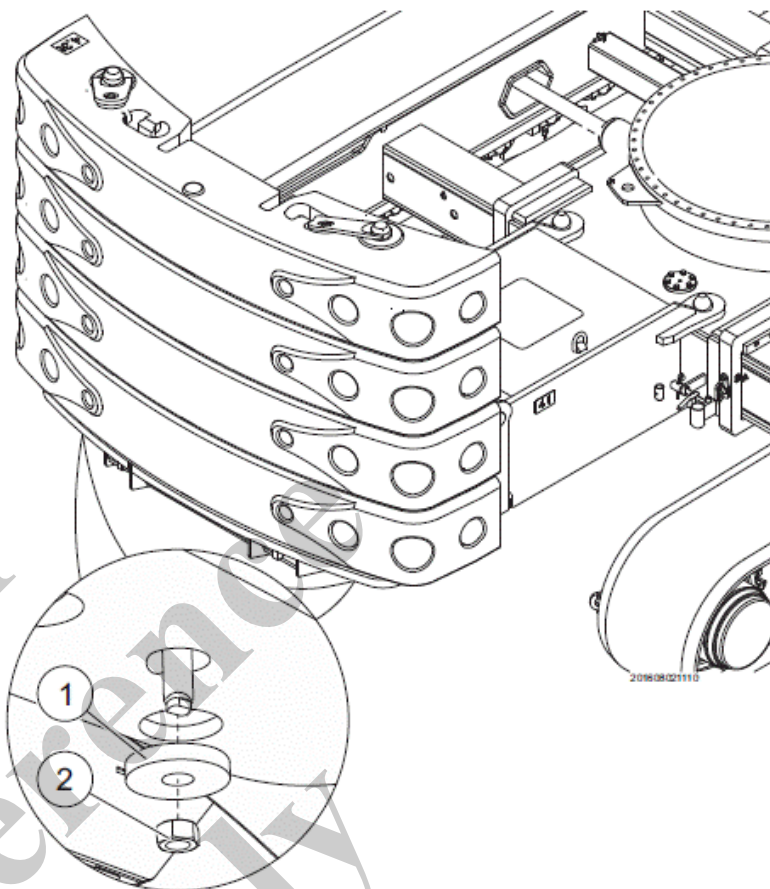
▲ WARNING! Risk of injury due to improperly placed ballast blocks.

When slewing the uppercarriage, ballast blocks that are not placed correctly on top of each other strike obstructions or persons. Persons will be injured and material damage occurs.

- Make sure all ballast blocks are seated properly.
- Make sure the ballast rods are in the correct position (no projecting from bottom).
- Make sure all ballast locks are tightly interlocked.



- 15.** ▶ Slide the ballast rods through the ballast blocks and ballast bracket from above.



- 16.** Set washer (1) on the ballast rods and tighten the ballast rods with the hex nut (2) (tightening torque 1000-1500 Nm).
- 17.** Tighten the second ballast rod in the same manner.

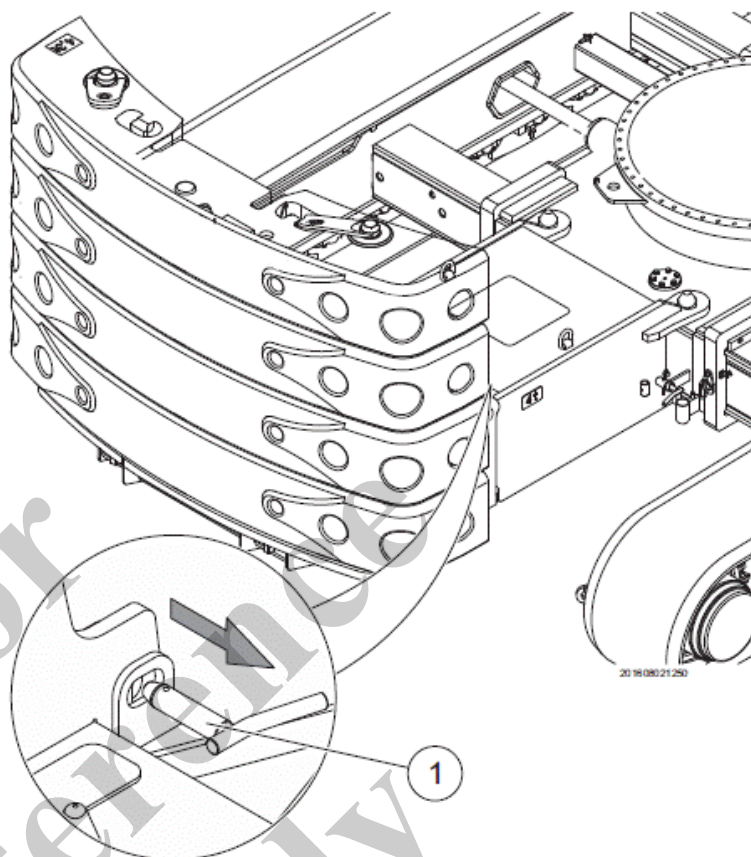
7.7.5 Lifting counterweight onto uppercarriage

Safety instructions

Make sure no one is on or under the counterweight.

Setup

Installing the counterweight > Lifting counterweight onto uppercarriage



1. → Enter the cab.
2. → Align the uppercarriage with the undercarriage in the direction of travel.
⇒ The uppercarriage should be at 0°.
3. → Lock the uppercarriage at 0°.
4. → Release and remove the bolts (1) between the ballast bracket and the ballast support.



Fig. 118: Uppercarriage is locked



Fig. 119: Ballasting mode is switched on

5. → Open the Setup window in the SENCON and select "Ballasting mode".

SENCAN Setup menu icons

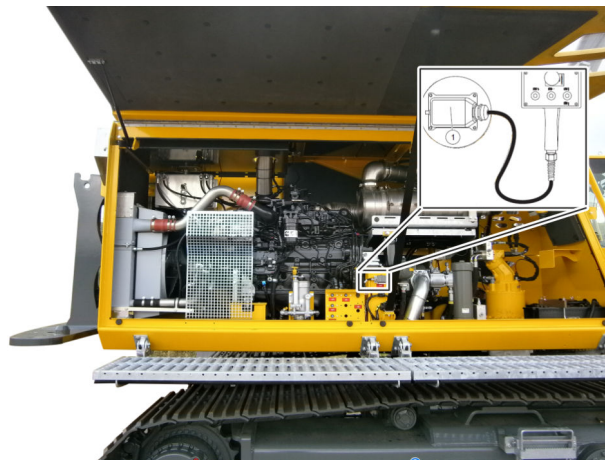
Icon	Name
	Grey: Uppercarriage is unlocked
	Green: Uppercarriage is locked
	Grey: The ballasting operation is switched off
	Green: The ballasting operation is switched on
	Green: Left locking bolt is locked
	Grey: Left locking bolt is unlocked
	Green: Right locking bolt is locked
	Grey: Right locking bolt is unlocked
	Green: The lifting arm is in the lower position.
	Grey: The lifting arm is in the upper position.

⇒ The diesel engine shuts off.

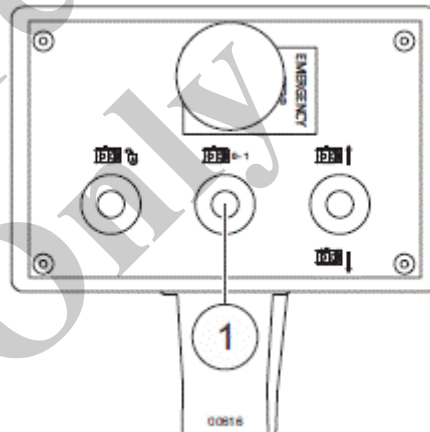
6. → Exit the cab.

Setup

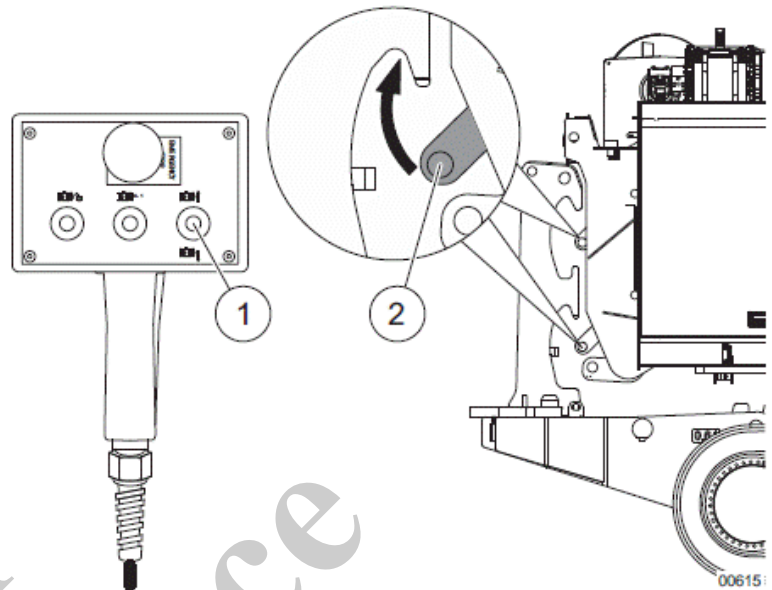
Installing the counterweight > Lifting counterweight onto uppercarriage



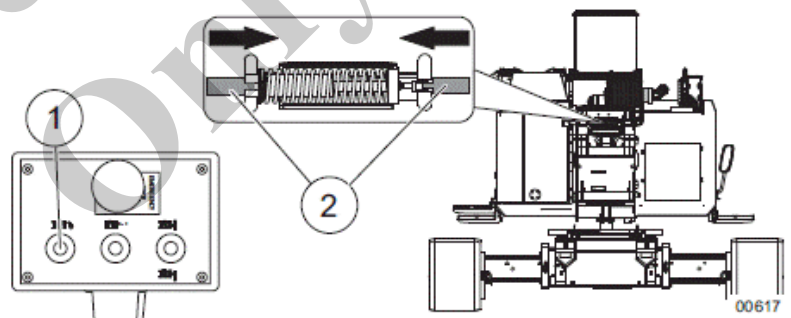
7. ▶ Plug the cable remote control (1) into the power socket. The power socket is under the right maintenance hatch.
8. ▶ Enter the cab.
9. ▶ Start the diesel engine in the cab using the "Start/Stop switch".
10. ▶ Exit the cab.



11. ▶ Push the lever (1) on the cable remote control to the right.
⇒ The cable remote control is ready for use.



- 12.** Push the lever (1) on the cable remote control upward until the lifting arms (2) completely enter the brackets on the ballast bracket.
- 13.** Make sure the lifting arms are in the brackets correctly.
- 14.** Continue to push the lever (1) on the cable remote control upward until the counterweight is fully elevated and the locking bolts are released.



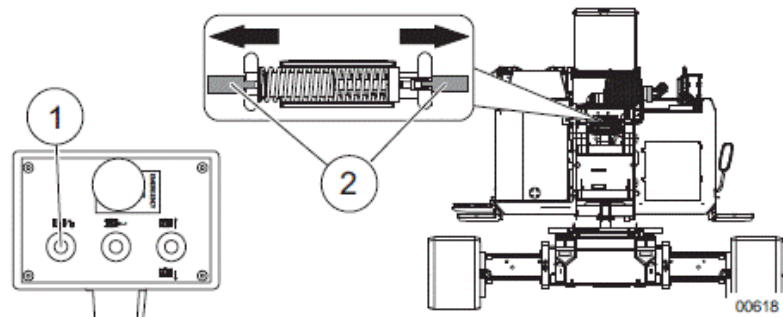
- 15.** Push the lever (1) on the cable remote control to the right and hold it until the locking bolts (2) on the counterweight are fully retracted.
- 16.** Check the symbol display in SENCON. The symbols for the locking bolts must be displayed in gray.



Fig. 120: Locking bolts in unlocked state

Setup

Installing the counterweight > Lifting counterweight onto uppercarriage



17. ▶ Release the lever (1) on the cable remote control.
 - ⇒ The locking pins (2) of the locking mechanism should move fully into the ballast bracket openings.
18. ▶ Check that the locking bolts are level with the outer edges of the frame plates.
19. ▶ Check the symbol display in SENCON. The symbols for the locking bolts must be displayed in green.

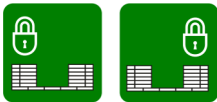
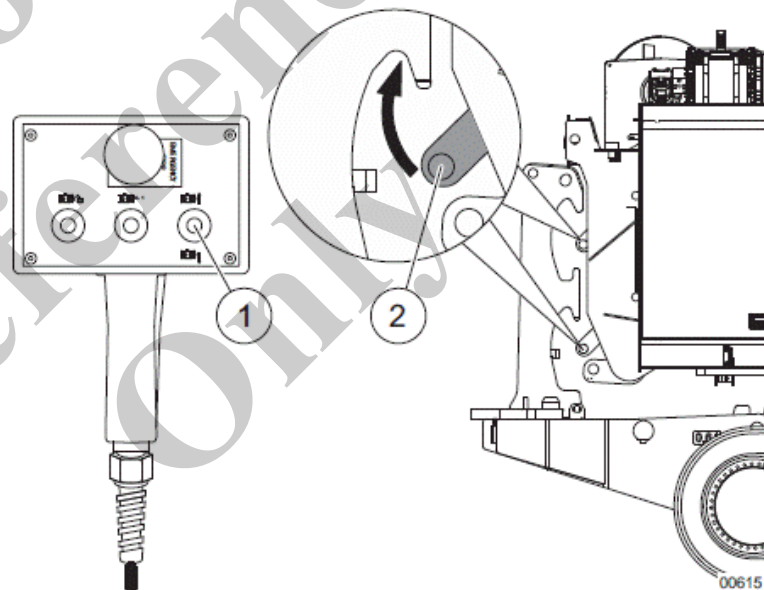


Fig. 121: Locking bolts in locked state



20. ▶ Push the lever (1) on the remote radio control downward until the lifting arms (2) completely retracted.
21. ▶ Unplug and stow the cable remote control.
 - ⇒ The diesel engine shuts off.
22. ▶ Start the diesel engine.
23. ▶ Deactivate "Ballasting mode" in the Setup window in the SENCON.



Fig. 122: Ballasting mode is switched off



- 24. ➤ Unlock the uppercarriage.
- 25. ➤ Remove ballast support when needed.

Fig. 123: Uppercarriage is unlocked

7.8 Removing the counterweight

7.8.1 Safety instructions

- Always use a banksman when removing the counterweight.
- Eye contact between the crane operator and the banksman must be maintained.
- Make sure no one is in the danger zone when installing or removing the counterweight.
- Do not change the setup mode in the SENCON while installing or removing the counterweight.
- Wear personal protective equipment.
- Do not move the machine while installing or removing the counterweight.

The counterweight is removed in three stages:

- Attaching the ballast support.
- Lowering the counterweight onto the ballast support.
- Lifting the counterweight off the ballast support.

7.8.2 Attaching ballast support

Safety instructions

- Make sure that no person is on or under the ballast support.
- Only use the suspension gear and shackles that came with the machine.
- Do not allow the suspension gear to become twisted and be sure to keep it even on both sides.

To detach the counterweight, the ballast support must be present. If necessary, attach the ballast support. See Section [Chapter 7.7.3 "Attaching ballast support" on page 231](#)

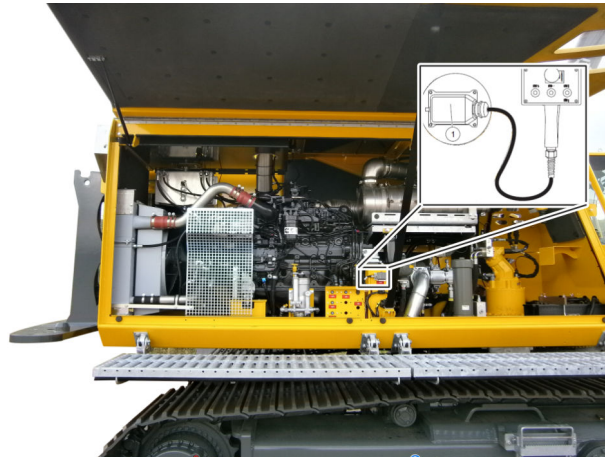
7.8.3 Lowering counterweight onto ballast support

Safety instructions

Make sure no one is on or under the counterweight.

Setup

Removing the counterweight > Lowering counterweight onto ballast support



1. → Enter the cab.
2. → Align the uppercarriage with the undercarriage in the direction of travel.
⇒ The uppercarriage should be at 0°.
3. → Lock the uppercarriage at 0°.



Fig. 124: Uppercarriage is locked

For Reference Only



Fig. 125: Ballasting mode is switched on

4. → Open the Setup window in the SENCON and select "Ballasting mode".

SENCAN Setup menu icons

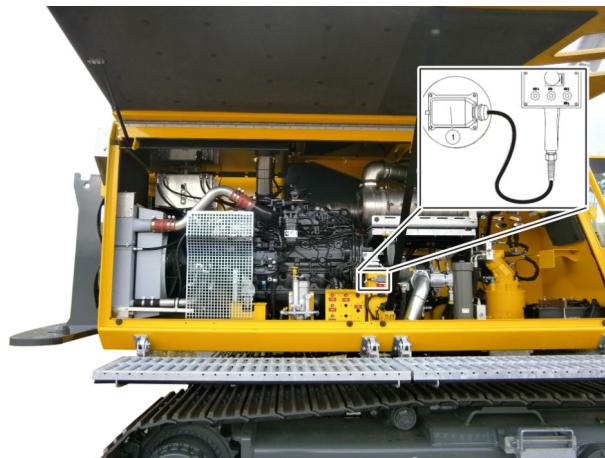
Icon	Name
	Grey: Uppercarriage is unlocked
	Green: Uppercarriage is locked
	Grey: The ballasting operation is switched off
	Green: The ballasting operation is switched on
	Green: Left locking bolt is locked
	Grey: Left locking bolt is unlocked
	Green: Right locking bolt is locked
	Grey: Right locking bolt is unlocked
	Green: The lifting arm is in the lower position.
	Grey: The lifting arm is in the upper position.

⇒ The diesel engine shuts off.

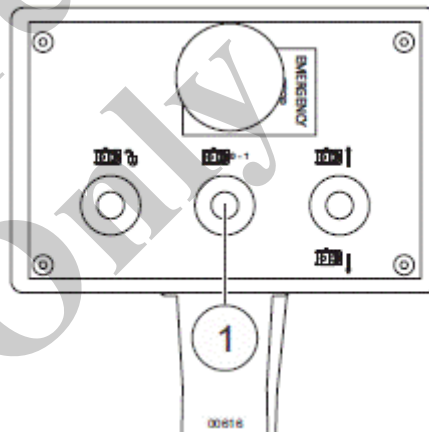
5. → Exit the cab.

Setup

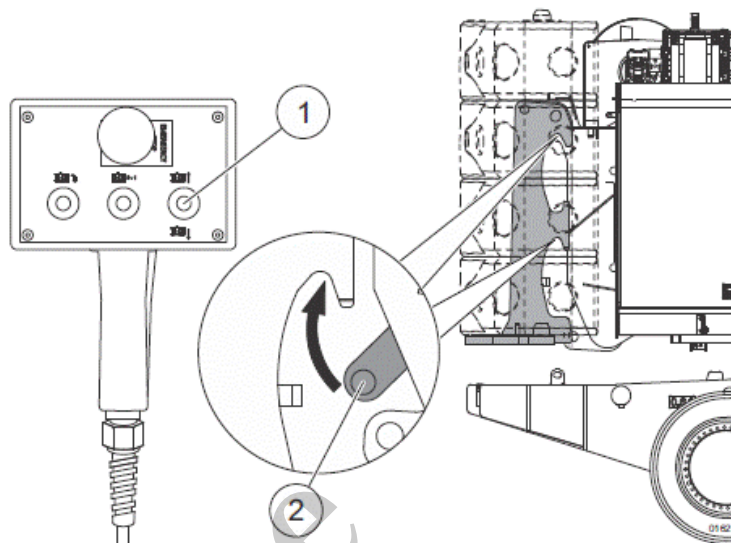
Removing the counterweight > Lowering counterweight onto ballast support



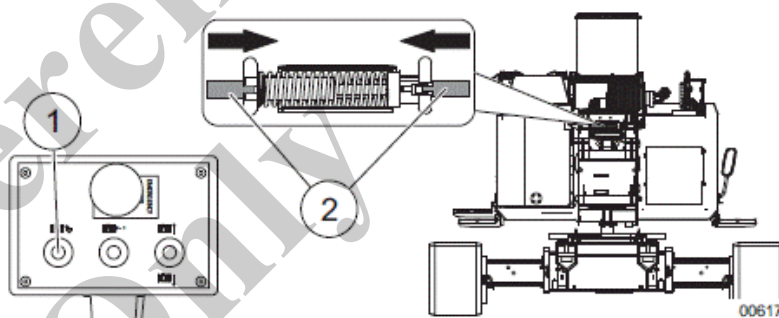
6. → Plug the cable remote control (1) into the power socket. The power socket is under the right maintenance hatch.
7. → Enter the cab.
8. → Start the diesel engine in the cab using the "Start/Stop switch".
9. → Exit the cab.



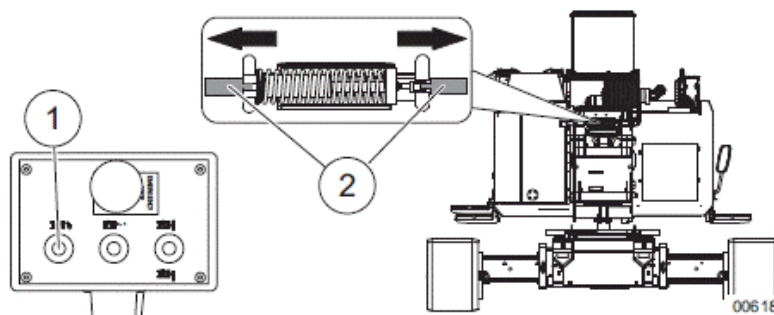
10. → Push the lever (1) on the cable remote control to the left.
 - The cable remote control is ready for use.



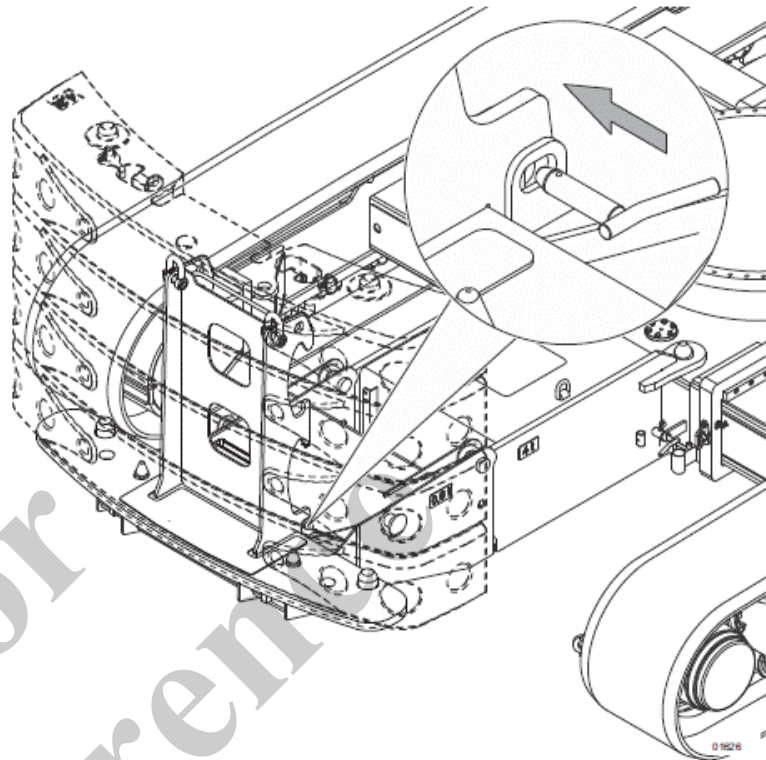
- 11.** Push the lever (1) on the cable remote control upward until the lifting arms (2) completely enter the brackets on the ballast bracket and the locking bolts are released.



- 12.** Push the lever (1) on the cable remote control to the right and hold it until the locking pins (2) on the counterweight are fully retracted. Push the lever (1) on the cable remote control downward until the counterweight is fully lowered onto the ballast support.



- 13.** Release the lever (1) on the cable remote control.
 ■ The counterweight locking pins (2) extend.



14. Bolt the counterweight on the ballast support and secure it with the retaining spring.
15. Completely retract the lifting arms.



Fig. 126: The lifting arm is in the lower position



Fig. 127: Ballasting mode is switched off



Fig. 128: Uppercarriage is unlocked

16. Deactivate "Ballasting mode" in the Setup window in the SENCON.
17. Unlock the uppercarriage.
18. Unplug and stow the cable remote control.
 - ⇒ The diesel engine shuts off.

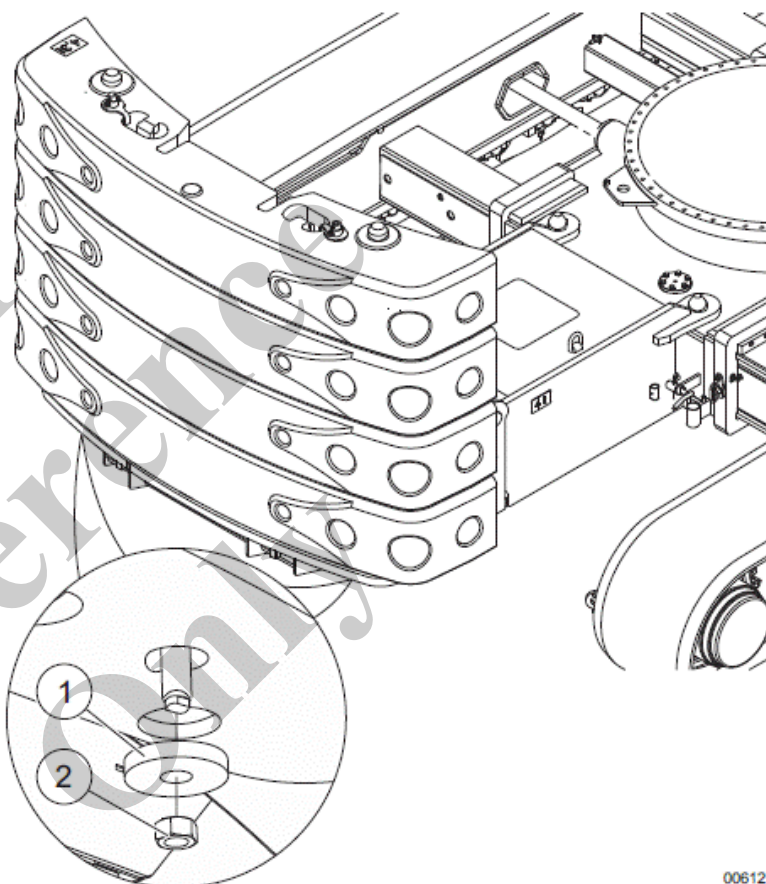
7.8.4 Lifting counterweight off ballast support

Safety instructions

- Lift the counterweight ballast blocks one at a time off of the bracket.
- Make sure no one is on or under the counterweight.

- Only use the suspension gear and shackles that came with the machine.
- Do not allow the suspension gear to become twisted and be sure to keep it even on both sides.
- Make sure the counterweight components do not collide with the machine.

1. → Position the lowbed trailer for the ballast blocks and ballast bracket near the machine.

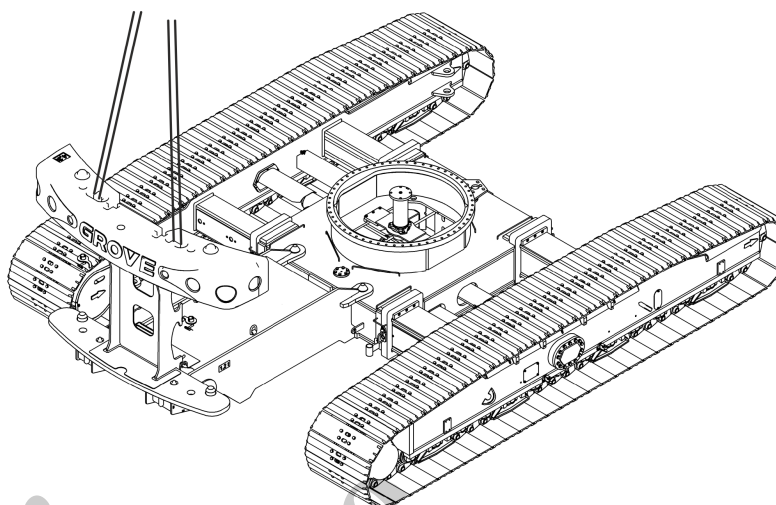


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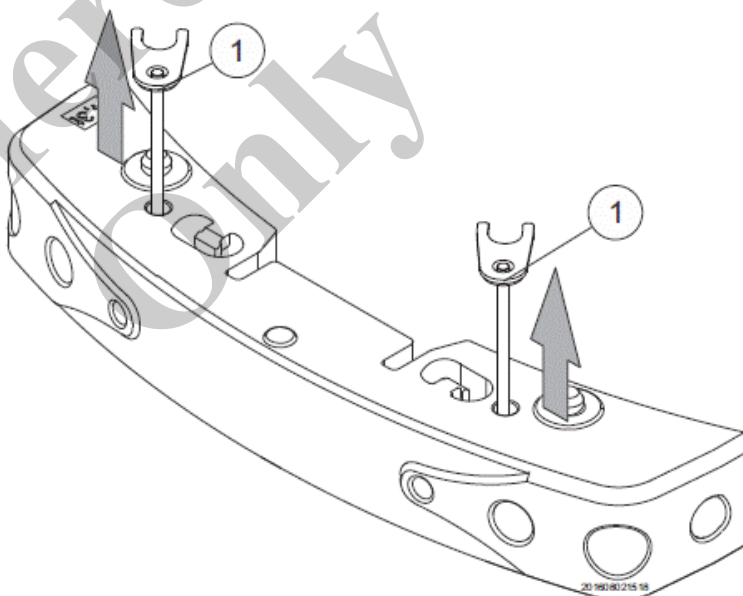
2. → Loosen the hex nut (2) and remove the washer (1) from the ballast rod.

Setup

Removing the counterweight > Lifting counterweight off ballast support



3. → Attach a load hook to the suspension gear that came with the machine, attach the other end of the load hook to the lifting points of the upper ballast block, then tension slightly.
4. → Carefully lift the fourth (uppermost) ballast block together with the ballast rods onto the lowbed trailer.



5. → Remove the ballast rods (1).
6. → Carefully lift the third ballast blocks onto the lowbed trailer.

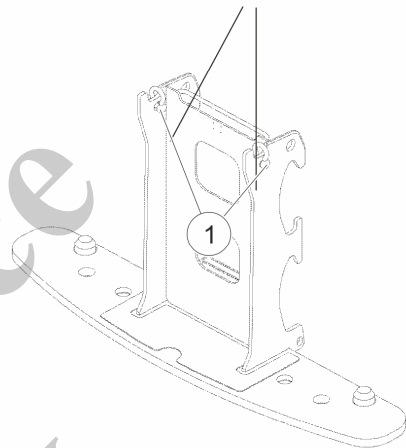
7. → Remove the steel bolts from the third ballast block and store them securely.

▲ WARNING! Danger from flying steel bolts

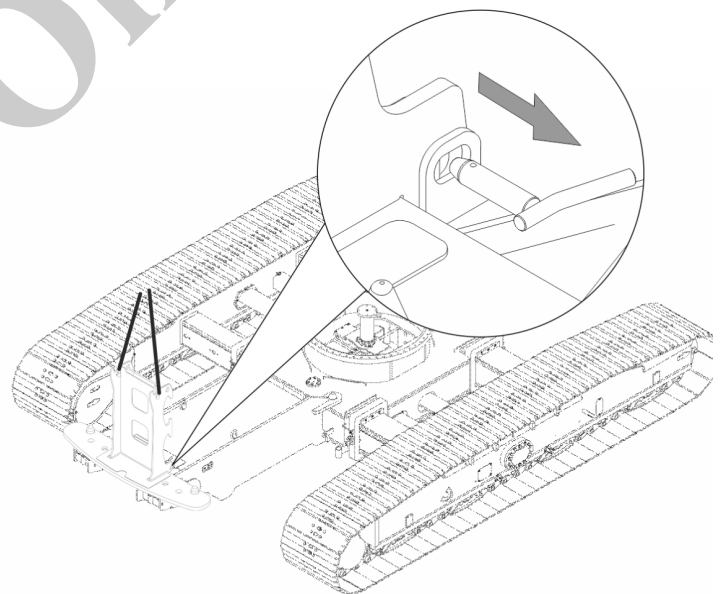
Always keep the steel bolts in a safe place

If the steel bolts remain in the ballast block, they may fall out during transport and cause damage

8. → Carefully lift the remaining ballast blocks onto the lowbed trailer.



9. → Attach a load hook to the suspension gear that came with the machine, attach the other end of the load hook to the lifting points (1) on the ballast bracket, then tension slightly.



10. → Releasing the ballast bracket from the ballast support.

11. ▶ Lift the ballast bracket onto the lowbed trailer.
12. ▶ Deactivate "Ballasting mode" in the Setup window in the SENCON.
13. ▶ Remove the ballast support.

7.9 Fly boom

7.9.1 General information

⚠ CAUTION

Risk of falling.

Risk of injury due to falling from height.

- At heights over 1.40 m, use a ladder to install or remove the bolts.

⚠ WARNING

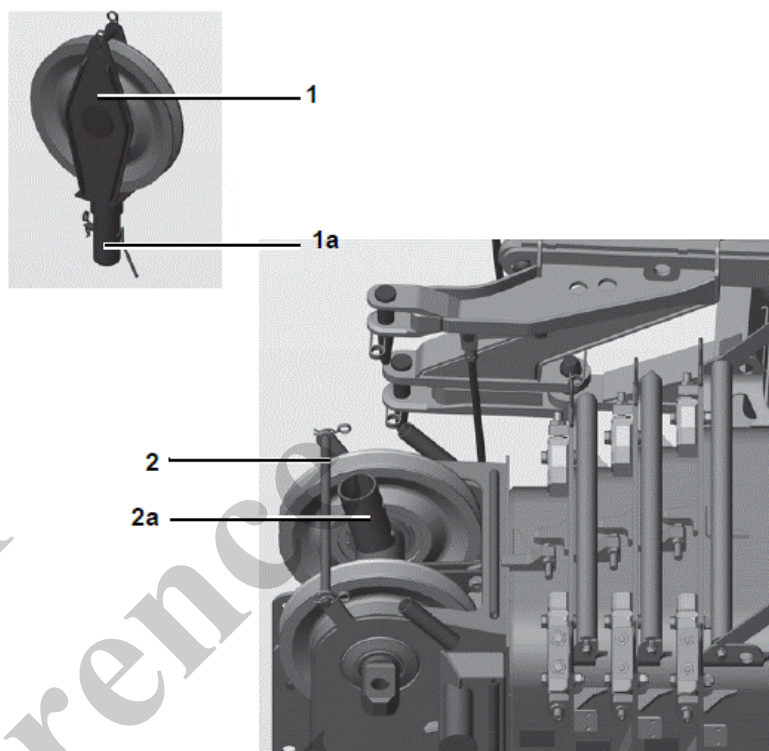
Risk of serious injury due to unintentional movement of the boom head.

If the "Remove jib" switch is deactivated, sudden movement of the boom head can crush body parts.

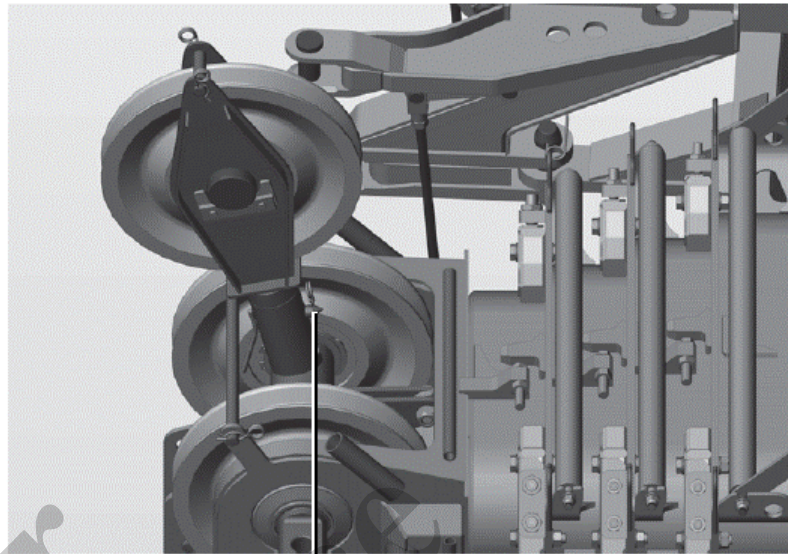
- Make sure the safety lever is always closed during installation.

For Reference Only

7.9.2 Attachment - deflection sheave



1. → Start the diesel engine.
2. → Push the safety lever forward.
3. → Completely retract the telescopic boom and bring it to 0°.
4. → Unfasten and pull out the rope guard (2) on the top sheave of the pulley head.
5. → Prepare the deflection sheave (1) and lift with an appropriate hoist.
6. → Use a service ladder to install the deflection sheave.
7. → Insert the deflection sheave (1a) into the guide tube (2a) on the fly boom head.




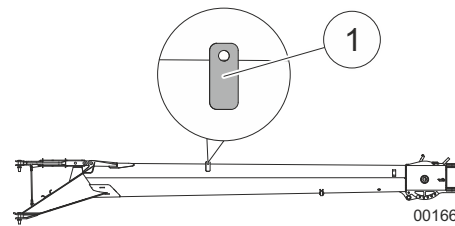
8. ▶ Bolt down and secure the deflection sheave in the bores (3).



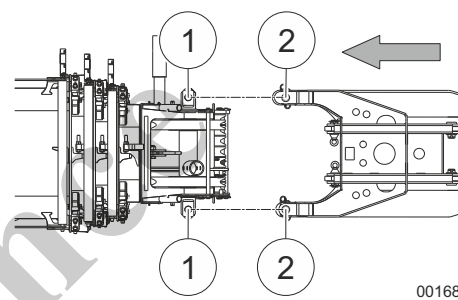
Information
Removal is the reverse of installation.

7.9.3 Attaching the fly boom

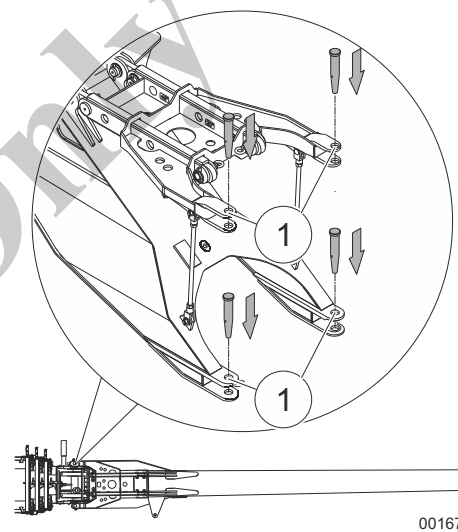
1. ▶ Attach the maximum counterweight.
2. ▶ Fully extend the undercarriage.
3. ▶ Enter the cab.
4. ▶ Start the diesel engine.
5. ▶ Select the operating mode **attachments**  on SENCON.
6. ▶ Push the safety lever forward.
7. ▶ Completely retract the telescopic boom and bring it to 0°.
8. ▶ Place the bottom hook block on the ground.
9. ▶ Unreeve the hoist rope from the pulley head and bottom hook block and wind it into the winch.
10. ▶ Switch off the diesel engine and pull the safety lever towards you.
11. ▶ Attach the deflection sheave.
12. ▶ Attach suitable hoisting gear to the fly boom at its lifting points (1) to an auxiliary crane.



- 13.** Lift the fly boom to the head of the telescopic boom.
- 14.** Align the fly boom to the telescopic boom head. The bores of the fly boom (2) in and the telescopic boom (1) must be aligned.



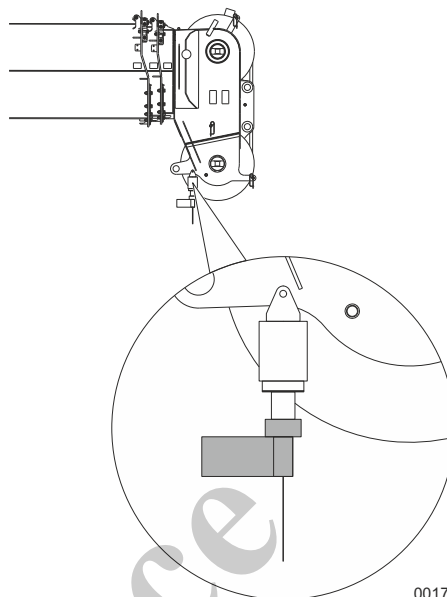
- 15.** Bolt the fly boom to the telescopic boom at the bolting positions (1) and secure with retaining pins.



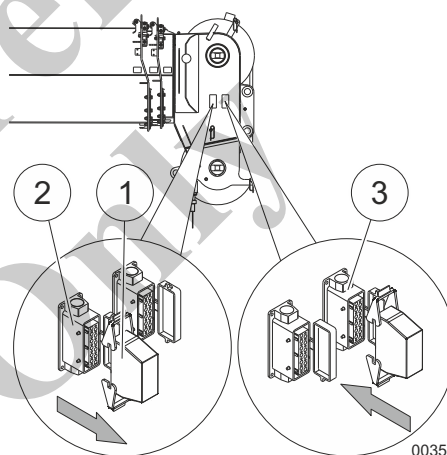
- 16.** Remove the lifting gear from the fly boom and move the auxiliary crane out of the work area.
- 17.** Reeve the hoisting rope of winch 1 over the deflection sheave and the fly boom head.
- 18.** Attach the bypass flag to the rope of the lifting limit switch.

Setup

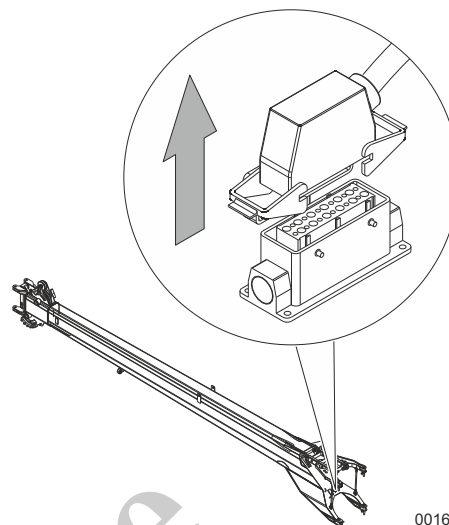
Fly boom > Attaching the fly boom



- 19.** Remove the bypass plug (1) from the left socket (2) on the telescopic boom head and insert it into the right socket (3).

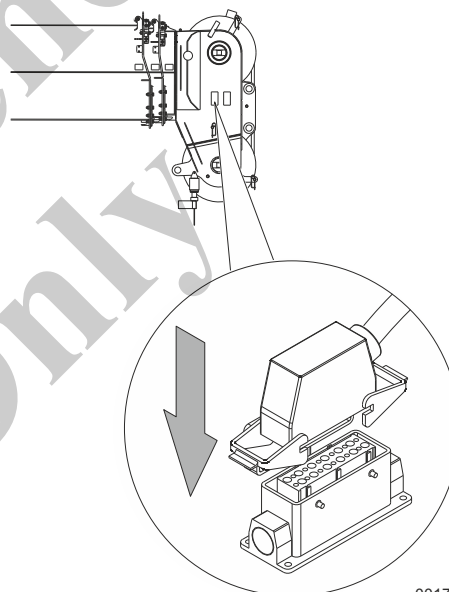


- 20.** Pull the lifting limit switch cable of the fly boom out of the socket.



00169


- 21.** ➤ Insert the lifting limit switch cable of the fly boom into the left socket on the telescopic boom.

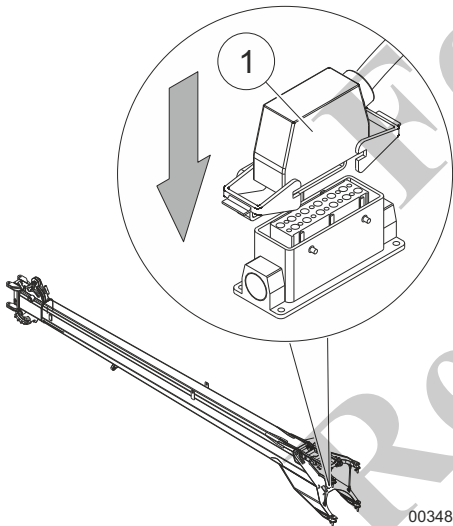


00170

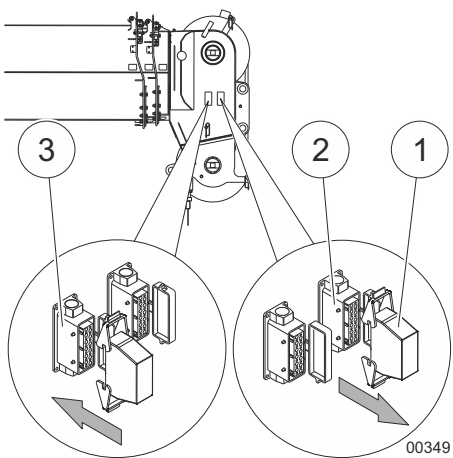
- 22.** ➤ Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom.
- 23.** ➤ Attach the bottom hook block.

7.9.4 Taking down the fly boom

1. ➤ Attach the maximum counterweight.
2. ➤ Fully extend the undercarriage.
3. ➤ Start the diesel engine.
4. ➤ Select the operating mode **attachments**  on SENCON.
5. ➤ Push the safety lever forward.
6. ➤ Completely retract the telescopic boom and bring it to 0°.
7. ➤ Place the bottom hook block on the ground.
8. ➤ Unreeve the hoist rope from the pulley head of the fly boom and bottom hook block and wind it into the winch.
9. ➤ Switch off the diesel engine and pull the safety lever towards you.
10. ➤ Attach the deflection sheave.
11. ➤ Remove the lifting limit switch cable of the fly boom from the telescopic boom and insert it into the storage socket on the fly boom.

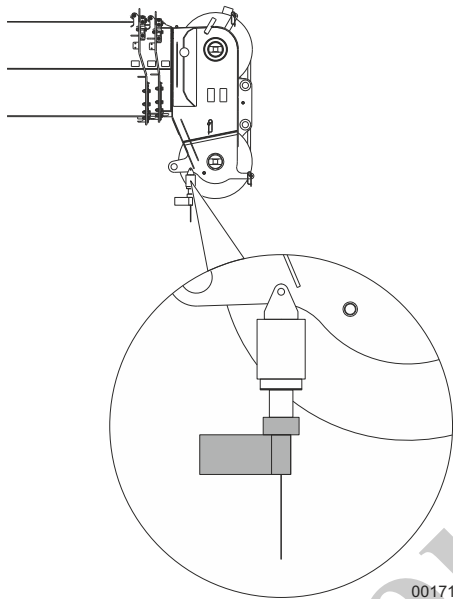


00348

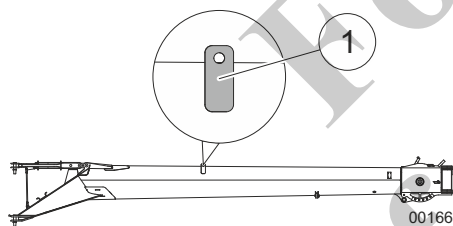


00349

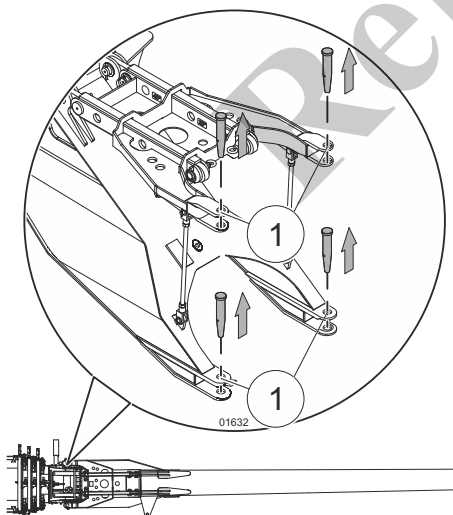
12. ➤ Remove the bypass plug shown from the right socket and insert it into the left socket.



- 13.** Remove the bypass flag of the lifting limit switch on the telescopic boom.



- 14.** Attach suitable hoisting gear to the fly boom at its lifting points to an auxiliary crane.



- 15.** Release the fly boom to the telescopic boom at the bolting positions and lift the fly boom away from the telescopic boom.
- 16.** Remove the lifting gear from the fly boom and move the auxiliary crane out of the work area.
- 17.** Reeve the hoist rope from Winch 1 onto the telescopic boom head and onto the bottom hook block.
- 18.** Attach the lifting limit switch weight to the hoist rope and the chain to the lifting limit switch of the telescopic boom.

7.9.5 Folding the fly boom into transport position


Safety instructions

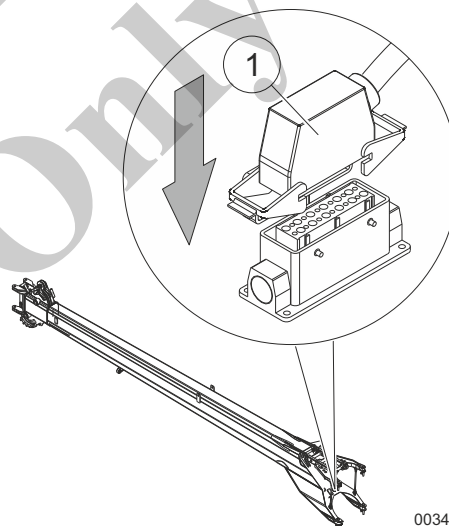
Strictly follow the steps described below.



Information

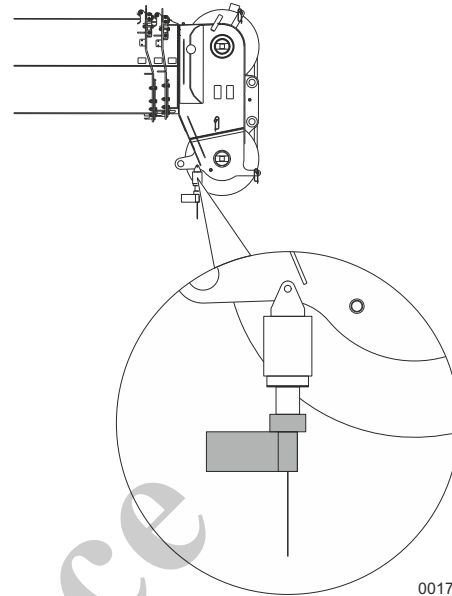
This procedure requires a space of at least 12 m to the right of the machine. The fly boom must be bolted to the telescopic boom at 0°. If necessary, fold the fly boom to 0°, see Chapter 7.9.12 “Folding the fly boom from 20° or 40° to 0°” on page 283.

1. ▶ Enter the cab.
2. ▶ Start the diesel engine.
3. ▶ Set the operating mode **attachments**  on SENCON.
4. ▶ Activate the switch **SA monitoring**
5. ▶ Push the safety lever forward.
6. ▶ Place the bottom hook block on the ground and unreeve it.
7. ▶ Remove the lifting limit switch weight and chain from the lifting limit switch of the fly boom.
8. ▶ Unreeve the hoisting cable and wind it onto the winch.
9. ▶ Completely retract the telescopic boom and bring it to 0°.
10. ▶ 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.

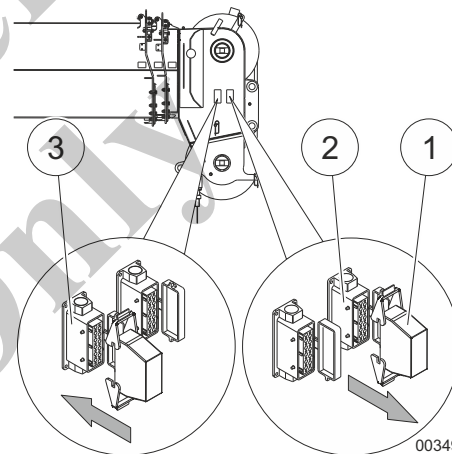


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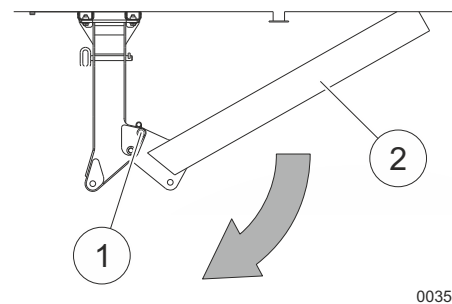
11. ▶ Remove the bypass flag of the lifting limit switch on the telescopic boom.



- 12.** Remove the bypass plug (1) shown from the right socket (2) and insert it into the left socket (3).



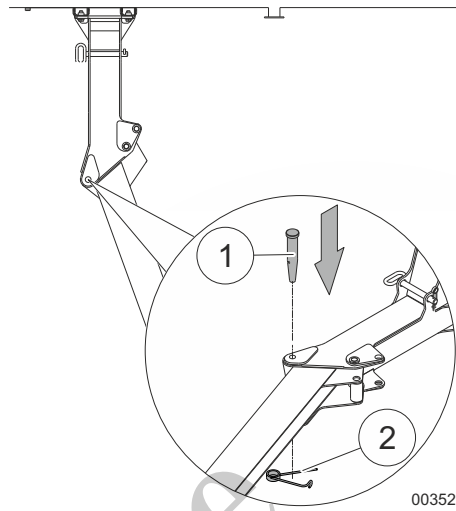
- 13.** Release the bolt (1) on the ramp. Fold out the ramp (2).



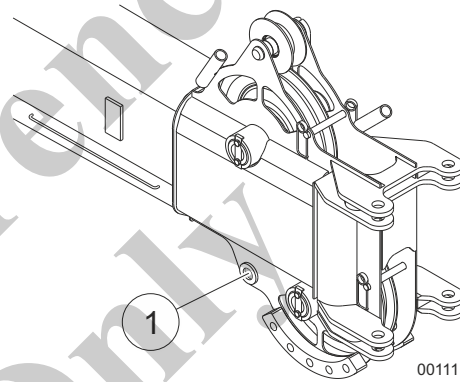
- 14.** Insert the bolt (1) in the ramp and secure it with the retaining spring (2).

Setup

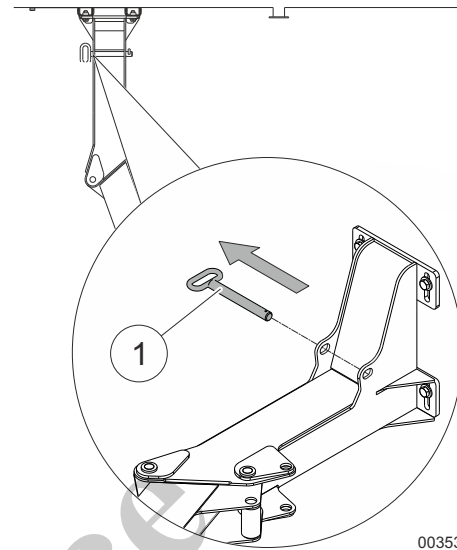
Fly boom > Folding the fly boom into transport position




15. ▶ Attach a rope to the eye (1) on the fly boom.



16. ▶ Release and remove the bolt (1) on the ramp.



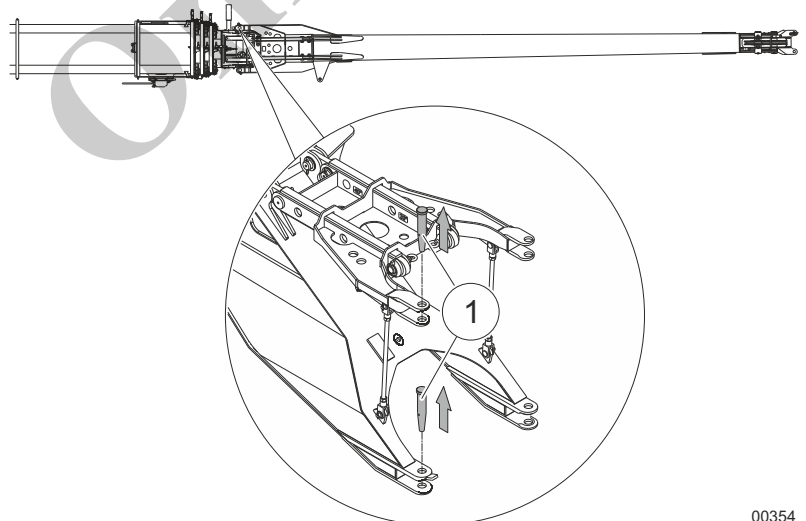
00353

- 17.**  **WARNING! Risk of death from swinging fly boom.**
The fly boom can swing off its support at high speed and severely injure anybody in its swing range.

- Observe the deadweight of the fly boom.
- Ensure that no one is in the danger zone. The swing radius is at least 12 m.

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

- 18.** Release and drive out the bolts (1) on the left side of the boom.

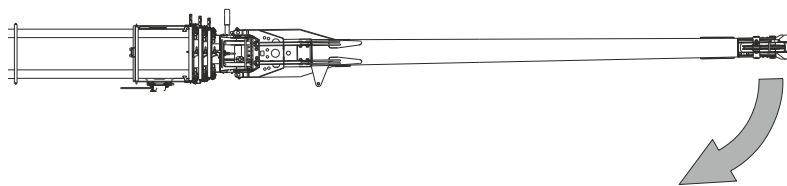


00354

- 19.** Use the rope to pull out the fly boom until the lock openings in the fly boom align with those of the telescopic boom.

Setup

Fly boom > Folding the fly boom into transport position

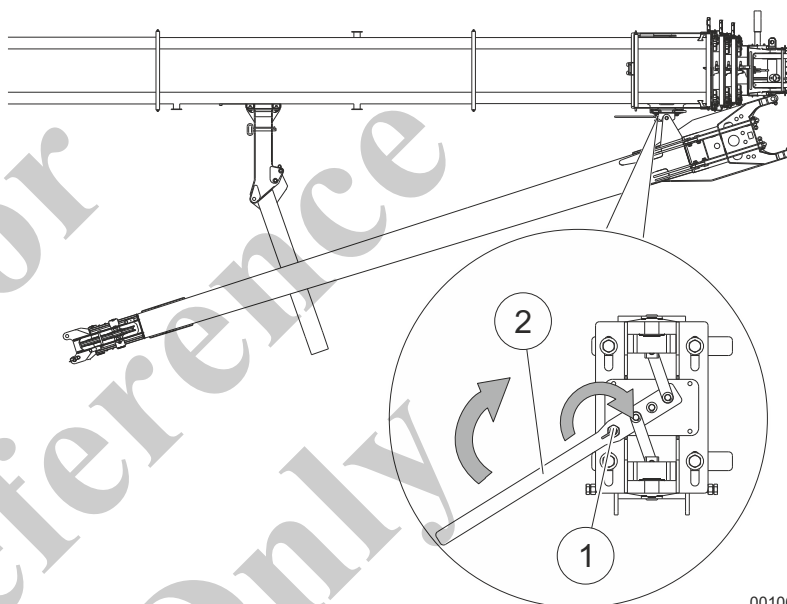


00355

20. ▶ Turn the securing lever (1) of the fly boom lock to the right.

21. ▶ Pull the locking lever (2) upward.

- The fly boom lock is now unlocked.

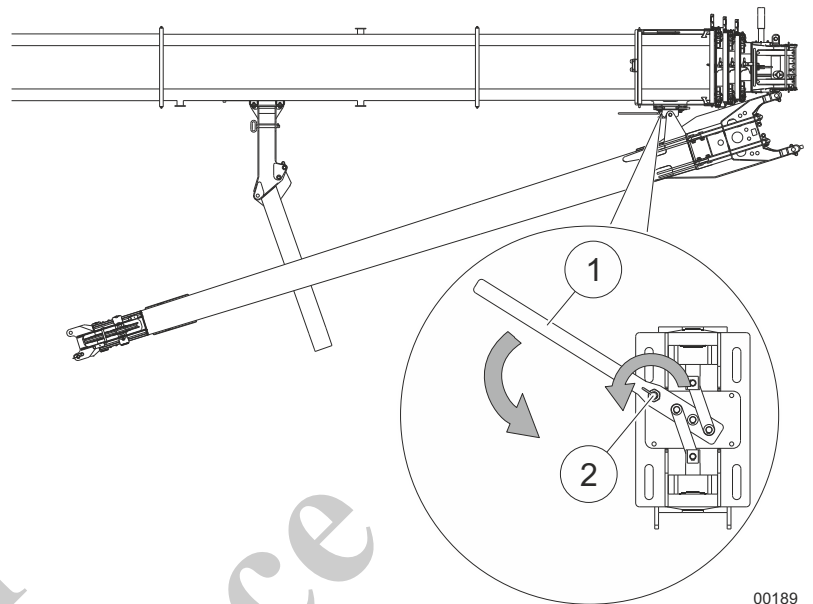


00106

22. ▶ Pull the fly boom around until it can be bolted to the fly boom lock.

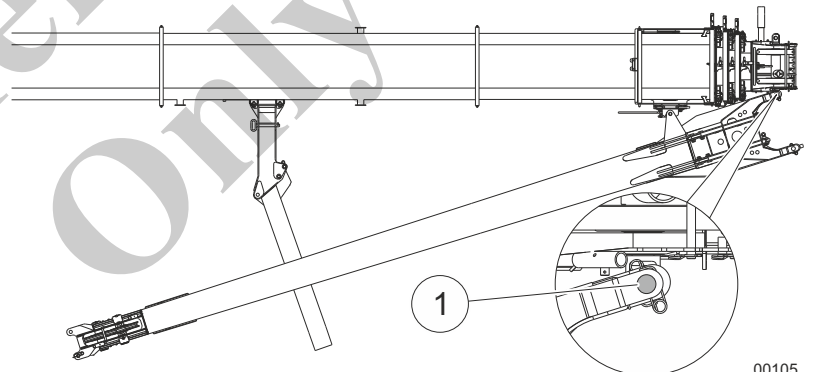
23. ▶ Pull the locking lever (1) down and turn the securing lever (2) to the left.

- The fly boom is now locked into the fly boom lock.



00189

- 24.** ▶ Check whether or not the fly boom is properly locked into the fly boom lock.
- 25.** ▶ Release and drive out the bolts (1) on the right side of the boom head.
- 26.** ▶ Insert and secure the bolts in the parking position.

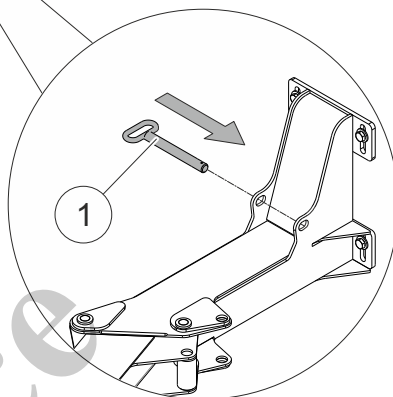
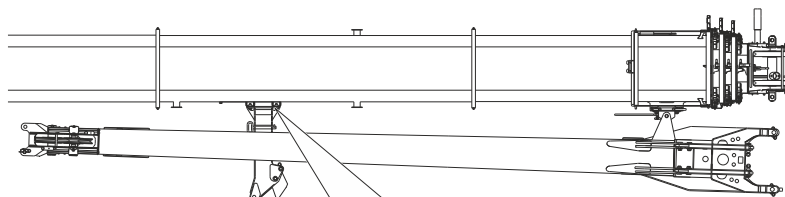


00105

- 27.** ▶ Use the rope to move the fly boom around until the fly boom can be secured to the ramp.
- 28.** ▶ Secure the fly boom to the ramp with the bolt (1).

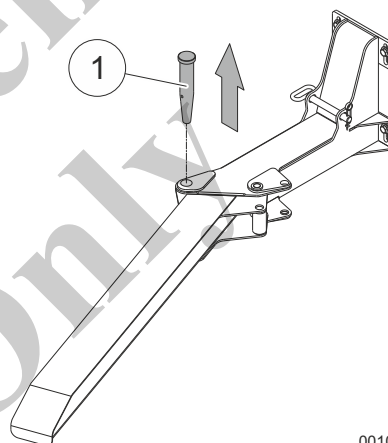
Setup

Fly boom > Folding the fly boom into transport position



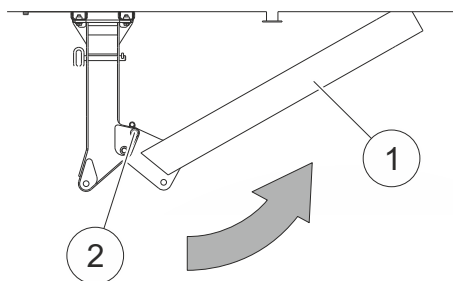
00358

29. ▶ Remove the bolt (1) on the ramp.



00109

30. ▶ Fold in the ramp (1) and secure it with the bolt (2) at the position shown.



00110


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 head.
34. ➤ Reeve the bottom hook block.

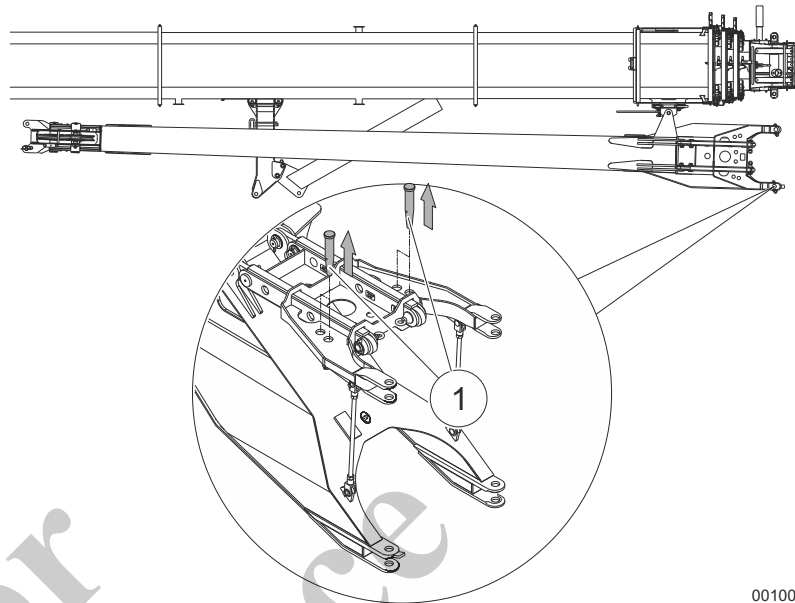
7.9.6 Folding the fly boom into working position

Safety instructions

- Ensure that the fly boom is correctly bolted to the basic body and secured.
 - The procedure requires a space of at least 12 m(39.4 ft) to the right of the machine.
1. ➤ Start the diesel engine.
 2. ➤ Set the operating mode **attachments**  on SENCON.
 3. ➤ Activate the switch **SA monitoring**
 4. ➤ Push the safety lever forward.
 5. ➤ Bring the telescopic boom to 0° and retract it.
 6. ➤ Place the bottom hook block on the ground.
 7. ➤ Unreeve the hoist rope.
 8. ➤ Change the switch "**Changeover luffing down-up/telescope in - out**" to the function "telescope in - out".
 9. ➤ Fully retract the telescopic boom with the right joystick.
 10. ➤ Press the button "**Setting up the fly boom**".
 - ⇒ The machine is then in the tele-holding circuit mode.
 11. ➤ Change the switch "**Changeover luffing down-up/telescope in - out**" to the function "Luffing down - up".
 12. ➤ Bring down the telescope with the right joystick.
 13. ➤ Release and remove the bolts (1) on the fly boom.

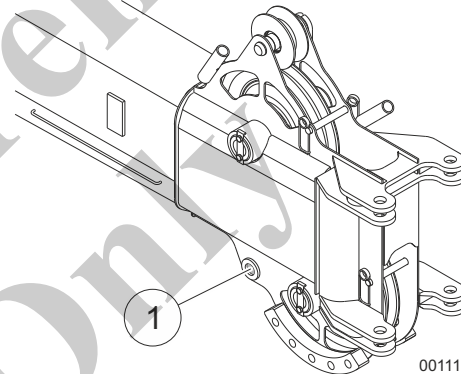
Setup

Fly boom > Folding the fly boom into working position



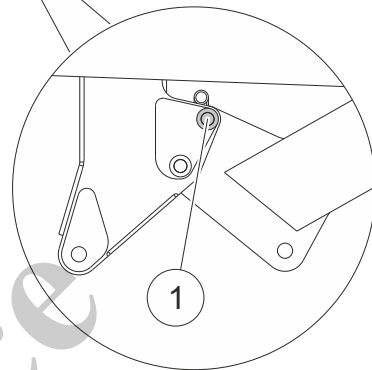
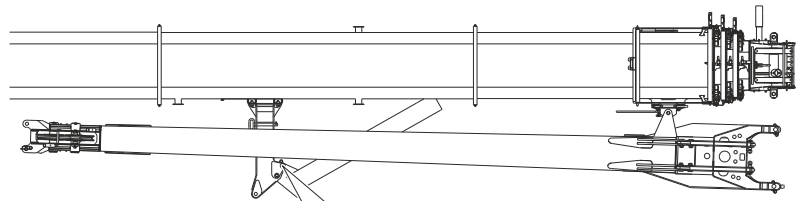
00100

14. Attach a rope to the eye (1) on the fly boom.



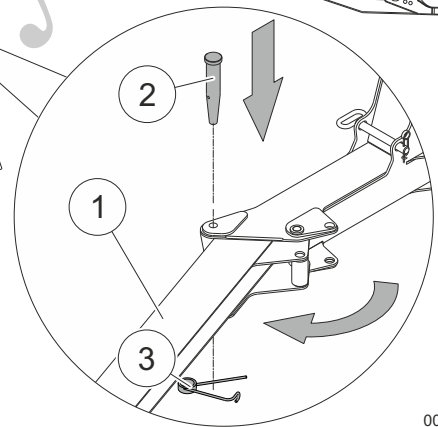
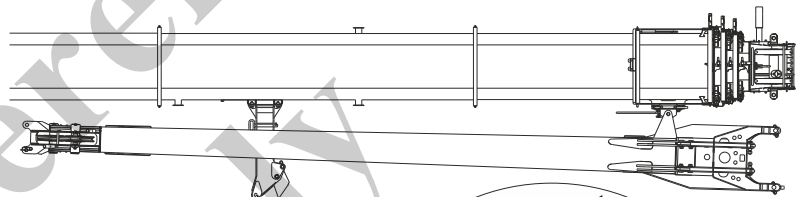
00111

15. Release and remove the pin (1).



00101

- 16.** Fold out the ramp (1). Insert the bolt (2) at the position shown and secure it with the retaining spring (3).



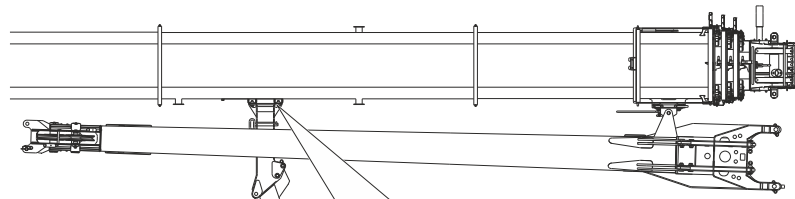
00102

- 17.** **⚠ WARNING! Risk of death from swinging fly boom.**
The fly boom can swing off its support at high speed and severely injure anybody in its swing range.
- Observe the deadweight of the fly boom.
 - Ensure that no one is in the danger zone. The pivot radius is at least 12 m (39.4 ft).

Unlock the bolt (1) on the ramp and pull it out.

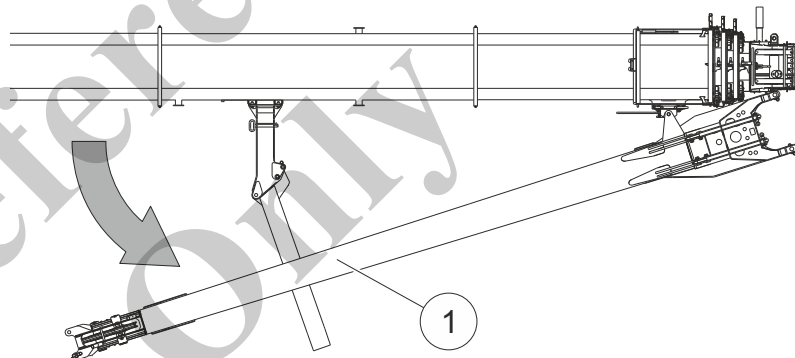
Setup

Fly boom > Folding the fly boom into working position



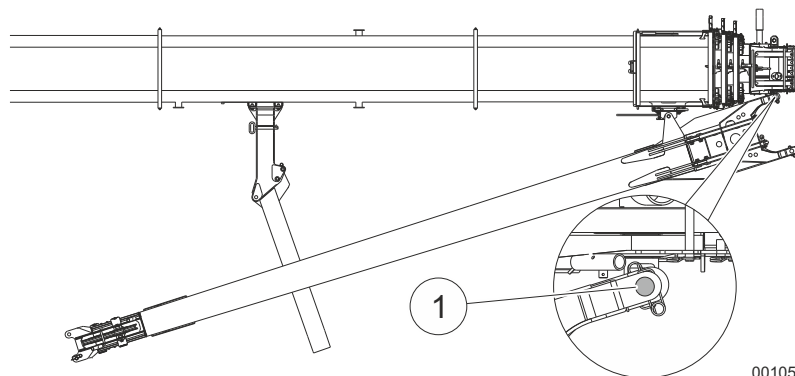
00103

- 18.** Use the rope to pull the fly boom (1) until the right-hand bolting openings of the fly boom and of the telescopic boom are in line.



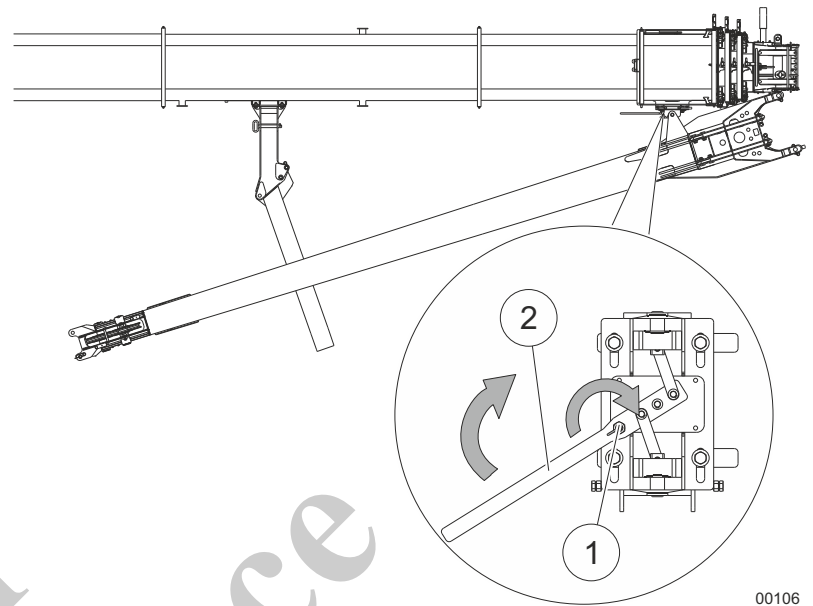
00104

- 19.** Bolt the fly boom to the telescopic boom at the bolting position (1) and secure it.



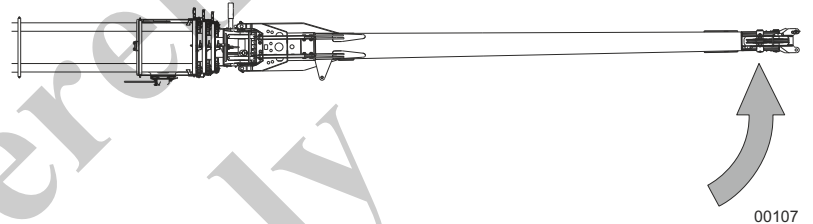
00105

- 20.** Turn the securing lever (1) on the fly boom lock to the right and pull the locking lever (2) upward.



00106

- 21.** → Fold the fly boom into working position.



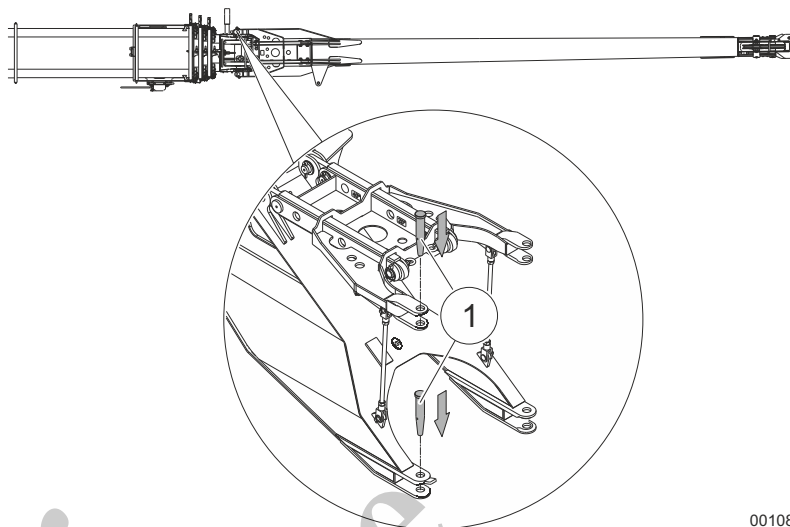
00107

- 22.** → Attach the fly boom to the main boom with the pin (1). Start with the bottom pin.
- 23.** → If problems occur when inserting the top pin, proceed as follows:
- Insert the pin as far as possible.
 - Slowly and carefully extend the boom to 21.6 m (70.8 ft) and lower it until the fly boom touches the ground. Make sure the pin does not fall out of the hole.
 - Secure the pin.

Alternatively, the fly boom can be easily bolted to the telescopic boom head in working position with the help of the optional support on the fly boom.

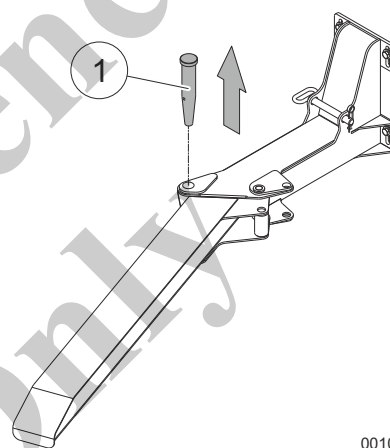
Setup

Fly boom > Folding the fly boom into working position



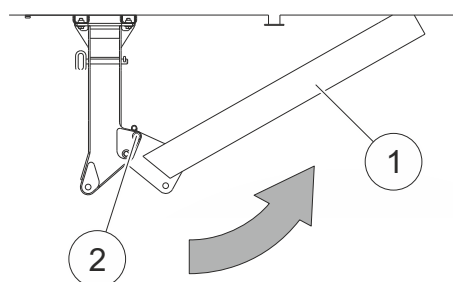
00108

24. ▶ Remove the bolt (1) on the ramp.



00109

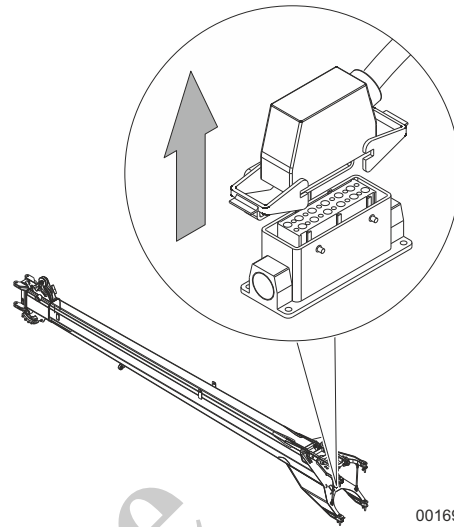
25. ▶ Fold in the ramp (1) and secure it with the bolt (2) at the position specified.



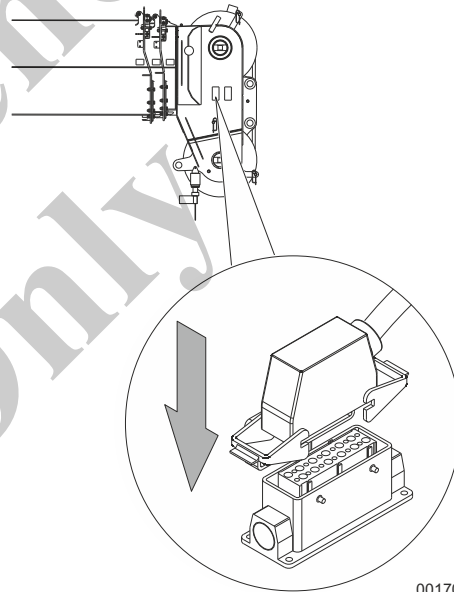
00110

26. ▶ Unplug the bypass plug on the telescopic boom head.

27. ▶ Pull the lifting limit switch cable of the fly boom out of the socket.



- 28.** Plug the fly boom's lifting limit switch cable into the telescopic boom head.

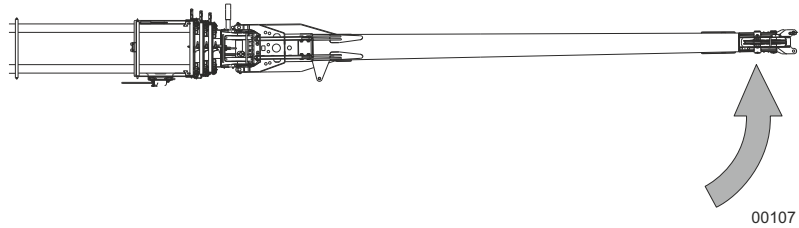


- 29.** Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom.
- 30.** Reeve the hoisting rope over the fly boom head.
- 31.** Attach the bottom hook block.

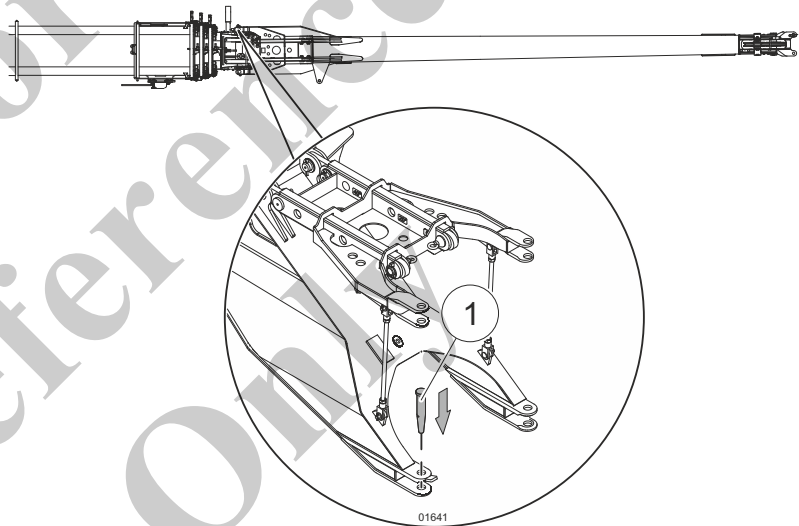
7.9.7 Fly boom support (option)

The support on the fly boom is an option to facilitate work. The support allows the fly boom to be secured to the telescopic boom head more easily.

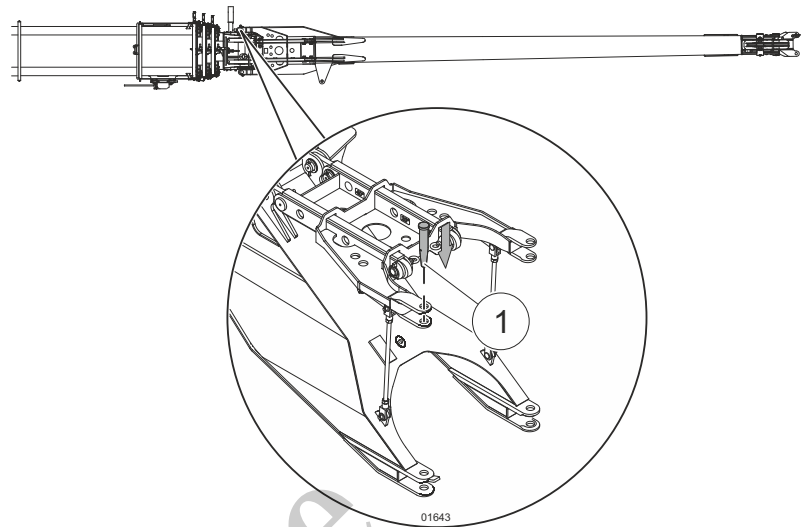
1. → Deploy the fly boom as described in Section 7.9.1, but do not yet secure the fly boom to the left side of the boom head.



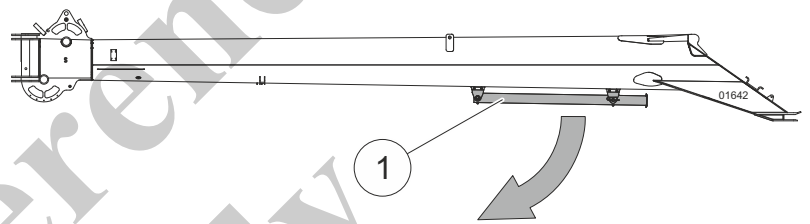
2. → Fasten and secure the fly boom to bottom left of the main boom with a pin (1).



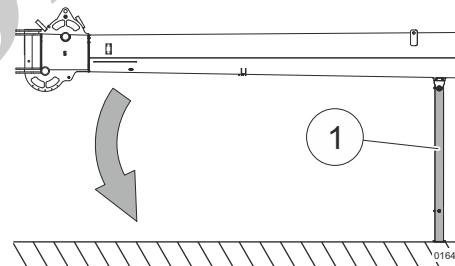
3. → Insert the pin (1) in the top left as far as it will go.



4. → Release and deploy the support (1) on the bottom of the fly boom (3).



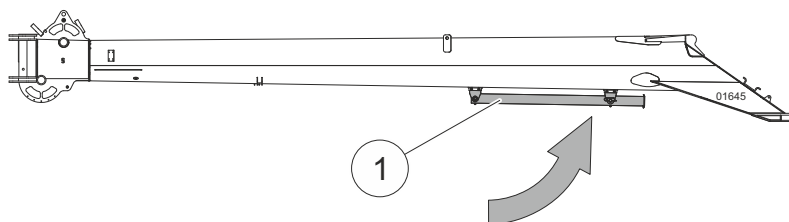
5. → Lower the telescopic boom until the support touches the ground (1). Make sure the top left pin does not fall out of the hole. Now lower the telescopic boom until the pin moves further into the hole.



6. → If necessary, drive in the top left pin all the way and secure it.
 7. → Raise the telescopic boom until the support can be stowed.
 8. → Stow the support (1) and secure it to the fly boom (2).

Setup

Fly boom > Fly boom support (option)




For
Reference
Only

7.9.8 Folding the fly boom from 0° to 20°



Information

The fly boom lets itself be folded in a retracted or telescoped (maximum 19.3 m (63.3 ft)) state.

1. → Start the diesel engine.
2. → Select the operating mode **attachments**  on SENCON.
3. → After folding out into working position, the fly boom is bolted at 0°.
4. → Lower and extend the telescopic boom until the fly boom head rests on the ground or on a suitable support.

i **Information** When lifting the boom, the fly boom slides on the support in the direction of the machine (approximately 500 mm (19.7 in)). Do not push the fly boom onto the ground.

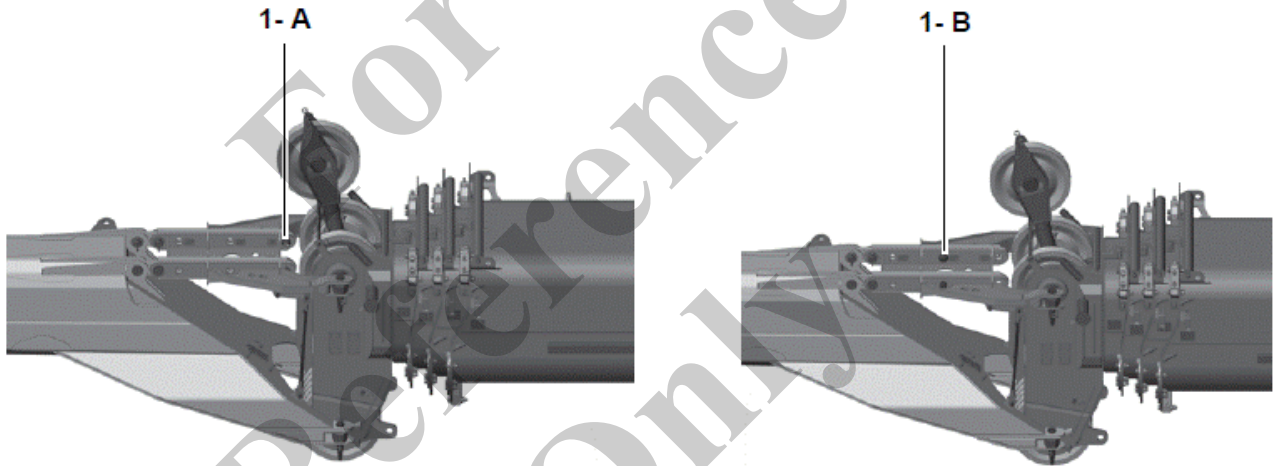


Fig. 129: Bolting the fly boom in 20° position

5. → Unlock bolts (1) from position (A) right and left, pull them out and insert them in position (B) and secure them.
6. → Carefully lift the boom, the fly boom swings downward 20°. Carefully lift the boom for operation.

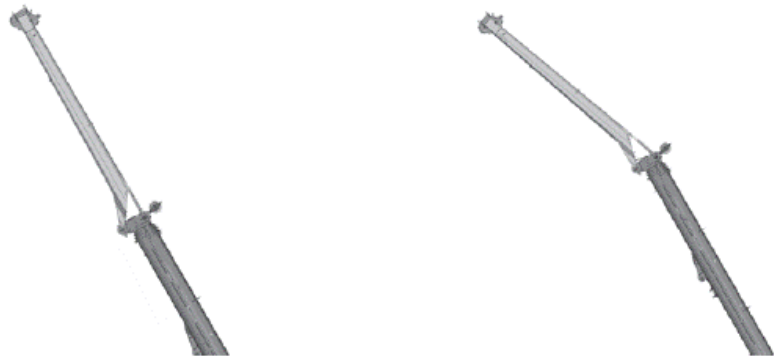



Fig. 130: Fly boom at 0° and 20°

7.9.9 Folding the fly boom from 0° to 40°



The fly boom can be folded when retracted or extended.

1. ▶ Start the diesel engine.
2. ▶ Select the operating mode **attachments**  on SENCON.
3. ▶ After folding out into working position, the fly boom is bolted at 0°.
4. ▶ Lower and extend the telescopic boom until the fly boom head rests on the ground or on a suitable support.

i Information When lifting the boom, the fly boom slides onto the support in the direction of the machine (approximately 1.5 m (4.1 ft)). Do not push the fly boom onto the ground.

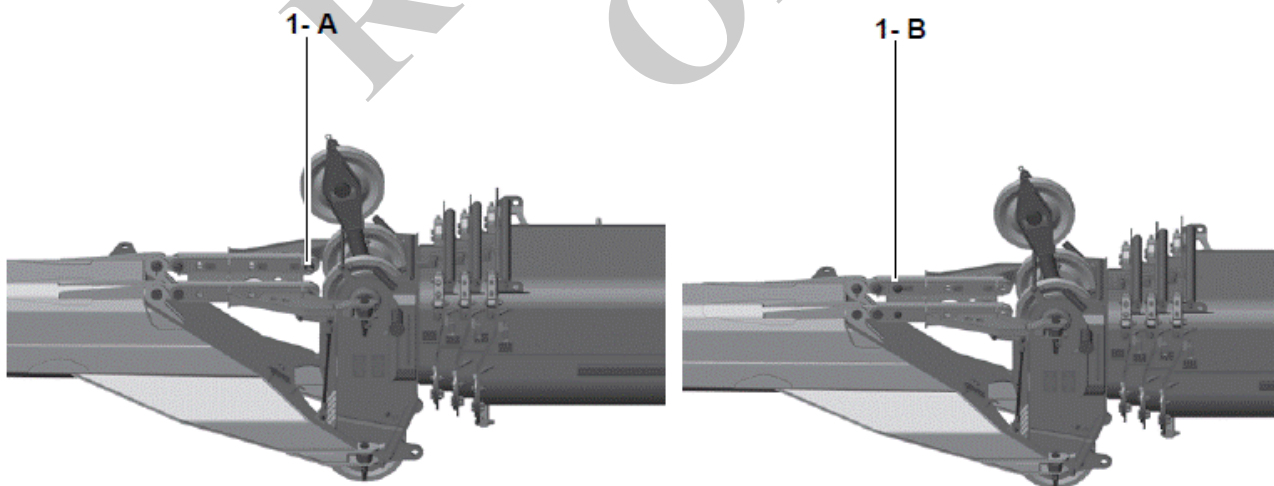


Fig. 131: Bolting the fly boom in 40° position

5. ▶ Unlock bolts (1) from position (A) right and left, pull them out and insert them in position (B) and secure them.

6. → Carefully lift the boom, the fly boom swings downward 40°. Carefully lift the boom for operation.

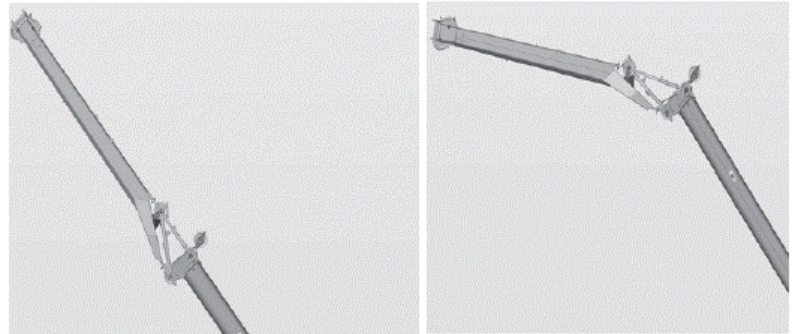



Fig. 132: Fly boom at 0° and 40°

7.9.10 Folding the fly boom from 20° to 40°

1. → Start the diesel engine.
2. → Select the operating mode **attachments**  on SENCON.
3. → Carefully lower the telescopic boom until the fly boom is supported on the ground or on a suitable support.

i Information When lifting the boom, the fly boom slides onto the support in the direction of the machine (approximately 500 m (19.69 ft)). Do not push the fly boom onto the ground.

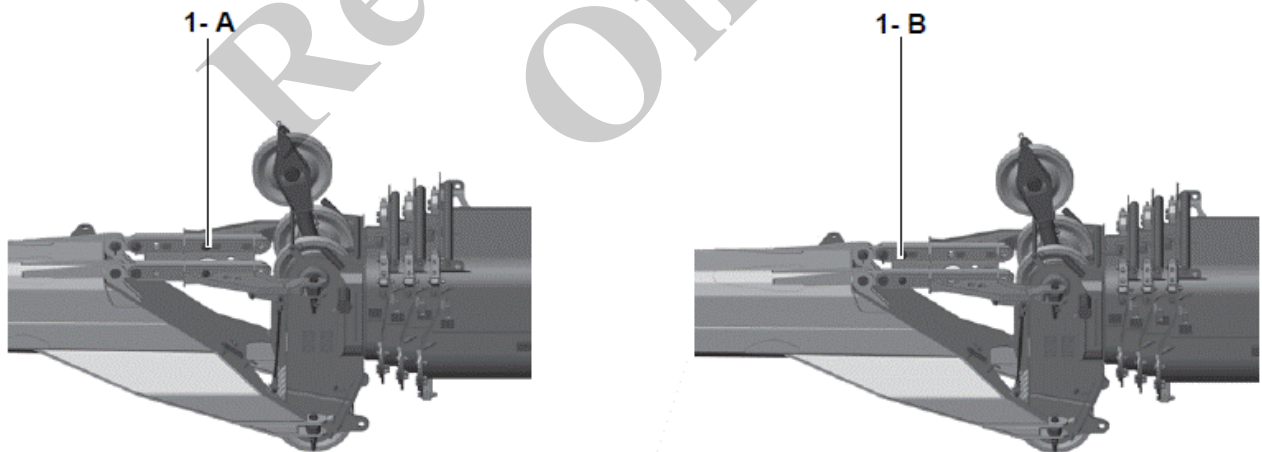


Fig. 133: Bolting the fly boom at 20° for 40°

4. → Carefully lower the telescopic boom until the fly boom is extended and the bolt (1) can be inserted from position A to B.
5. → Unlock the bolts (1) in position A in sequence left and right, pull them out and insert them in position B and secure them.

Setup


Fly boom > Folding the fly boom from 40° to 20°

6. Carefully lift the telescopic boom, fly boom folds from 20° to 40°.
7. Carefully lift the telescopic boom further for operation.



Fig. 134: Fly boom at 20° and 40°

7.9.11 Folding the fly boom from 40° to 20°

1. Start the diesel engine.
2. Select the operating mode **attachments**  on SENCON.
3. Carefully lower the telescopic boom until the fly boom is supported on the ground or on a suitable support.

i Information When lifting the boom, the fly boom slides onto the support in the direction of the machine (approximately 1.5 m (4.1 ft)). Do not push the fly boom onto the ground.

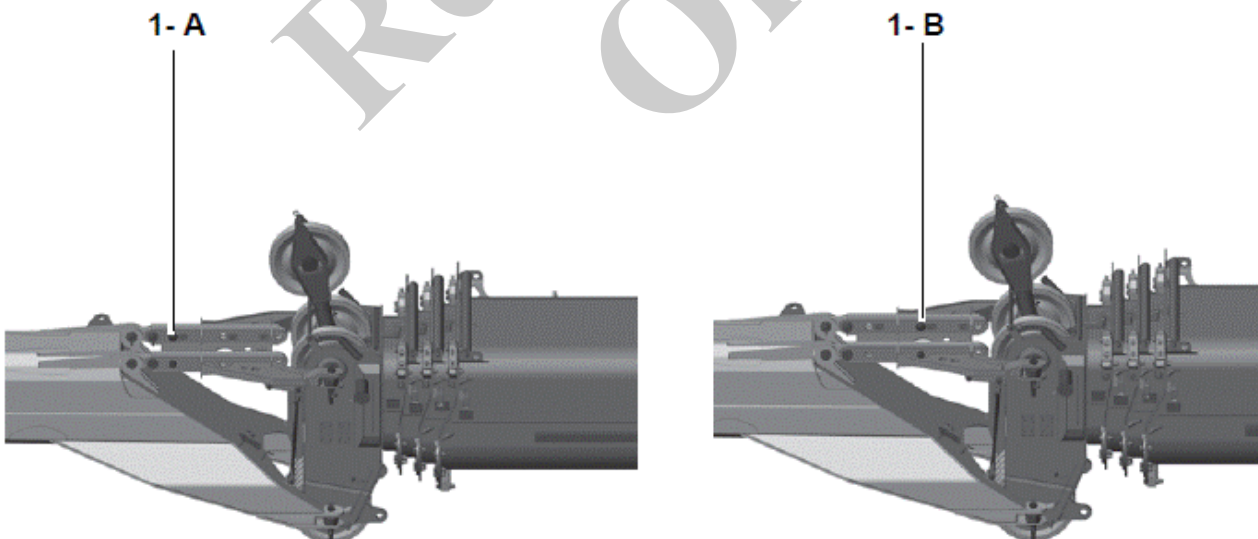


Fig. 135: Bolting the fly boom at 40° for 20°

4. Carefully lower the telescopic boom further until the fly boom is extended and the bolt (1) can be inserted from position A to B.

5. → Unlock the bolts (1) in position A in sequence left and right, pull them out and insert them in position B and secure them.
6. → Carefully lift the telescopic boom, fly boom folds from 40° to 20°.
7. → Carefully lift the telescopic boom further for operation.

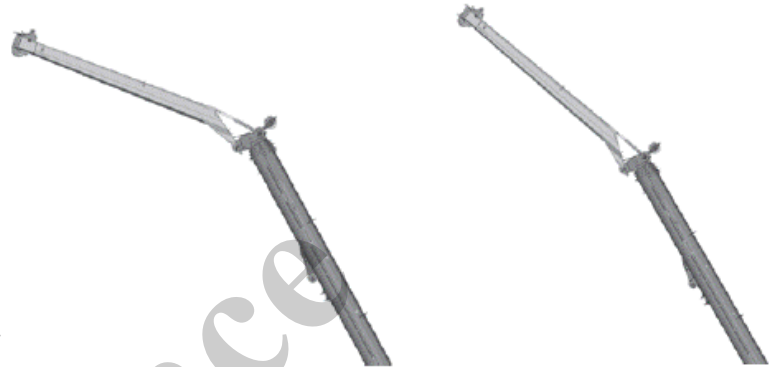



Fig. 136: Fly boom at 40° and 20°

7.9.12 Folding the fly boom from 20° or 40° to 0°

1. → Start the diesel engine.
2. → Select the operating mode **attachments**  on SENCON.
3. → Carefully lower the telescopic boom until the fly boom head is supported on the ground or on a suitable support.

i Information When lifting the boom, the fly boom slides onto the support in the direction of the machine (approximately 1.5 m (4.1 ft)). Do not push the fly boom onto the ground.

4. → Carefully lower the telescopic boom further until the fly boom is extended and the bolt (1) can be inserted in position C.

Setup

Fly boom > Folding the fly boom from 20° or 40° to 0°

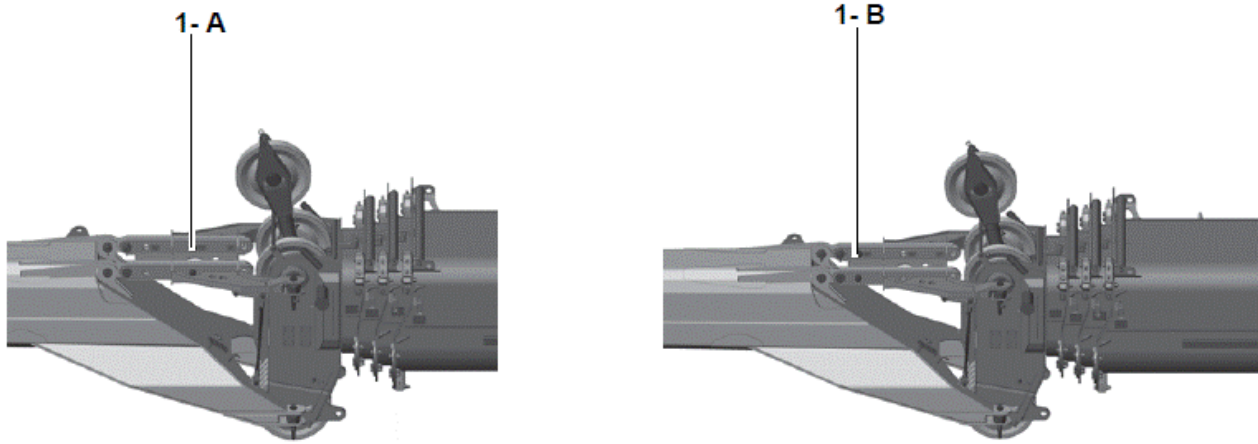


Fig. 137: Bolting the fly boom from 20°/40° for 0°

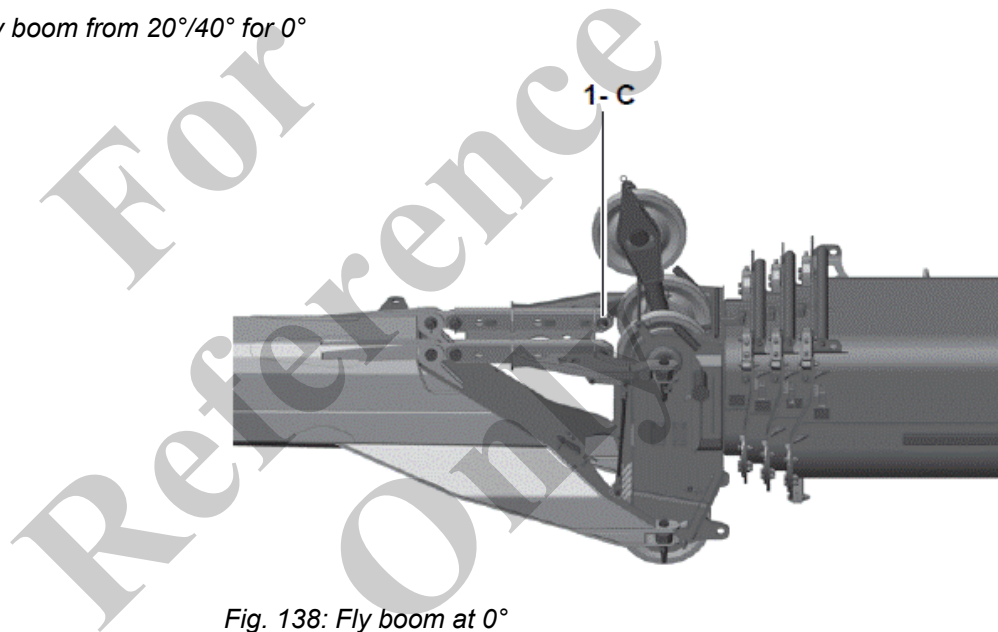


Fig. 138: Fly boom at 0°

5. → Unlock the bolt (1) from position A or B left and right, pull it out and insert it in position C and secure it.
6. → Carefully lift telescopic boom for operation.



Fig. 139: Fly boom at 0°, 20° and 40°

7.10 Fly jib extension

For
Reference
Only

7.10.1 Attaching the fly boom extension

NOTICE

Information


The procedure requires at least two operators. The work position in the cab must be occupied by an operator during the whole procedure.

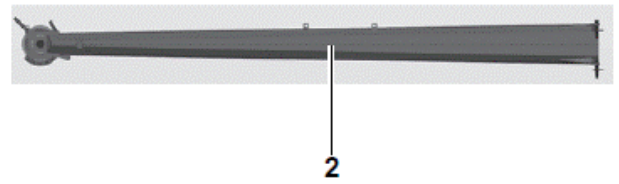
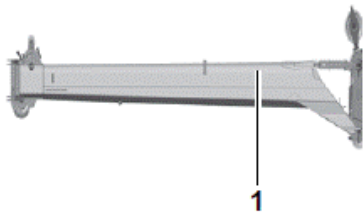
CAUTION

Risk of falling without fall-arrest equipment.

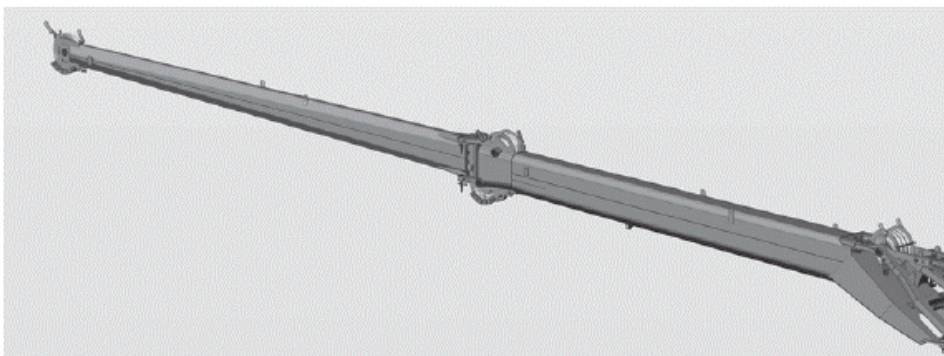
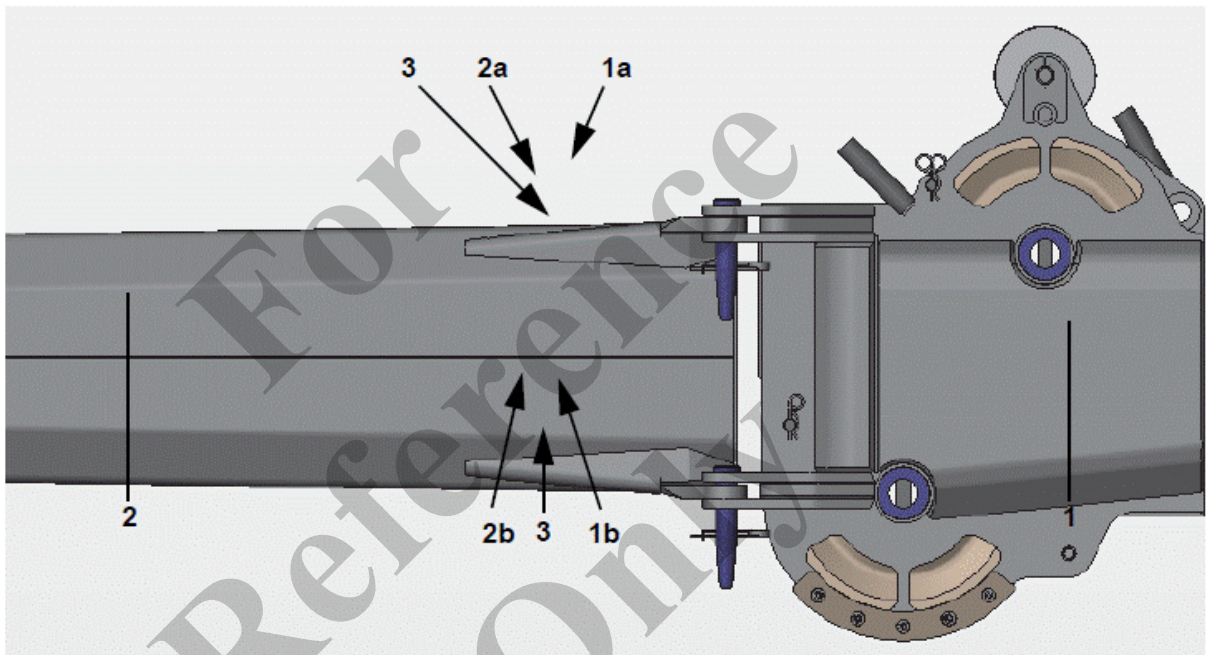
Risk of injury from falling off the machine.

- Use a ladder to install/remove bolts above a work height of 1.40 m (4.7 ft).
- Do not climb on the telescopic boom or the fly boom.

1. ▶ Start the diesel engine.
2. ▶ Select the operating mode **attachments**  on SENCON.
3. ▶ Completely retract the telescopic boom with the fly boom (1) attached and lower it to 0°.
4. ▶ Place the bottom hook block on the ground.
5. ▶ Reeve out the hoist rope from the fly boom and the bottom hook block.
6. ▶ Using suitable load suspension equipment (minimum load-bearing capacity 2000 kg (4409.2 lbs)), hook the fly boom extension (2) onto an auxiliary crane and move it near the fly boom (1).
7. ▶ Lift/lower the fly boom extension using the auxiliary crane until the bores of the fork elements (1a, 1b) on the fly boom head and the bores of the straps (2a, 2b) on the fly boom extension align and the bolts can be inserted.
8. ▶ Insert the bolts (3) on the right and left, top and bottom, and secure them with retaining springs.
9. ▶ Remove the lifting gear and move the auxiliary crane out of the work area.
10. ▶ Guide the hoist rope of winch 1 over the deflection sheave of the main boom to the head of the fly boom. Guide the hoist rope further between the small (6) and large sheave on the fly boom head and further over the sheave on the end of the fly boom extension, and reeve it in between the sheave on the fly boom and bottom hook block.
11. ▶ Plug the connecting cable for (fly boom) lifting limit switch (4) into the socket of the fly boom (5).

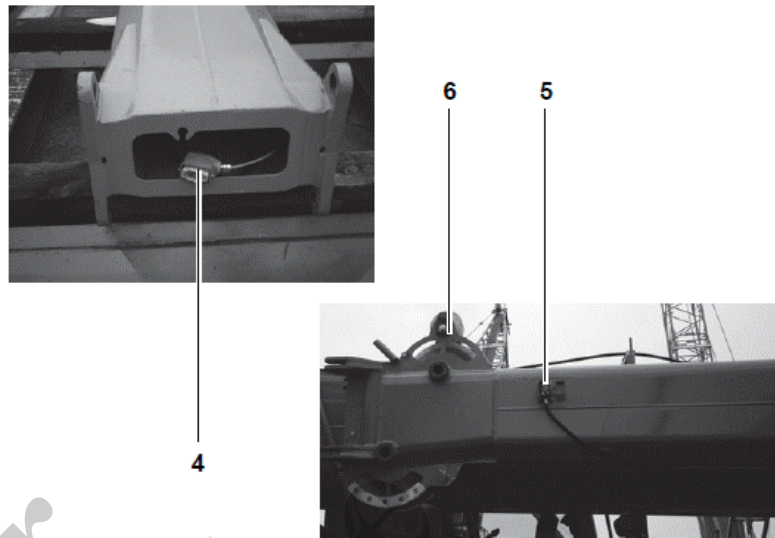


- 1 Fly boom 8 m (26.2 ft)
- 2 Fly boom extension 7 m (23 ft)

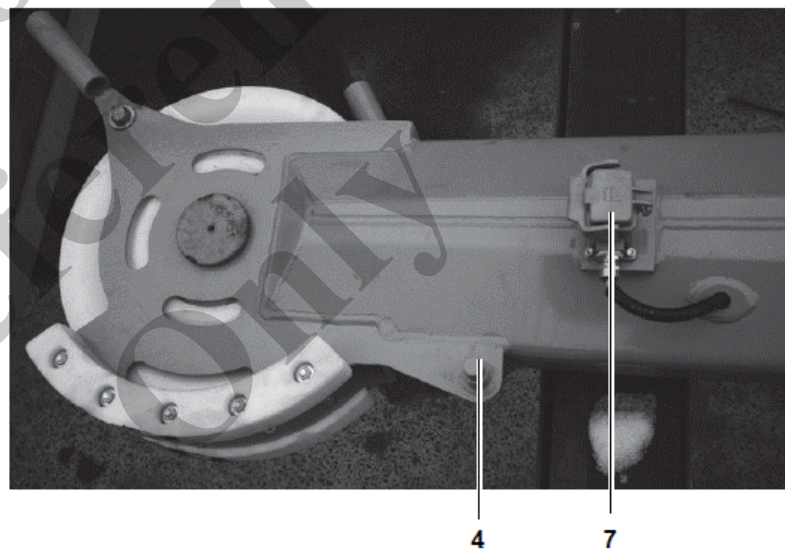


Setup

Fly jib extension > Attaching the fly boom extension



12. ▶ Fasten the lifting limit switch on the fly boom extension (6) and plug it into the appropriate power socket (7).




13. ▶ Install the lifting limit switch weight and chain on the lifting limit switch.

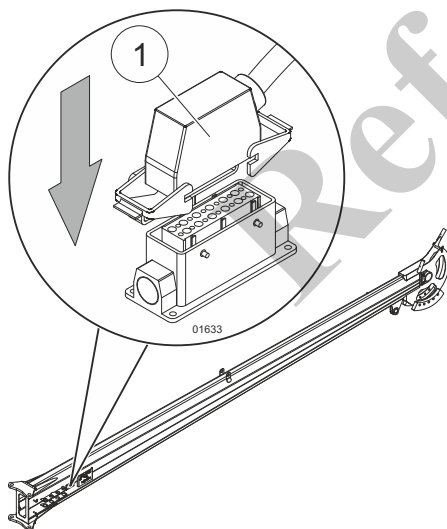
7.10.2 Detaching the fly boom extension

⚠ CAUTION

**Risk of falling without fall-arrest equipment.
Risk of injury from falling off the machine.**

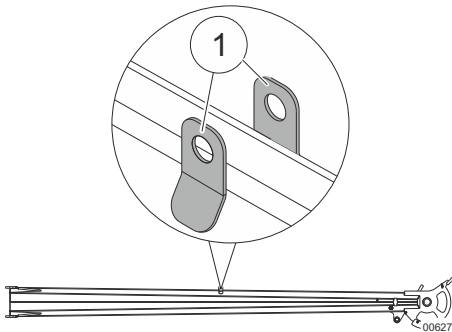
- Use a ladder to install/remove bolts above a work height of 1.40 m (4.7 ft).
- Do not climb on the telescopic boom or the fly boom.

1. → Attach the maximum counterweight.
2. → Fully extend the undercarriage.
3. → Folding the fly boom and fly boom extension into working position.
4. → Start the diesel engine.
5. → Select the operating mode **attachments**  on SENCON.
6. → Push the safety lever forward.
7. → Completely retract the telescopic boom with the fly boom attached and bring it to 0°.
8. → Place the bottom hook block on the ground.
9. → Un-reeve hoisting cable and wind it onto the winch.
10. → Switch off the diesel engine and pull the safety lever towards you.
11. → Remove the lifting limit switch of the fly boom extension from the fly boom and insert it in the socket of the fly boom extension.

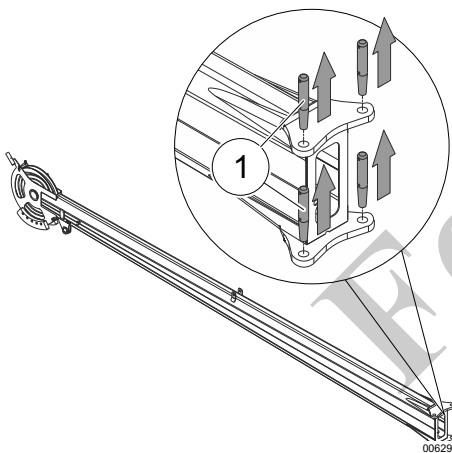


Setup

Auxiliary jib > Installing the auxiliary jib



12. ▶ Attach suitable hoisting gear to the fly boom extension at its lifting points to an auxiliary crane.

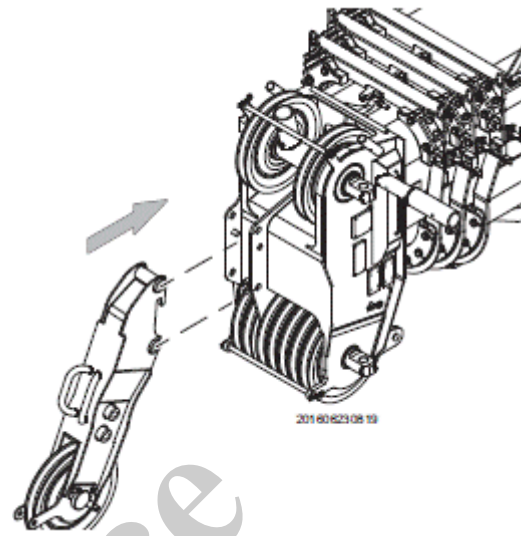


13. ▶ Release and remove the bolts on the fly boom extension.
14. ▶ Lift the fly boom extension from the fly boom.

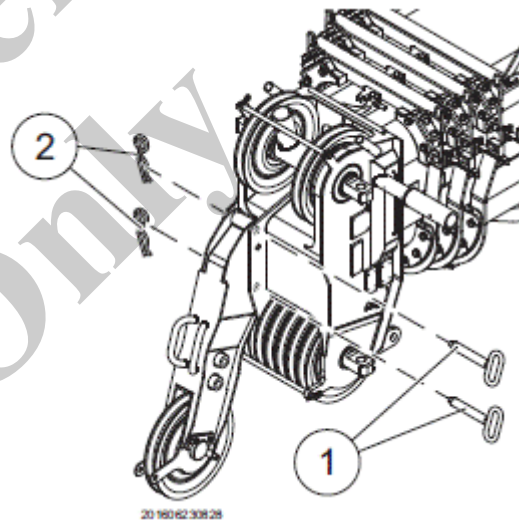
7.11 Auxiliary jib

7.11.1 Installing the auxiliary jib

1. ▶ Start the diesel engine.
2. ▶ Select **Setup 2** operating mode on the SENCON.
3. ▶ Fully retract the telescopic boom and lower it to installation height.
4. ▶ Place the bottom hook block on the ground.
5. ▶ Unreeve the hoist rope.
6. ▶ Bring the auxiliary jib (1) to the boom pulley head (2) and hook it in.



7. → Insert the bolts (1) and secure with retaining springs.

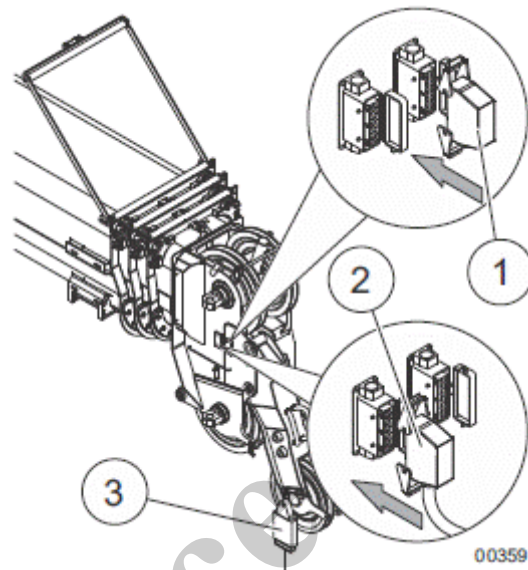


Reeving the hoist rope

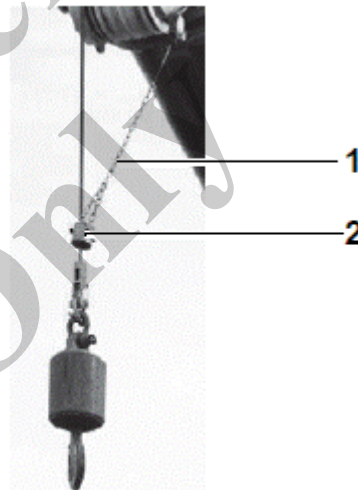
1. → Guide the hoist rope of winch 1 over the sheave of the telescopic boom and over the sheave of the auxiliary jib.
2. → Remove the bypass plug (1) from the left socket on the telescopic boom head and insert it into the right socket.
3. → Attach the lifting limit switch (3) to the auxiliary jib and insert it into the left socket on the telescopic boom (2).

Setup

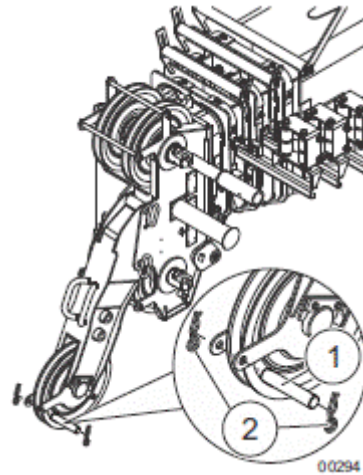
Auxiliary jib > Installing the auxiliary jib



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



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



6. → Attach the bottom hook block.

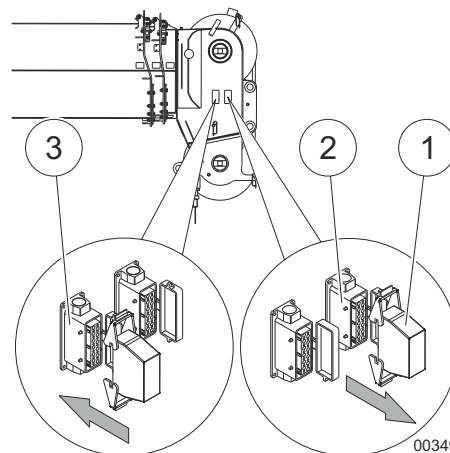


Information

Removal is the reverse of installation.

7.11.2 Dismantling the auxiliary jib

1. → Start the diesel engine.
2. → Select **Setup 2** operating mode on the SENCON.
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.

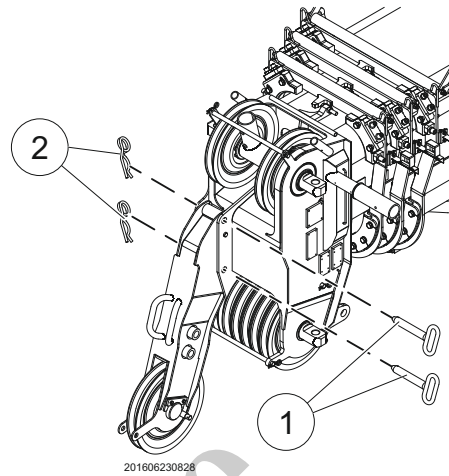


7. → Remove the bypass plug shown from the right socket and insert it into the left socket.

Setup

Auxiliary jib > Dismantling the auxiliary jib

- 8.** ▶ Fasten the auxiliary jib to a suitable lifting tool.



- 9.** ▶ Loosen the spring cotter pins and pull out the bolts 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.

For Reference Only

8 Transport

8.1 Safety instructions

Preliminary work

Transport on a lowbed trailer requires the following preliminary tasks to be performed:

- Select a suitable transport vehicle.
- Clean the machine.
- Bring the telescopic boom into transport position. To completely lower the boom, operate the key switch "Bypass RCL".
- If necessary, dismount the fly boom or fold and secure it.
- Secure the bottom hook block against swinging.
- Lock uppercarriage and undercarriage.
 - Turn the uppercarriage parallel to the undercarriage. For ballasting, the uppercarriage must be precisely in the 0° position.
 - The uppercarriage can be locked in at exactly 0° from the corresponding SENCON menu.
- Adjust the minimum track width of the undercarriage.
- Stow or remove the walkways and deploy the railings.

Safety during transport

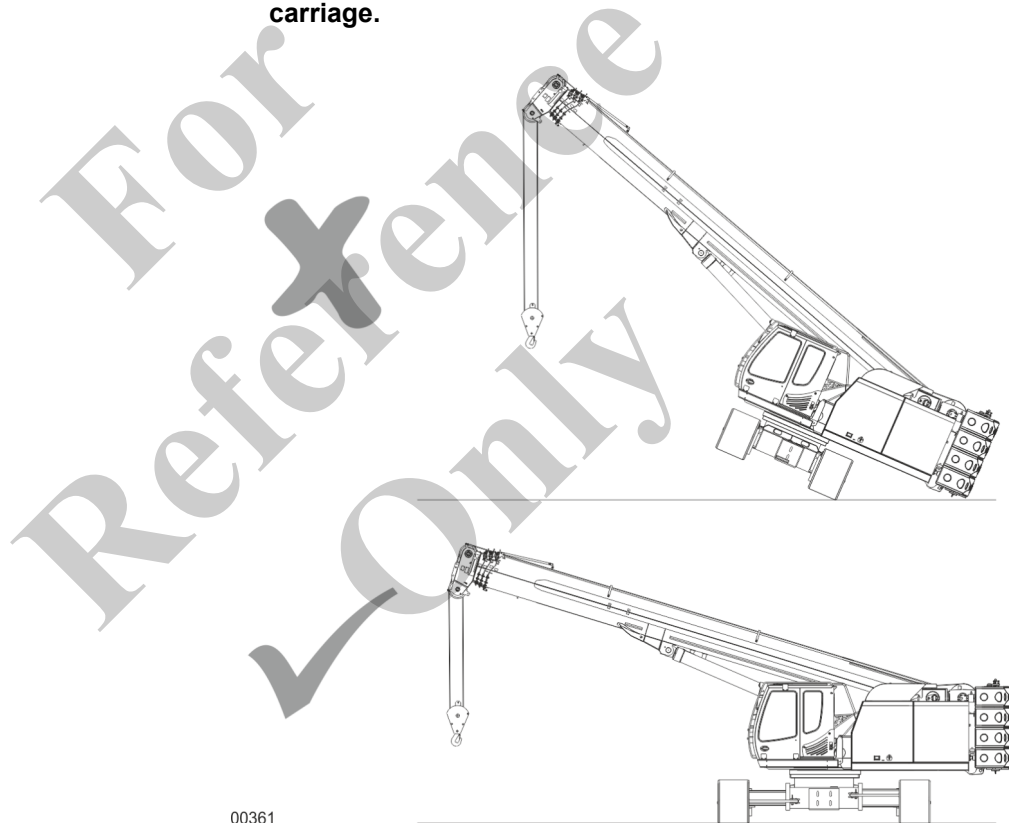
- Only have authorized specialists execute loading and transport tasks.
- Observe the relevant regulations for securing loads. The respective transport company is always responsible for the transport of machine and accessories.
 - When loading and transporting, safeguard the machine and the working equipment against unintentional movements.
 - When loading, secure all required auxiliary equipment, such as ramp sections or wooden planks against any unintentional movement.
- Clean the machine's wheels or chains of mud, snow, and ice.
- Check the conditions of the route before starting the transport.
- Only transport the machine using the designated lashing and lifting points.
- Ensure that the machine does not pose any hazards for other traffic participants.
- Wear personal protective equipment (e.g. hard hat, protective gloves, safety footwear).

⚠ WARNING

Risk of death due to machine tipping over.

Slewing the uppercarriage with maximum counterweight and undercarriage fully retracted can cause the machine to tip over. This can cause death or serious injury.

- In work mode, when performing maintenance on or setting up the machine with full counterweight, never work with the undercarriage fully retracted.
- Before adjusting the track width, align the uppercarriage with the undercarriage in the direction of travel and secure it in place.
- Do not slew the uppercarriage while adjusting the track width.
- With a minimum track width, only slew the uppercarriage with a working radius of more than 9 m (29.5 ft). Make sure there is no load on the load hook when slewing the uppercarriage.



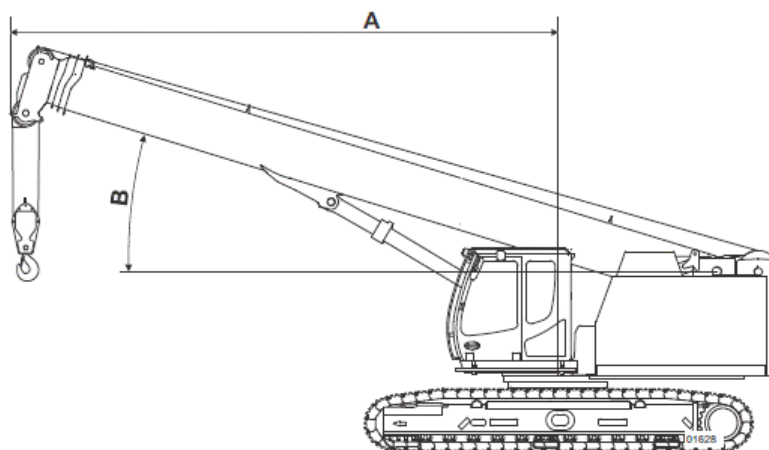
00361

⚠ WARNING

Risk of death due to machine tipping over.

When retracting the track width, the following conditions must be met before the uppercarriage is swung over the side.

- With full counterweight - the radius must be at least 9.14 m (30 ft) and the boom length must be 13.7 m (45.3 ft).
- Without counterweight - the boom must be fully retracted and the radius should be 7.6 m (25 ft) and the boom angle should be at 30°.



For
Reference
Only

8.2 Controls for unloading the machine

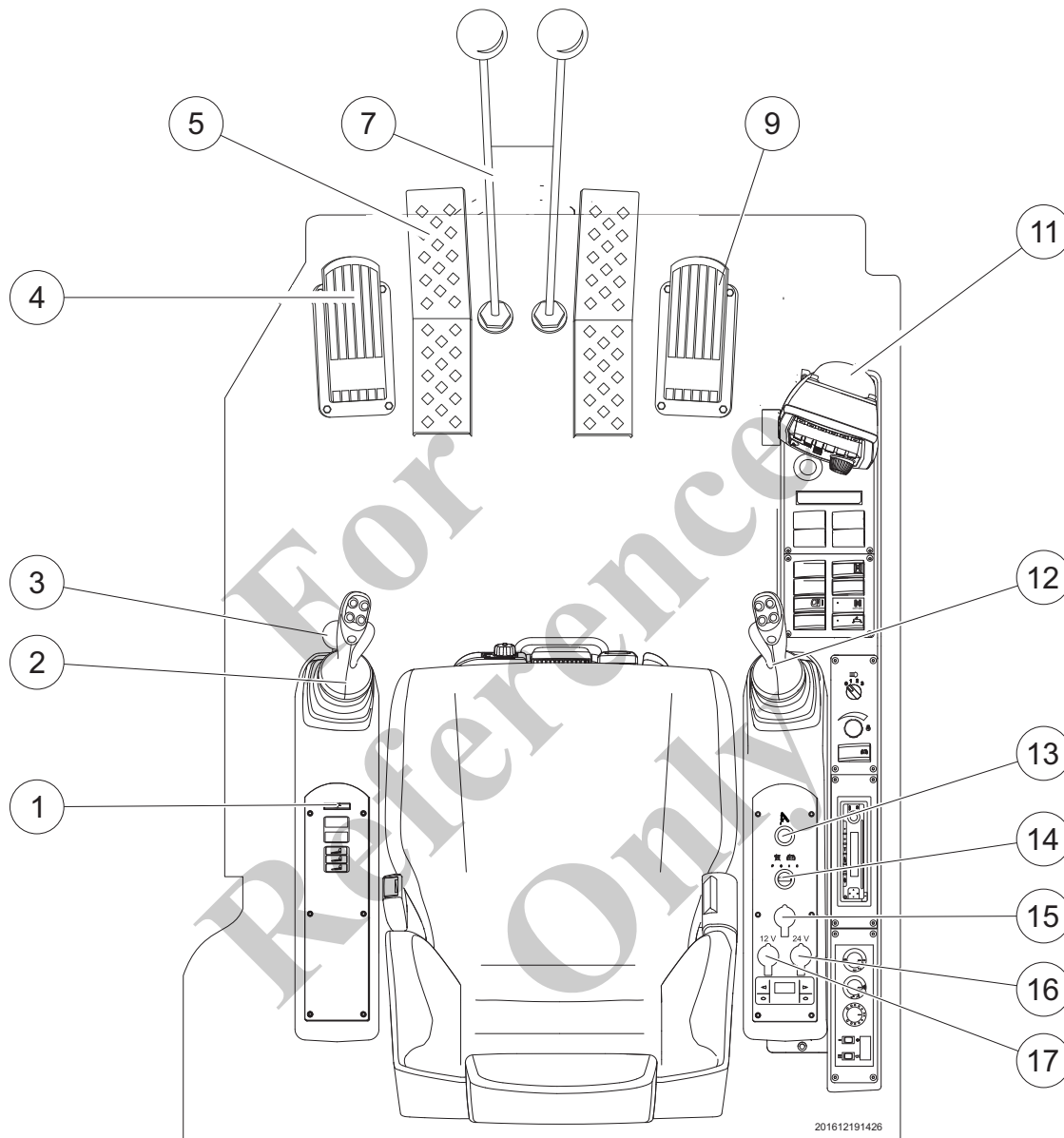
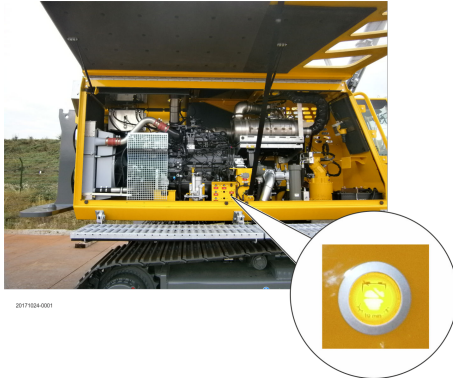


Fig. 140: Operating elements in the cab

- | | | | |
|---|--------------------|----|-----------------------|
| 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 |

8.3 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. 141: Battery disconnect switch

8.4 Unloading the machine

8.4.1 Safety instructions

Safety while loading and unloading the machine

- Make sure that no unauthorized persons are near the machine when it is being loaded and unloaded.
- Boom angle is set to 30°.
- Machine uppercarriage is locked.
- Uppercarriage is facing direction of travel.
- Do not lift loads with the machine.
- Only use the specified controls.
- Make sure the ballast is secure and tighten if necessary.

The machine is unloaded from the transport vehicle in two steps:

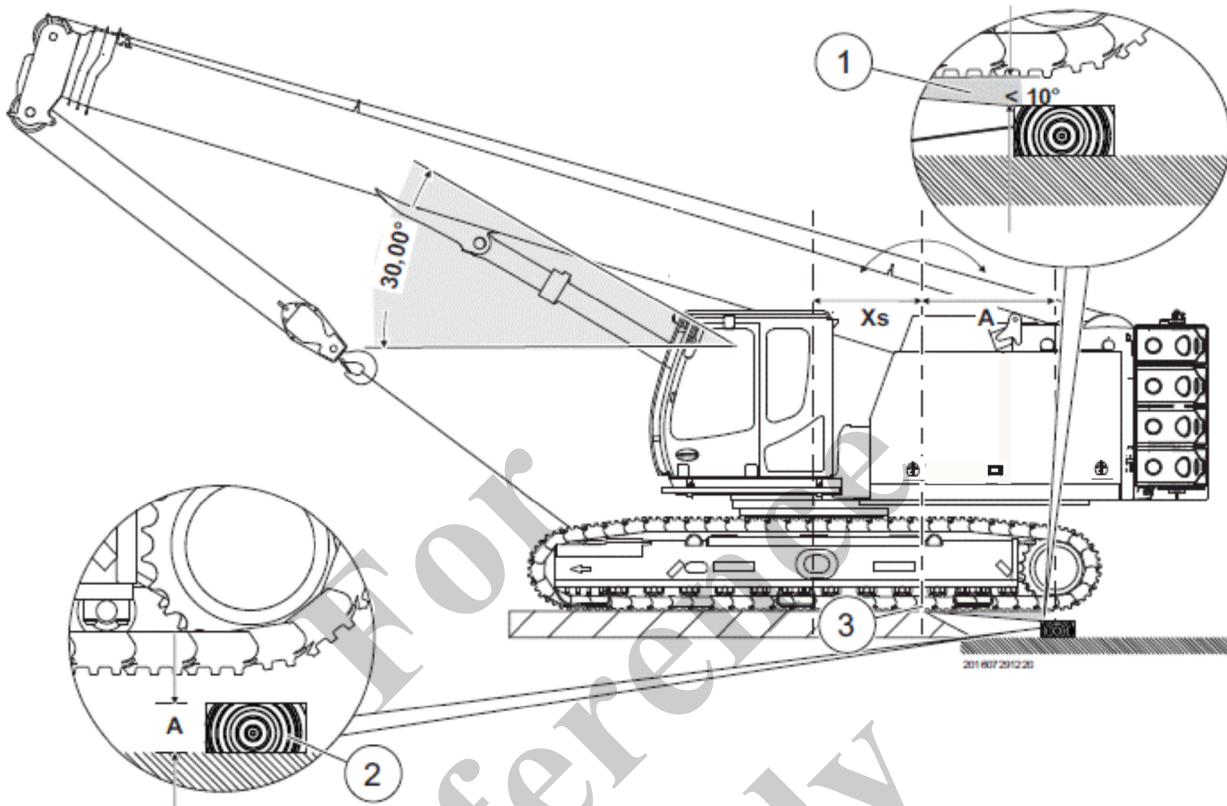
- Configuring the setup program in the SENCON.
- Driving the machine off the transport vehicle.

8.4.2 Setup mode



See Section Setup.

8.4.3 Moving the machine off the transport vehicle



- Position 1: Ramp angle <math>< 10^\circ</math>
- Position 2: Support (wood, rubber mat)
- Dimension A: Support height (wood, rubber mat): 1.57 - 1.96 in

	Dimension Xs	Dimension A
with rear ballast	approx. 3.94 in	approx. 97.24 in

Dimension Xs = center of gravity of the machine
 Dimension A = Distance from the center of gravity to the sprocket

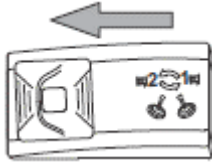
NOTICE

Risk of machine damage when unloaded improperly!

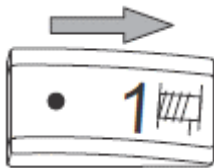
Driving the machine off the flatbed trailer in an uncontrolled fashion may cause the machine to collide with the ground and damage the ballast suspension.

- Lower the boom to 30°.
- Place a 4–5 cm high support (wood, thick rubber mat) (2) on the ground behind the edge of the ramp to absorb the impact of the machine on the ground.
- Carefully maneuver the machine to the tipping point (3).
- Do not move the machine while it is tipping onto the ground from the flatbed trailer.
- The ramp angle (1) is <math>< 10^\circ</math>.

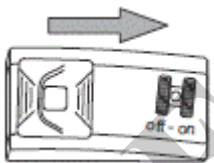
1. → Turn the ignition key to position II.
 - The diesel engine is started.
2. → Press the **Changeover Winch 1/Winch 2** switch to the right.



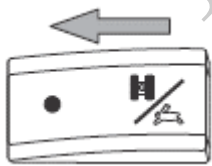
3. → Turn the **Activate winch** switch to the right.



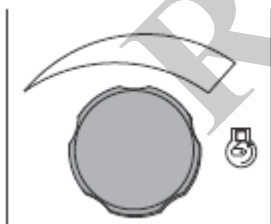
4. → Unlock the **Release drive mode** switch and press it to the right.

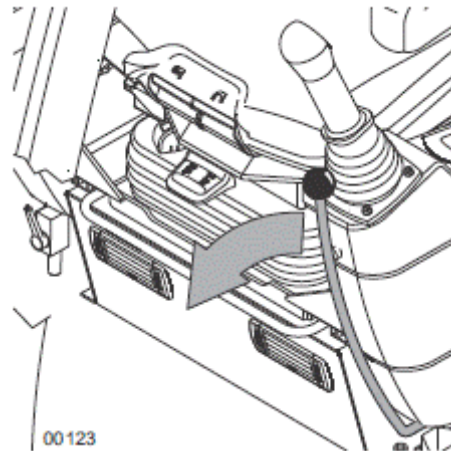


5. → Press the **Travel slow/fast** switch to the left.



6. → Turn the hand throttle slightly to the right.
7. → Press the button with the horn function on the right joystick.
 - The horn sounds.
8. → Push the safety lever forward.



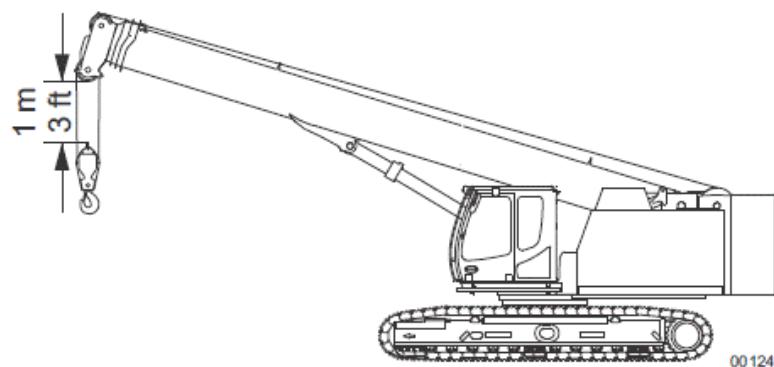


9. ▶ Lift the boom into the 30° position.
 - The boom position is displayed on the SENCON.
10. ▶ Move the machine off of the lowbed trailer. Use extreme caution when maneuvering the machine to the tipping point and do not move the machine while it is tipping.
11. ▶ Lower the boom.

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

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

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



12. ▶ Park the machine at a suitable location.
13. ▶ Turn the ignition key to position 0.

14. ➤ Pull the safety lever back.
15. ➤ Exit the cab.
16. ➤ Switch off the battery disconnect switch and lock the machine.

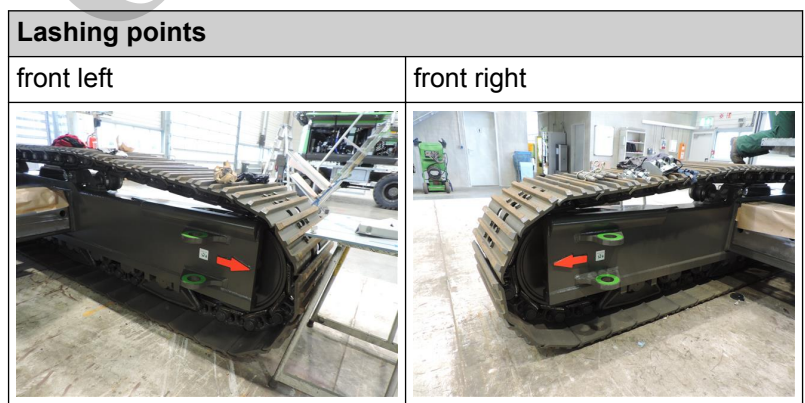
8.5 Lashing the machine



Safety instructions

- Ensure that the sling gear has a sufficient safe working load and is undamaged.
- Ensure that the machine will not be damaged if additional securing is necessary.
- The respective transport company is always responsible for the transport of machine and accessories.
- Only attach the machine at the designated 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.



Lashing points	
rear left	rear right
	

8.6 Lifting the machine

8.6.1 Lifting the machine

Safety instructions

- Only attach machine at the designated lifting points.
- Ensure that the lifting equipment has a sufficient safe working load and safe stability.
- Ensure that the sling gear has a sufficient safe working load and is undamaged.
- The following items are suitable sling gear:
 - Chain suspension
 - Cable suspension
 - Round slings/sling devices
- Pay attention to the danger zone.
- Ensure that there is nobody near, on or below the machine.
- Do not stand underneath a suspended load!

1. ➤ Select suitable lifting crane and sling gear.
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).

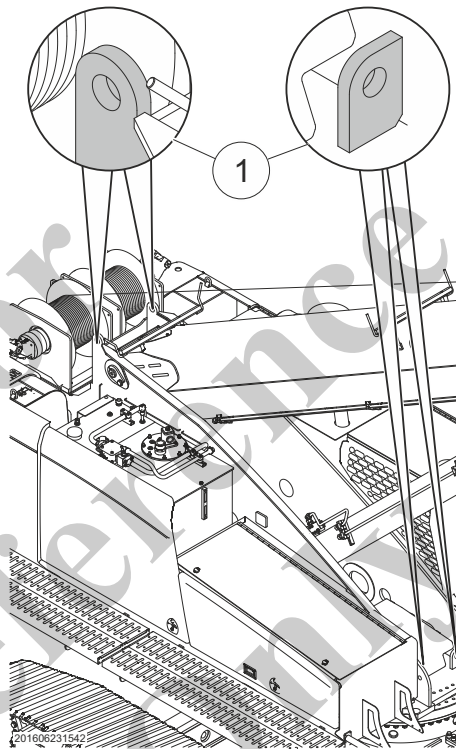


Fig. 142: Lifting point (Model Presentation)

7. ➤ Lift up the machine carefully.

Transport

Lifting the machine > Lifting the machine

Weight: 65.2 t (143741 lbs)

Machine configuration: Machine with 900 mm (35.4 in) 3-bar base plates, with foldable fly boom 8 m (26.2 ft), with counterweight 17.8 t (39,242 lbs), 2 hoisting winches, 35 t (77,161 lbs) hook

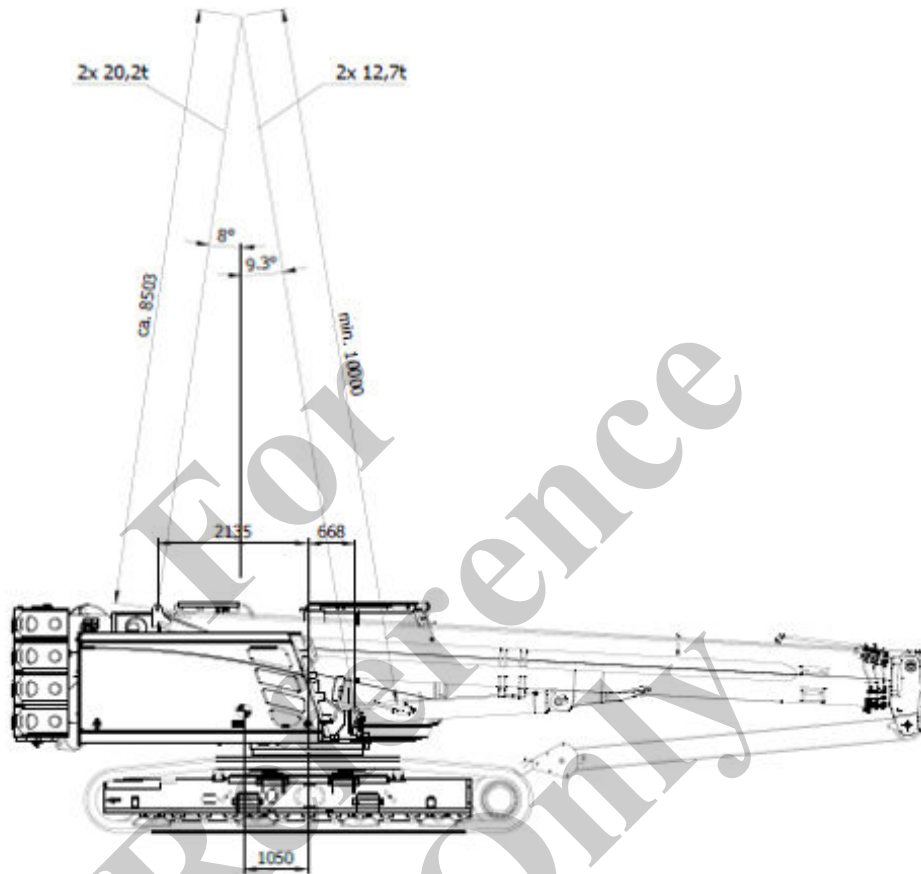


Fig. 143: Lifting data

Conversion table	
2135 mm	84.06 in
668 mm	26.3 in
1050 mm	41.34 in
8503 mm	334.76 in
10000 mm	393.7 in
20.2 t	44,533 lbs
12.7 t	27,998 lbs

Weight: 46.7 t (102,955 lbs)

Machine configuration: Machine with 900 mm (35.4 in) 3-bar base plates, without foldable fly boom, without counterweight, 2 hoisting winches, 35 t (77,161 lbs) hook

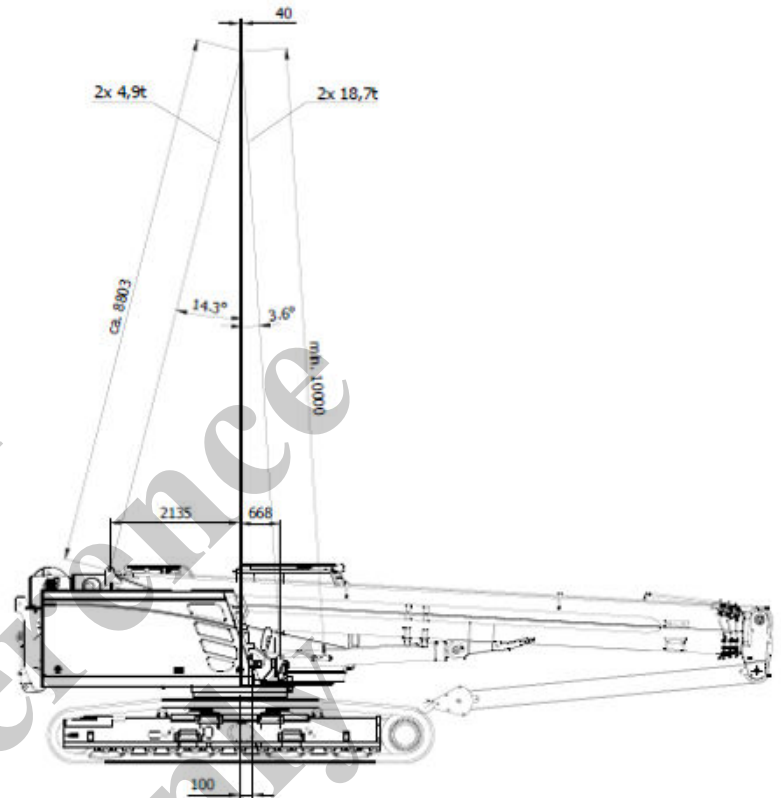


Fig. 144: Lifting data

Conversion table	
2135 mm	84.06 in
668 mm	26.3 in
100 mm	3.94 in
8803 mm	346.57 in
10000 mm	393.7 in
4.9 t	10.02 lbs
18.7 t	41,226 lbs

9 Maintenance schedule

Activities that must be performed on the individual subassemblies are specified in the maintenance schedule.

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

The "Section" column refers the user to the respective chapter in the maintenance manual.

Safety instructions

- The maintenance work listed must only be carried out by trained and instructed specialists.
- Wear personal protective equipment (for example, hard hat, hearing protection, protective gloves, safety footwear).
- Only mix oils, lubricants and operating fluids that are of the same type, i.e. identical (same specifications) from one manufacturer!
- Only use the oils, lubricants and operating materials provided by GROVE.

Information

- Under extreme operating conditions, for example at high ambient temperatures, shorter intervals can be necessary.
- Observe the instructions in the supplemental manuals, if required.
- Observe the provided instructions from the manufacturer of the assemblies as well (e.g. MOTOR DOCUMENTATION).

Activity	Every 10 OH / daily	Every 50 OH / weekly	Once after 250 OH / 6 weeks	Every 500 OH / 3 months	Every 1000 OH / yearly	Every 2000 OH/2 years
Carry out visual and functional check in accordance with the operating manual.	x	x	x	x	x	x
Cab – cab mounting: Check bolts and screw fastenings.	x	x	x	x	x	x
Check that all loose fixtures are seated firmly (bolts, cotter pins, etc.).	x	x	x	x	x	x
Visual inspection of all straps: Fastening, lubrication and wear	x	x	x	x	x	x
Wire cable: Uncoil and then coil up again under sufficient tension ¹⁾		x ¹⁾				

¹⁾ After 100 OH at the latest, then every 100 OH

Activity	Every 10 OH / daily	Every 50 OH / weekly	Once after 250 OH / 6 weeks	Every 500 OH / 3 months	Every 1000 OH / yearly	Every 2000 OH/2 years
Visual inspection of all links and diagonal ties.	x	x	x	x	x	x
Check engine oil level. Observe the intervals specified in the manual provided by the engine manufacturer.	x	x	x	x	x	x
HydroClean micro-filtration system (option): check contamination indicator on SENCON.	x	x	x	x	x	x
Hydraulic system: Check oil level.	x	x	x	x	x	x
Lubricate slewing ring gearing.	x	x	x	x	x	x
Lubricate the rotary connection.		x	x	x	x	x
Central lubrication system: Check level (option).		x	x	x	x	x
Slewing ring pinion lubrication: Check level of lubricant tank		x	x	x	x	x
Check and clean engine cooler.		x	x	x	x	x
Check coolant level.		x	x	x	x	x
Water separator: Check filter		x	x	x	x	x
Slewing gear: Check oil level, add oil if necessary ²⁾ .		x ²⁾	x ²⁾			
²⁾ After 50-100 OH, then every 50-100 OH/monthly						
Slewing gear: Clean oil filter ³⁾ .		x ³⁾	x ³⁾			
³⁾ After 250 OH/6 weeks, then monthly						
Slewing gear: Lubrication ⁴⁾ .		x ⁴⁾	x ⁴⁾			
⁴⁾ After 250 OH/6 weeks, then every 150-200 OH/weekly						
Check and clean hydraulic oil cooler.		x	x	x	x	x
Check and clean combination cooler.		x	x	x	x	x
Check heating system filter.		x	x	x	x	x

Maintenance schedule

Activity	Every 10 OH / daily	Every 50 OH / weekly	Once after 250 OH / 6 weeks	Every 500 OH / 3 months	Every 1000 OH / yearly	Every 2000 OH/2 years
Clean hydraulic cylinders and check for leaks.		x	x	x	x	x
Hoisting winches: Check oil level and check for leaks.		x	x	x	x	x
Rotary connection: Visually check all connecting elements for damage and corrosion.		x	x	x	x	x
Batteries: Check cables and fuses.		x	x	x	x	x
Lubricate machine.		x	x	x	x	x
Rope clamps: Re-tighten bolts.		x	x	x	x	x
Air conditioning compressor: Check belt tension and status.		x	x	x	x	x
Air conditioning compressor: Check the compressor mounts and bolts for tightness. ⁵⁾			x ⁵⁾	x ⁵⁾	x ⁵⁾	x ⁵⁾
⁵⁾ Every 250 OH						
Check heating system filter.			x	x	x	x
Shut-off flap - hydraulic tank (option): Visually check for leaks			x	x	x	x
Check antifreeze.			x	x	x	x
All winches: Lubricate bearing bushes.			x	x	x	x
Both crawler gearboxes: Check oil level and check for leaks.			x	x	x	x
Crawler track: Check the chain tension.			x	x	x	x
Sprocket: Check bolts for firm seat using appropriate means.			x	x	x	x
Base plates: Check bolts for firm seat using appropriate means.			x	x	x	x

Activity	Every 10 OH / daily	Every 50 OH / weekly	Once after 250 OH / 6 weeks	Every 500 OH / 3 months	Every 1000 OH / yearly	Every 2000 OH/2 years
Check slewing ring bolts for firm seat with suitable methods.			x	x	x	x
Steel structure Clean and maintain using suitable materials.		x		x	x	x
Steel structure Check the steel structure for structural damage (e.g., deformation, damage, corrosion, cracking).			x	x	x	x
Counterweight Check for secure fastening of the counterweight elements to the required torque.				x	x	x
Preload pressure - have hydraulic accumulator checked by specialized hydraulic company ⁶⁾ .			x ⁶⁾	x ⁶⁾	x ⁶⁾	x ⁶⁾
⁶⁾ After 250 OH/6 weeks and after 500 OH/3 months, then every 1000 OH/yearly						
Slewing gear: Change oil ⁷⁾ .			x ⁷⁾			x ⁷⁾
Slewing gear: Clean the magnetic closure of the oil drain ⁸⁾ .			x ⁷⁾			x ⁷⁾
Return filter: Replace filter element. ⁷⁾			x ⁷⁾			x ⁷⁾
Leakage oil filter Replace filter element. ⁷⁾			x ⁷⁾			x ⁷⁾
Aeration filter: Replace filter element. ⁷⁾			x ⁷⁾			x ⁷⁾
Hoisting winches: change oil. ⁷⁾			x ⁷⁾			x ⁷⁾
Both travel gears: Change oil. ⁷⁾			x ⁷⁾			x ⁷⁾
⁷⁾ After 250 OH/6 weeks, then every 2000 OH/yearly						
Check the gallery (= operator bridge) for cracks and general damage and repair immediately if necessary.				x	x	x
Heating/climate control system (option): Have checked by an authorized workshop.					x	x

Maintenance schedule

Activity	Every 10 OH / daily	Every 50 OH / weekly	Once after 250 OH / 6 weeks	Every 500 OH / 3 months	Every 1000 OH / yearly	Every 2000 OH/2 years
Air filter: Change replacement cartridge and safety cartridge.					x	x
DEF tank filter: Replace 10).						
DEF supply module: Replace ¹⁰⁾ .						
Change coolant.						x
Hydraulic system: Change oil ⁸⁾ .						x ⁸⁾
⁸⁾ Certain hydraulic oils do not have to be changed as often depending on the results of regularly performed hydraulic oil analyses. The machine must be equipped with GROVE-HydroClean. The hydraulic oils approved for extended intervals are included in the list of operating fluids in the Appendix. The sampling intervals can be found in Section 9.18.2.						
Check or replace slewing ring bolts. ⁹⁾						x ⁹⁾
⁹⁾ Every 5000 OH/5 years						
¹⁰⁾ Every 4500 OH						



Information

Testing the slew ring bolts must be performed by an expert from an independent specialist company / an independent institute.
 Unrestricted further use of the slewing ring bolts must be verified with a certificate. Otherwise, replace the slewing ring screws!

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

11 Fault search

11.1 General information

Safety when correcting faults

- Note chapter **SAFETY**.
- Personnel for maintenance, inspection and fault correction must have the appropriate qualifications for these tasks.
- For activities not described in more detail, notify the GROVER Customer Service organization.

11.2 Safety instructions for troubleshooting

⚠ WARNING

Risk of serious injury due to unforeseen fault!

- 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.

11.3 Drive engine

Fault description	Cause	Remedy
Engine does not start	Battery capacity too low	<ul style="list-style-type: none"> ■ Check fluid level of batteries. ■ Recharge or replace batteries. ■ Start machine using auxiliary battery.
	Shut-off flap on hydraulic tank closed	<ul style="list-style-type: none"> ■ Open shut-off flap.
	Fuel tank empty	<ul style="list-style-type: none"> ■ Refuel machine.
	Emergency stop switch pressed	<ul style="list-style-type: none"> ■ Pull out emergency stop switch
Engine power loss	Intake air flow resistance too high	<ul style="list-style-type: none"> ■ Replace filter element of the water separator.
Machine does not move	Gearbox defective	<ul style="list-style-type: none"> ■ Have fault remedied.
Oil or fuel leaks on the engine	Hose clampings loose	<ul style="list-style-type: none"> ■ Fasten hose clampings.
	Hoses or seals damaged	<ul style="list-style-type: none"> ■ Replace hoses or seals.

11.4 Hydraulic system

Fault description	Cause	Remedy
Oil leaks on the hydraulic system	Hose clampings loose	■ Fasten hose clampings.
	Hoses or seals damaged	■ Replace hoses or seals.
Hydraulic pump not working	Fault in pump circuit	■ Have fault localized and corrected by a hydraulics specialist.
Work equipment malfunctioning or not working	Hydraulic oil level too low	■ Check hydraulic oil level. ■ Add hydraulic oil as needed.
	Hydraulic system leaking	■ Check working cylinder, connections and hoses for leaks. ■ Have the fault corrected by a hydraulics specialist.
	Fault in one of the working circuits	■ Have the fault corrected by a hydraulics specialist.
Noises when moving a working cylinder	Cylinder piston rod not lubricated	■ Have fault corrected by a hydraulics specialist.
No power or low power of the hydraulic system	Hose clampings loose	■ Fasten hose clampings.
	Hoses or seals damaged	■ Replace hoses or seals.
	Pressure relief valve opens too soon	■ Have the fault corrected by a hydraulics specialist.
	Hydraulic pump worn or defective	■ Have pump replaced by a hydraulics specialist.
Noises in hydraulic system	Hydraulic pump takes in air	■ Have the fault corrected by a hydraulics specialist.
	Hydraulic pump delivers insufficient oil	■ Check hydraulic oil level. ■ Add hydraulic oil as needed.
	Pressure relief valve chatters	■ Have the fault corrected by a hydraulics specialist.

11.5 Heating/climate control system

11.5.1 Heat output

Fault description	Cause	Remedy
Blower not working	Fuse defective or loose	■ Check the fuse and insert it correctly, if necessary. Replace defective fuse. If another defect occurs within a short time, it indicates a short-circuit or a blockage. Check the blower for blockages or other defects and rectify the fault.

Fault search

Heating/climate control system > Heat output

Fault description	Cause	Remedy
	Power supply interrupted	■ Check lines for loose contacts or breaks.
	Blower motor defective	■ Replace the blower.
	Defective control element	■ Check control element, replace, if necessary.
Blower cannot be shut off	Short circuit in the cable	■ Rectify short-circuit, install new cable(s) if necessary
Blower working with reduced power	Contacts soiled	■ Clean the plug contact. Proceed carefully to avoid short-circuits.
	Electric line dimensions too small	■ Install recommended cable cross section.
	Heat exchanger contaminated	■ Clean thoroughly and prevent damage that could cause leaks. Notice: Observe the safety instructions.
	Air flow insufficient because air filter is clogged	■ Clean or replace filter.
No heat or insufficient heating output	Coolant feed temperature too low	■ Wait until the vehicle engine is warm
	Vehicle thermostat defective	■ Replace thermostat
	Heat exchanger fins soiled	■ Check heat exchanger and clean if necessary
	Water lines kinked or crushed	■ Rectify cause of fault or install new hose.
	Insufficient water pump pressure	■ No coolant flow through heat exchanger. Install an additional or more powerful pump.
	Insufficient air flow because air filter is clogged	■ Clean or replace filter.
	Resistor defective	■ Replace resistor
	Climate control defective	■ Check and replace if necessary.
Water leaking from unit	Hose connection loose	Check hoses and tighten hose clips
	Water hose damaged	■ Install and connect new hose
	Heat exchanger damaged	■ Install an original replacement part and connect. Notice: Observe the safety instructions.
Air flaps stuck	Servomotor defective	■ Replace servomotor
	Foreign object is blocking flap	■ Check flap, remove foreign object.
	Flap deformed	■ Check flap and straighten if necessary.
	Flap bearing is defective	■ Check flap bearing and replace if necessary.
	Control system defective	■ Check control system and replace if necessary.

11.5.2 Cooling capacity

Fault description	Cause	Remedy
Compressor not working	Interruption in the solenoid coil of the compressor	■ Check the current flow to the clutch.
	V-belt loose or torn	■ Adjust the V-belt tension, replace V-belt.
	V-belt pulley does not turn, even though the magnetic clutch is engaged	■ Check compressor and replace if necessary.
	Compressor clutch slips	■ Repair coupling or replace compressor.
	Control system defective	■ Check control system and replace if necessary.
Evaporator flooding	Expansion valve is stuck in open position, or hangs	■ Replace expansion valve.
Evaporator icing up	Thermostat sensor at the wrong position	■ Reposition sensor.
	Expansion valve, thermostat or collector drier is defective	■ Replace expansion valve, thermostat or collector drier
Evaporator clogged	Cooling fins soiled	■ Clean evaporator
Loss of refrigerant	Break in refrigerant line	■ Check all lines for break due to external effects or abrasion
	Leakage in the system	■ Evacuate, fill, check for leaks and repair.
Insufficient cooling output	Air flow insufficient because air filter is clogged	■ Clean or replace filter.
	Relay defective	■ Replace relay.
	Fan passage obstructed	■ Check air channels for obstructions. Rectify fault.
	Outside air-/recirculating air flap set to outside air at higher outside air temperature	■ Set to recirculating air.
	Air flow of liquefier insufficient because cooling fins are soiled	■ Clean the cooling fins.
	Insufficient refrigerant fill level	■ Fill with refrigerant (service engineer).
	Moisture in the system	■ Empty the climate control system, replace the collector drier, evacuate and fill (service engineer).
	Collector drier saturated	■ Empty the climate control system, replace the collector drier, evacuate and fill (service engineer).
System cooling intermittently	Line break, faulty ground connection or loose contacts in the solenoid coil of the compressor	■ Check lines, repair or replace.

Fault search

Travel gear/undercarriage

Fault description	Cause	Remedy
	Blower motor defective	<ul style="list-style-type: none"> ■ Replace blower.

11.5.3 System very noisy

Fault description	Cause	Remedy
System very noisy	V-belt loose or excessively worn	<ul style="list-style-type: none"> ■ Tighten or replace V-belt.
	Clutch noisy	<ul style="list-style-type: none"> ■ Repair clutch.
	The compressor bracket is loose or the internal components of the compressor are worn	<ul style="list-style-type: none"> ■ Repair holder; replace compressor.
	Excessive wear of fan motor	<ul style="list-style-type: none"> ■ Replace blower.
	System overfilled	<ul style="list-style-type: none"> ■ Extract refrigerant until the high-pressure display shows normal value.
	Insufficient refrigerant level in the system	<ul style="list-style-type: none"> ■ Check for leaks; fill system.

11.6 Slewing gear

Fault description	Cause	Remedy
Oil leaks in slewing mechanism transmission	Loose connections	<ul style="list-style-type: none"> ■ Tighten connections.
Rotary feedthrough leaking	Seals damaged	<ul style="list-style-type: none"> ■ Replace seals.
	Lines loose	<ul style="list-style-type: none"> ■ Tighten fastening screws.
Noise from the slewing gear	Insufficient lubrication on gear rim	<ul style="list-style-type: none"> ■ Lubricate gear rim according to lubrication plan

11.7 Travel gear/undercarriage

Fault description	Cause	Remedy
Oil leaks on the travel gear	Sealing plugs loose	<ul style="list-style-type: none"> ■ Fasten sealing plugs.
	Seals damaged.	<ul style="list-style-type: none"> ■ Replace seals.

11.8 Cab

Fault description	Cause	Remedy
Increased shaking or vibration of cab	Cab suspension or cab attachment damaged	<ul style="list-style-type: none"><li data-bbox="715 407 1474 497">■ Check all connection elements, screws and bolts of cab suspension and fastening for damage, cracking or deformation.<li data-bbox="715 497 1474 564">■ Have damaged parts exchanged immediately by trained and instructed specialist personnel.

For
Reference
Only

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.

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Appendix

A ANSI signage for GHC 75

For
Reference
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ANSI signage for GHC75

GHC75



en

WSS-rec-0134

Release date: 03. March 2016

Current revision status: 4

Printed copies are not subject to change.

For
Reference
Only

690609_en, 4, en_US

Foreword

Information on this decal scheme This decal scheme contains an overview of safety-relevant signage and is part of the operating manual.

It refers to the state of the machine upon delivery. It must be reviewed and modified as needed if changes are made to the machine's equipment.

Layout This decal scheme is divided into sections on the cab, the upper-carriage and the undercarriage. The overview graphics show the application areas on the machine. These areas are numbered. The locations of adhesive signage are numbered consecutively on the overview graphic.

Optional decals This decal scheme includes the maximum number of warning and safety signage. Optional decals are indicated as such. Further information on optional versions can be found in the operating manual.

Parts The operator must check spare parts for the necessary warning and safety signage and apply them as needed.

If the machine leaves the original country of destination for a job, the operator must make sure the warning and safety signage meets the regulations of the new country and modify, add, or change the signage accordingly.

**DANGER!**

Failure to observe warning and safety signage can result in death or serious injury.

- Follow all warning and safety signage.
- Stay clear of the danger zone.

*For
Reference
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Table of contents

1	ANSI signage for the Maxcab.....	7
1.1	Overview graphics of Maxcab.....	7
1.2	ANSI warning and safety signage for Maxcab.....	10
2	ANSI signage for GHC75 undercarriage.....	23
2.1	Overview graphics of GHC75 undercarriage.....	23
2.2	Warning and safety signs on GHC75 undercarriage..	23
3	ANSI signage for GHC75/130 uppercarriage.....	27
3.1	Overview graphics of GHC75/130 uppercarriage.....	27
3.2	Warning and safety signs on GHC75/130 uppercarriage.....	29
4	Index.....	51

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1 ANSI signage for the Maxcab

1.1 Overview graphics of Maxcab

Exterior cab

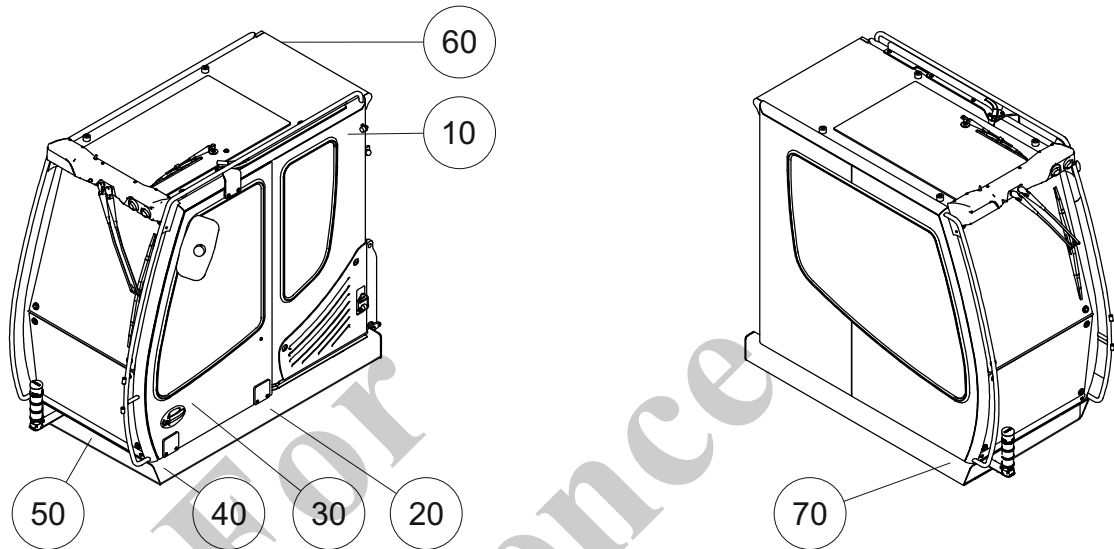


Fig. 1: Exterior cab signage

Interior cab

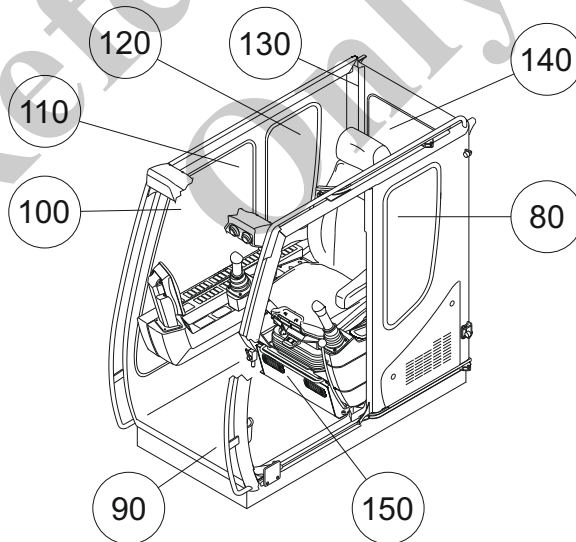


Fig. 2: Interior cab signage

ANSI signage for the Maxcab

Overview graphics of Maxcab

Cab platform and safety guard

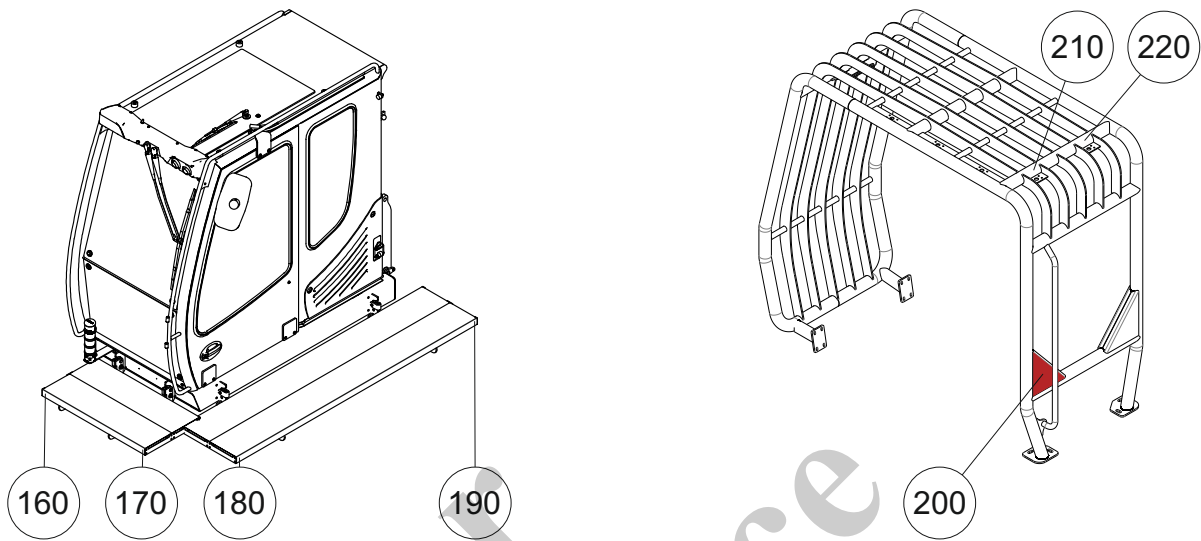


Fig. 3: Cab platform and FOPS signage

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ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

1.2 ANSI warning and safety signage for Maxcab


10

Fire extinguisher label

	General application area	Fire extinguisher storage locations
	Option 1	ANSI
	Option 2	Fire extinguisher
SE	187974	

20

Risk of collapse/falling when exceeding maximum platform load per section as per DIN EN ISO 2867 and ISO 11660-2. Do not exceed maximum platform load.


	General application area	Exterior cab, exterior uppercarriage
	Option 1	ANSI
	Option 2	Cab platform
	Option 3	Uppercarriage platform
SE	187962	

30

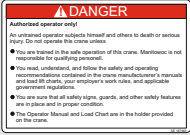
ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab


DANGER. Electric current from overhead lines can result in death or serious injury. Maintain a safe distance.

	General application area	Interior cab Exterior cab
	Option 1	ANSI
	Option 2	Crane
SE	187236	

DANGER. Operation by authorized personnel only.

	General application area	Interior cab, exterior cab
	Option	Grove
SE	187983	


Crane Star

	General application area	Exterior cab
	Option	Grove
SE	187881	

ANSI signage for the Maxcab


ANSI warning and safety signage for Maxcab

WARNING. Rotating machine can cause death or serious injury. Stay clear of the danger zone.


	General application area	Exterior cab, exterior uppercarriage
	Option	ANSI
SE	187233	

50

WARNING. Lowering cab can result in crushing. Stay clear of the danger zone.

	General application area	Front exterior cab
	Option 1	ANSI
	Option 2	Cab adjustment
SE	187973	

WARNING. Falling loads can result in death or serious injury. Never stand under suspended loads.


	General application area	Exterior cab, uppercarriage access ladder
	Option	ANSI
SE	187957	

60

ANSI signage for the Maxcab


ANSI warning and safety signage for Maxcab

24 V socket label

	General application area	On every 24 V socket
	Option	24 V socket
SE	186587	


70

WARNING. Rotating machine can cause death or serious injury. Stay clear of the danger zone.

	General application area	Exterior cab, exterior uppercarriage
	Option	ANSI
SE	187233	

80


Never leave the machine unattended with the engine running.

	General application area	Interior cab
	Option	ANSI
SE	187979	

ANSI signage for the Maxcab

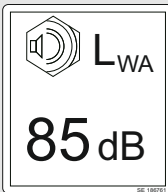
ANSI warning and safety signage for Maxcab

If you do not understand the language in the operating manual, you are not allowed to start the machine.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Grove
SE	187963	


Sound power level dB(A), Outdoor Guideline L_{WA}

Values: 85–115 dB

	General application area	Interior cab
	Option	EU
SE	186761, 186762, 186851 - 186879	

90

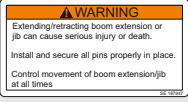
DANGER. Electric current from overhead lines can result in death or serious injury. Maintain a safe distance.

	General application area	Interior cab Exterior cab
	Option 1	ANSI
	Option 2	Crane
SE	187236	

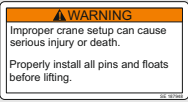
ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

WARNING. Folding boom extension or boom can cause death or serious injury. Only operate crane when properly assembled. Exercise caution in the danger zone.


	General application area	Interior cab
	Option	ANSI
SE	187947	

WARNING. Improper crane assembly can result in death or serious injury. Only operate crane when properly assembled.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187948	

100

Emergency exit label

	Material handling machine application area	Rear interior cab
	Other application area	Right interior cab
	Option	ANSI
SE	187970	

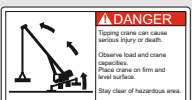
ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

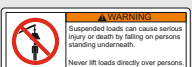
DANGER. Crane falling backward can result in death or serious injury. Only operate crane when properly assembled.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187951	

DANGER. Tipping crane can result in death or serious injury. Observe specified safe working loads. Always position crane on level ground. Keep away from danger zones.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187955	

WARNING. Suspended loads can cause death or serious injury to personnel below. Never swing suspended loads over personnel.

	General application area	Interior cab
	Option	ANSI
SE	187953	

Failure to observe load lift charts and operating instructions can result in death or serious injury.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187952	

ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

110


Machine controller sticker

	General application area	Interior cab
	Option	---
SE	Various	

Operating mode sticker

	General application area	Interior cab
	Option	Material handling machine, telescopic cranes
SE	Various	

Crane Star

	General application area	Interior cab
	Option	Grove
SE	187877	

120

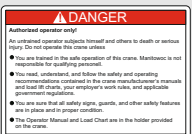
ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

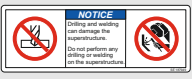
DANGER. Improper use of the crane can cause death or serious injury. For proper use only as described in the manual.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187950	

DANGER. Operation by authorized personnel only.

	General application area	Interior cab, exterior cab
	Option	Grove
SE	187983	

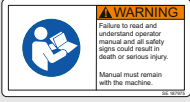
Drilling and welding prohibited.

	General application area	Interior cab
	Option 1	ANSI
SE	187949	

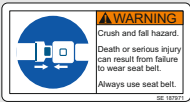
ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.


	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

Risk of falling out of cab. Wear seat belt.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Seat belt
SE	187971	

140

Emergency exit label


	Material handling machine application area	Rear interior cab
	Other application area	Right interior cab
	Option	ANSI
SE	187970	

150

ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

Emergency drop label

	General application area	On emergency drop levers
	Option 1	ANSI
	Option 2	Cab adjustment
SE	194111	


160

170

180


190

Warning sign hatching


	General application area	Outer edges of platform (machine boundaries), on shearing points
	Option	Platform
SE	187969	

180

WARNING. Rotating machine can cause death or serious injury. Stay clear of the danger zone.

	General application area	Outer edges of platform (machine boundaries)
	Option 1	ANSI
	Option 2	Platform
SE	187993	

Other decals

Warning sign hatching		
	General application area	On shearing points
	Option 1	Cab adjustment
	Option 2	Mobile undercarriage with claw support
SE	186734	

For
Reference
Only

ANSI signage for the Maxcab

ANSI warning and safety signage for Maxcab

For
Reference
Only

2 ANSI signage for GHC75 undercarriage

2.1 Overview graphics of GHC75 undercarriage

Crawler undercarriage

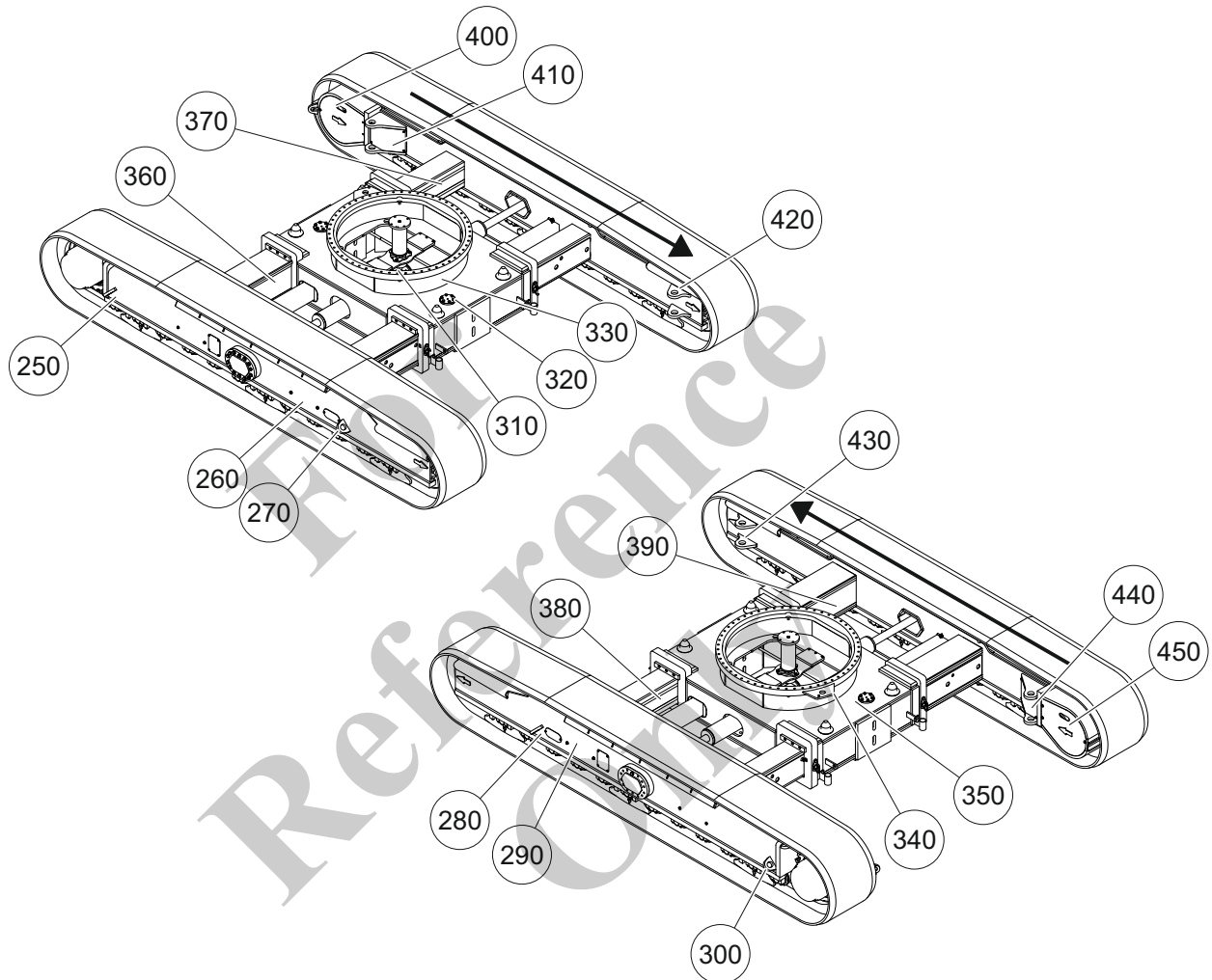


Fig. 4: Crawler undercarriage signage, front/rear view


2.2 Warning and safety signs on GHC75 undercarriage



ANSI signage for GHC75 undercarriage

Warning and safety signs on GHC75 undercarriage

Lashing point label

	General application area	On lashing points
	Option	---
SE	186793	


360

370

380

390


Insertion track label

	General application area	Stabilizer insertion tracks
	Option	Telescopic crawler undercarriage: MS40, MS30, MS16, T119, T73, T41/410HD
SE	187964	

400

450

Transmission oil

	General application area	Transmission lubricating point
	Option 1	Uppercarriage: diesel engine
	Option 2	Undercarriage: mobile and crawler
SE	See List of Operating Fluids and Lubricants	

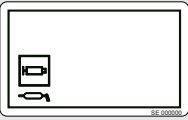
ANSI signage for GHC75 undercarriage

Warning and safety signs on GHC75 undercarriage

320

350


Grease

	General application area	Manual grease points
	Option	---
SE	See List of Operating Fluids and Lubricants	

260

290

WARNING. Pressurized sealing cover can cause serious injury. Maintain a safe distance.

	General application area	Undercarriage
	Option 1	ANSI
	Option 2	Crawler undercarriage
SE	187944	

330

340

ANSI signage for GHC75 undercarriage

Warning and safety signs on GHC75 undercarriage

WARNING. Retracting track wheel carrier can cause serious crushing injury. Stay clear of the danger zone.

	General application area	Between track wheel carriers
	Option 1	ANSI
	Option 2	Telescopic crawler undercarriage
SE	187942	

310

Slewing ring grease

	General application area	Grease cylinder
	Option	---
SE	See List of Operating Fluids and Lubricants	

3 ANSI signage for GHC75/130 uppercarriage

3.1 Overview graphics of GHC75/130 uppercarriage

Exterior uppercarriage

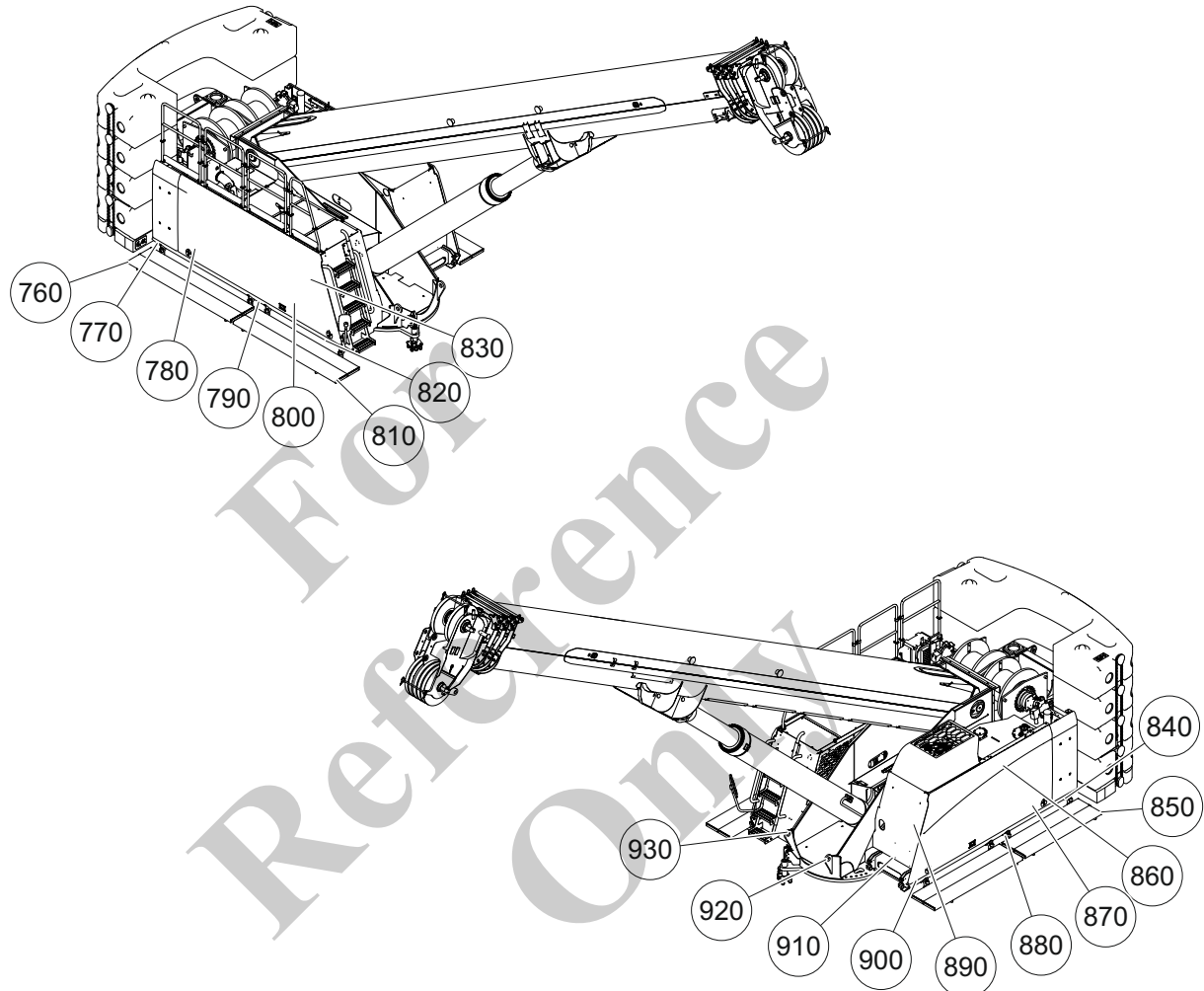


Fig. 5: Left/right exterior uppercarriage signage

ANSI signage for GHC75/130 uppercarriage

Overview graphics of GHC75/130 uppercarriage

Top uppercarriage

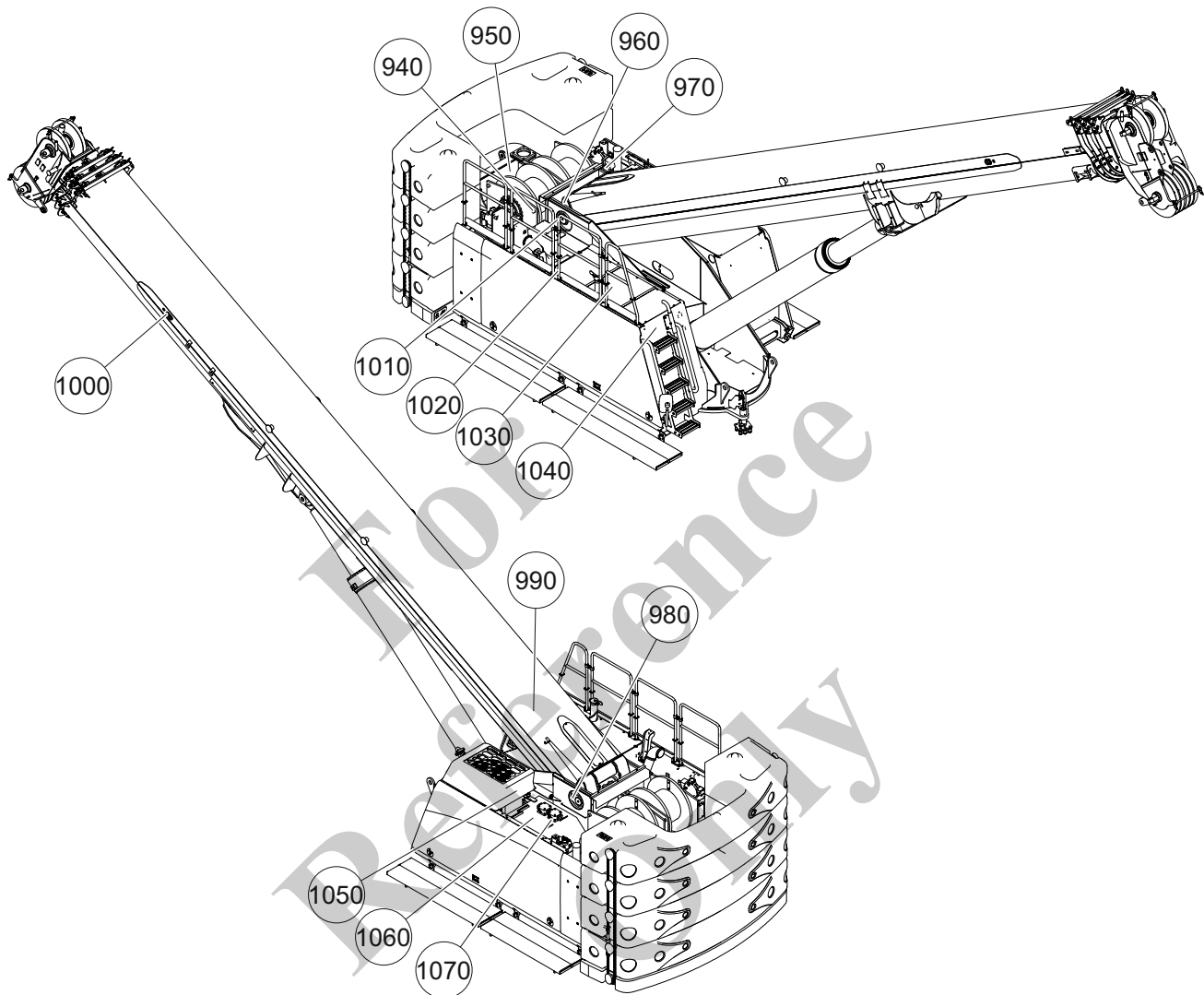


Fig. 6: Top left/right uppercarriage signage

ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

Interior uppercarriage

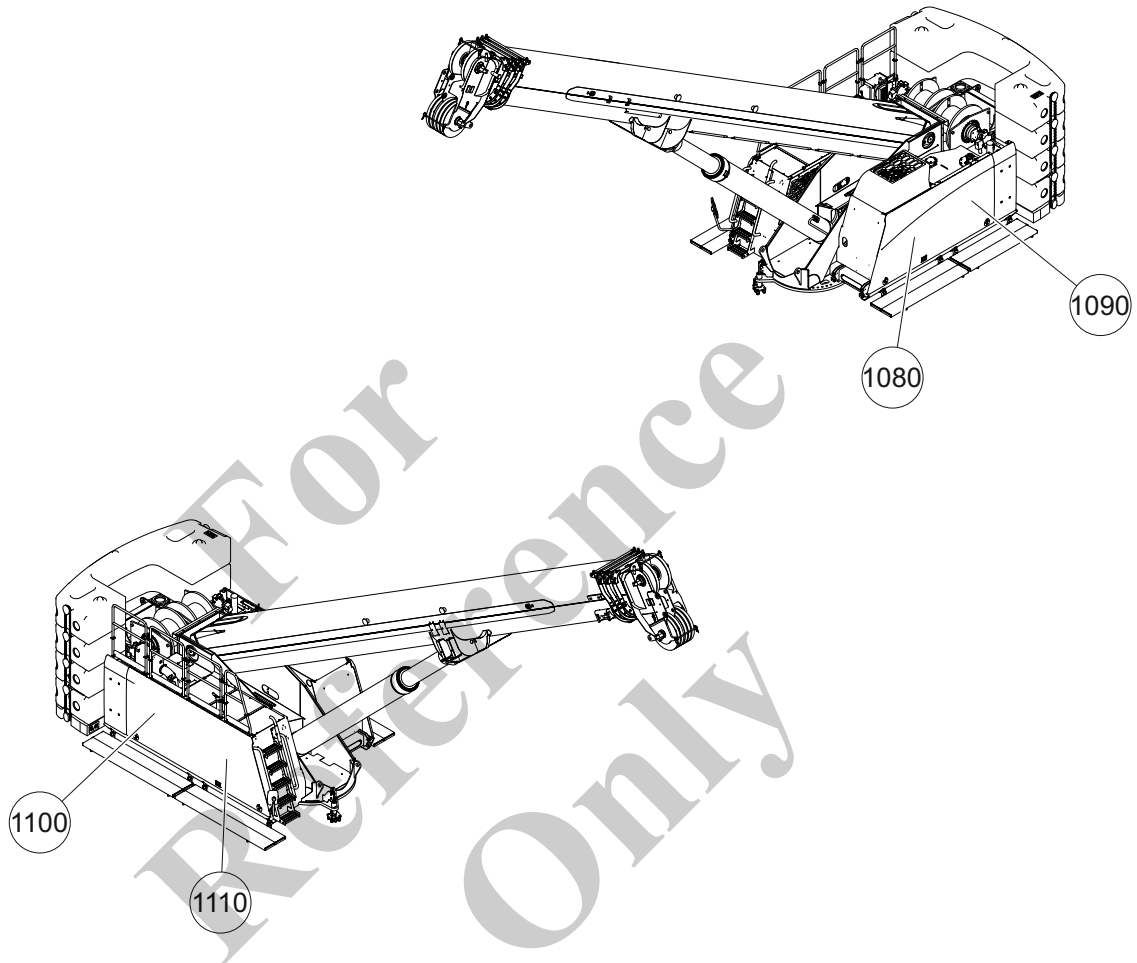


Fig. 7: Left/right interior uppercarriage signage

3.2 Warning and safety signs on GHC75/130 uppercarriage

760


810

850

ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

Warning sign hatching


	General application area	On shearing points
	Option 1	Cab adjustment
	Option 2	Mobile undercarriage with claw support
SE	186734	

780

800

870

WARNING. Risk of injury during maintenance. Turn off engine and remove ignition key before performing maintenance. Wear hard hat, eye protection, protective gloves and protective clothing. Read the manual.

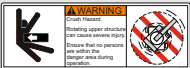
	General application area	Exterior uppercarriage, uppercarriage access ladder
	Option	ANSI
SE	187976	

770

820

840

WARNING. Rotating machine can cause death or serious injury. Stay clear of the danger zone.

	General application area	Exterior cab, exterior uppercarriage
	Option	ANSI
SE	187233	

ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

790

880

Risk of collapse/falling when exceeding maximum platform load per section as per DIN EN ISO 2867 and ISO 11660-2. Do not exceed maximum platform load.



	General application area	Exterior cab, exterior uppercarriage
	Option 1	ANSI
	Option 2	Cab platform
	Option 3	Uppercarriage platform
SE	187962	

830

Crane hand signals




	General application area	Exterior uppercarriage
	Option 1	ANSI
	Option 2	Grove
SE	187239	

860

ANSI signage for GHC75/130 uppercarriage


Warning and safety signs on GHC75/130 uppercarriage

No smoking

	General application area	Diesel filler neck
	Option 1	ANSI
	Option 2	Diesel engine
SE	187984	


890

Keep off

	General application area	Top uppercarriage, AdBlue [®]
	Option 1	ANSI
	Option 2	Installing AdBlue [®] tank on exterior uppercarriage
SE	187987	

900

WARNING. Lowering cab can result in crushing. Stay clear of the danger zone.

	General application area	On shearing points between cab and uppercarriage
	Option 1	ANSI
	Option 2	Cab adjustment
SE	187972	

ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

910

AdBlue®

Diesel exhaust fluid for US EPA Tier 4 final/EU Level IV diesel engines

	General application area	At filling point
	Option 1	AdBlue®
	Option 2	Tier IIIb/Tier IVi/Tier IVf
	Option 3	Grove
SE	187996	

920

930

Lifting point label

	General application area	On lifting points
	Option	---
SE	186792	

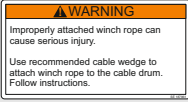
940

980

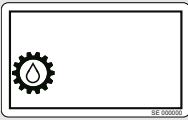
ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

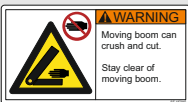
WARNING. Improper fastening of the rope can cause serious injury. Read the manual.

	General application area	Top uppercarriage
	Option 1	ANSI
	Option 2	Winch with rope
SE	187961	


Transmission oil

	General application area	Transmission lubricating point
	Option 1	Uppercarriage: diesel engine
	Option 2	Undercarriage: mobile and crawler
SE	See List of Operating Fluids and Lubricants	

WARNING. Moving machine parts can cause serious crushing injury. Do not touch while in operation.

	General application area	Boom
	Option 1	ANSI
	Option 2	Retractable boom
SE	187945	

WARNING. Winding winch can cause serious injury. Do not touch while in operation.


	General application area	Winch spool (rope guide)
	Option 1	ANSI
	Option 2	Winch spool (rope guide)
SE	187943	

ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

950

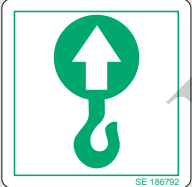
WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

960

970

Lifting point label


	General application area	On lifting points
	Option	---
SE	186792	

990


ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

Keep off


	General application area	Top uppercarriage, AdBlue [®]
	Option 1	ANSI
	Option 2	Installing AdBlue [®] tank on exterior uppercarriage
SE	187987	

Risk of falling. Attach safety harness.

	General application area	Top uppercarriage
	Option 1	ANSI
	Option 2	Eye bolts
SE	187986	

1000

Grease


	General application area	Manual grease points
	Option	---
SE	See List of Operating Fluids and Lubricants	

1010


ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

WARNING. Overflow or boil-over can cause serious injury or scalding. Maintain a safe distance.


	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187960	

WARNING. Hot surface can cause burns. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

1020

Risk of falling. Keep off.


	General application area	Top uppercarriage
	Option	ANSI
SE	187985	

1030

ANSI signage for GHC75/130 uppercarriage

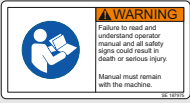
Warning and safety signs on GHC75/130 uppercarriage

WARNING. Hot surface can cause burns. Maintain a safe distance.

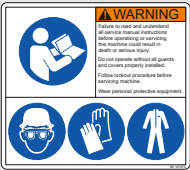
	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

1040

WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	


WARNING. Risk of injury during maintenance. Turn off engine and remove ignition key before performing maintenance. Wear hard hat, eye protection, protective gloves and protective clothing. Read the manual.

	General application area	Exterior uppercarriage, uppercarriage access ladder
	Option	ANSI
SE	187976	


ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage


No unauthorized access

	General application area	Uppercarriage access ladder
	Option	ANSI
SE	187956	


WARNING. Falling loads can result in death or serious injury. Never stand under suspended loads.

	General application area	Exterior cab, uppercarriage access ladder
	Option	ANSI
SE	187957	

WARNING. Unauthorized use of the ladder can cause injury from falling. Authorized personnel only.

	General application area	Uppercarriage access ladder
	Option	ANSI
SE	187958	

Risk of falling. Attach safety harness and wear safety shoes.

	General application area	Top uppercarriage
	Option	ANSI
SE	187946	

ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

WARNING. Risk of injury during maintenance. Turn off engine and remove ignition key before performing maintenance. Wear hard hat, eye protection, protective gloves and protective clothing. Read the manual.

	General application area	Exterior uppercarriage, uppercarriage access ladder
	Option	ANSI
SE	187976	

WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

WARNING. Rotating fan blades can cause serious injury. Maintain a safe distance.

	General application area	Interior uppercarriage and top uppercarriage: fan
	Option	ANSI
SE	187941	

Risk of falling. Keep off.


	General application area	Top uppercarriage
	Option	ANSI
SE	187985	

ANSI signage for GHC75/130 uppercarriage

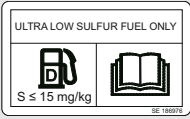
Warning and safety signs on GHC75/130 uppercarriage

1060

No smoking

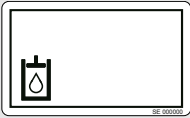
	General application area	Diesel filler neck
	Option 1	ANSI
	Option 2	Diesel engine
SE	187984	

Sulfur-free diesel fuel or diesel fuel with less than 15 mg/kg sulfur content only.

	General application area	Top uppercarriage: diesel filler neck
	Option 1	Diesel engine
	Option 2	Tier IIIb/Tier 4i/Tier 4f
SE	186976	

1070

Hydraulic oil

	General application area	Hydraulic oil tank
	Option	---
SE	See List of Operating Fluids and Lubricants	

ANSI signage for GHC75/130 uppercarriage


Warning and safety signs on GHC75/130 uppercarriage

1080

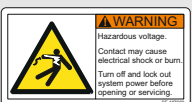
WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

24 V socket label

	General application area	On every 24 V socket
	Option	24 V socket
SE	186587	

WARNING. Voltage can cause electric shock or burns. Turn off machine before performing maintenance.


	General application area	Interior uppercarriage, top uppercarriage
	Option 1	ANSI
	Option 2	Generator
SE	187980	

1090

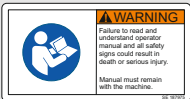
ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage


WARNING. Hot surface can cause burns. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

WARNING. Pressurized and/or corrosive fluids can cause serious injury. Wear protective gloves and eye protection.

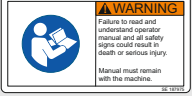
	General application area	Interior uppercarriage: drive motor Interior uppercarriage: central hydraulic system Top uppercarriage: drive motor Top uppercarriage: hydraulic connections
	Option	ANSI
	SE	187981

1100


ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage


WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	


WARNING. Hot surface can cause burns. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

WARNING. Pressurized and/or corrosive fluids can cause serious injury. Wear protective gloves and eye protection.

	General application area	Interior uppercarriage: drive motor Interior uppercarriage: central hydraulic system Top uppercarriage: drive motor Top uppercarriage: hydraulic connections
	Option	ANSI
	SE	187981


WARNING. Rotating belt drive can cause serious injury. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187982	


ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage


WARNING. Overflow or boil-over can cause serious injury or scalding. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187960	


WARNING. Rotating fan blades can cause serious injury. Maintain a safe distance.

	General application area	Interior uppercarriage and top uppercarriage: fan
	Option	ANSI
SE	187941	

Coolant

	General application area	Coolant reservoir
	Option	---
SE	See List of Operating Fluids and Lubricants	


Do not clean with high-pressure cleaner.

	General application area	Interior uppercarriage: central hydraulic system Interior uppercarriage: switch cabinet Top uppercarriage: optional generator
	Option 1	ANSI
	Option 2	Generator
SE	187977	

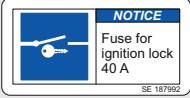
ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

Battery disconnect switch

	General application area	Interior uppercarriage: battery disconnect switch
	Option 1	ANSI
	Option 2	Diesel engine
SE	225045	

40 A ignition fuse label

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	Diesel engine
SE	187992	

For Reference Only

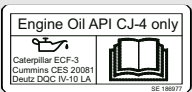
ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

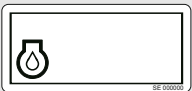
24 V socket label

	General application area	On every 24 V socket
	Option	24 V socket
SE	186587	

Only use engine oils as per specification ACEA E9-08 or API CJ-4.

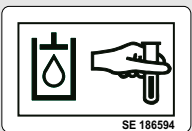
	General application area	Interior uppercarriage: diesel engine
	Option 1	Diesel engine
	Option 2	Tier IIIb/Tier IVi/Tier IVf
SE	186977	

Engine oil

	General application area	Engine oil reservoir or dipstick
	Option	Diesel engine
SE	See List of Operating Fluids and Lubricants	

1110

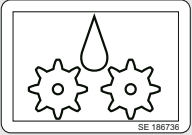
Hydraulic oil sampling point label

	General application area	Hydraulic oil sampling point
	Option	---
SE	186594	

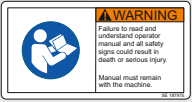
ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

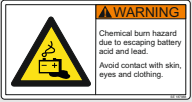
Pinion gear lubrication label

	General application area	At filling point
	Option	Pinion gear lubrication
SE	186736	


WARNING. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

WARNING. Corrosive battery acid and lead can cause serious injury. Maintain a safe distance.

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	Diesel engine
SE	187988	


WARNING. Pressurized and/or corrosive fluids can cause serious injury. Wear protective gloves and eye protection.

	General application area	Interior uppercarriage: drive motor Interior uppercarriage: central hydraulic system Top uppercarriage: drive motor Top uppercarriage: hydraulic connections
	Option	ANSI
SE	187981	


ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

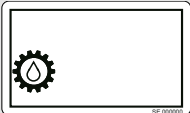
WARNING. Risk of explosion from overheated battery. No smoking or open flame.

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	Diesel engine
SE	187989	


WARNING. Hot surface can cause burns. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

Transmission oil

	General application area	Transmission lubricating point
	Option 1	Uppercarriage: diesel engine
	Option 2	Undercarriage: mobile and crawler
SE	See List of Operating Fluids and Lubricants	


HydroClean label

	General application area	Interior uppercarriage: HydroClean
	Option 1	HydroClean
	Option 2	Grove
SE	187994	

ANSI signage for GHC75/130 uppercarriage

Warning and safety signs on GHC75/130 uppercarriage

Do not clean with high-pressure cleaner.

	General application area	Interior uppercarriage: central hydraulic system Interior uppercarriage: switch cabinet Top uppercarriage: optional generator
	Option 1	ANSI
	Option 2	Generator
	SE	187977

For
Reference
Only

4 Index

C

Coolant 45

E

Engine oil 47

G

Grease 25, 36

H

Hydraulic oil 41

S

SE 186587 13, 42, 47

SE 186594 47

SE 186734 21, 30

SE 186736 48

SE 186761 14

SE 186762 14

SE 186792 33, 35

SE 186793 24

SE 186851 14

SE 186852 14

SE 186853 14

SE 186854 14

SE 186855 14

SE 186856 14

SE 186857 14

SE 186858 14

SE 186859 14

SE 186860 14

SE 186861 14

SE 186862 14

SE 186863 14

SE 186864 14

SE 186865 14

SE 186866 14

SE 186867 14

SE 186868 14

SE 186869 14

SE 186870 14

SE 186871 14

SE 186872 14

SE 186873 14

SE 186874 14

SE 186875 14

SE 186876 14

SE 186877 14

SE 186878 14

SE 186879 14

SE 186976 41

SE 186977 47

SE 187233 12, 13, 30

SE 187234 46

SE 187236 11, 14

SE 187239 31

SE 187877 17

SE 187881 11

SE 187941 40, 45

SE 187942 26

SE 187943 34

SE 187944 25

SE 187945 34

SE 187946 39

SE 187947 15

SE 187948 15

SE 187949 18

SE 187950 18

SE 187951 16

SE 187952 16

SE 187953 16

SE 187955 16

SE 187956 39

SE 187957 12, 39

SE 187958 39

SE 187960 37, 45

SE 187961 34

SE 187962 10, 31

Index

SE 187963	14
SE 187964	24
SE 187969	20
SE 187970	15, 19
SE 187971	19
SE 187972	32
SE 187973	12
SE 187974	10
SE 187975	19, 35, 38, 40, 42, 43, 44, 48
SE 187976	30, 38, 40
SE 187977	45, 50
SE 187978	37, 38, 43, 44, 49
SE 187979	13
SE 187980	42
SE 187981	43, 44, 48
SE 187982	44
SE 187983	11, 18
SE 187984	32, 41
SE 187985	37, 40
SE 187986	36
SE 187987	32, 36
SE 187988	48
SE 187989	49
SE 187992	46
SE 187993	20
SE 187994	49
SE 187996	33
SE 194102	46
SE 194111	20
SE 194773	46
Slewing ring grease	26

T

Transmission oil	24, 34, 49
------------------------	------------

B Additional documentation

B.1 Personnel basket

Name	Data
Designation	Personnel basket
Type	Yoke
Number	557-01
Type of manual	Operation instructions
Manufacturer	Manitowoc

For Reference Only



OPERATOR MANUAL

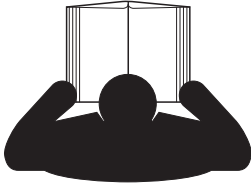
This manual has been prepared for and is considered part of the

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>⚠ 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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For
Reference
Only

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TABLE OF CONTENTS

.....

..... **TABLE OF CONTENTS**

..... **Personnel Basket**

Safety	1-1
General Safety Requirements	1-1
Equipment Operator	1-2
Ground Crew	1-3
Platform Occupants	1-3
Communications	1-4
Lifting Personnel Near Power Lines	1-5
Inspection and Testing	1-6
Inspection	1-6
Lift Testing	1-9
Basket Type and Test Weights	1-10
Yoke Basket	1-15
Safety harnesses	1-15
Basket Installation	1-15
Basket Yoke to Main Boom Installation	1-16
Basket Yoke to Jib Boom Installation	1-16
Yoke Basket Adjustment	1-16
Before Making the Lift	1-17
Yoke Basket Operation	1-17

Reference Only

TABLE OF CONTENTS

PERSONNEL BASKET

For
Reference
Only

This Page Blank

TOC-2

OPTION

PERSONNEL BASKET

PERSONNEL BASKET

OPTION

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.

PERSONNEL BASKET

OPTION

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.

- b. The operator has been working for more than ten hours prior to the start of the lift or the lift will not be completed before the operator has been working for twelve hours.
- c. The operator did not have at least eight hours off immediately prior to the work shift containing the personnel lift operation.
- 4. Not engage in any practice that will divert their attention while actually engaged in operating the hoisting equipment.
- 5. Only respond to signals from the Personnel Lift Supervisor or a designated signal person. The operator shall obey a stop signal at any time, no matter who gives it.
- 6. Consult with the Personnel Lift Supervisor before commencing or continuing the lift whenever the operator has any doubt as to the safety of the lift.
- 7. When involved with a boom mounted platform without controls, remain at the hoisting equipment controls whenever personnel are in the platform.
- 8. When involved with a boom mounted platform with boom motion controls and a means of lowering, retracting and rotating in the event the primary power source becomes inoperative, be free not to remain at the hoisting equipment controls.
- 9. Consult the Safety and Operation sections in the Operator Manual for specific instruction on the equipment operation.
- 10. Inspect the hoist equipment setup area before the personnel lift and report his observations to the Personnel Lift Supervisor. The operator shall inspect the area for potential hazards such as, but not limited to:
 - a. Excessive load or radius.
 - b. Overhead obstructions and electrical transmission lines.
 - c. Hazardous locations.
 - d. Inadequate surface and support to withstand all forces imposed.
 - e. Wind, weather and other unstable conditions.
 - f. Any potentially hazardous conditions.
- 11. Inspect the hoist equipment immediately prior to starting a personnel lift operation. The criteria for a frequent inspection as specified in the appropriate hoisting equipment ASME B30 volume shall be used.
- 12. Operate hoisting equipment with tracks at full extension and pinned and crane equipped with full counterweight configuration. Handling of personnel is not permitted with mid span or zero span positions.

OPTION

PERSONNEL BASKET

OPTION

- 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.

PERSONNEL BASKET

OPTION

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).

OPTION

PERSONNEL BASKET

OPTION

Lifting Personnel Near Power Lines



8466

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.

PERSONNEL BASKET

OPTION

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.

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>

OPTION

PERSONNEL BASKET

OPTION

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 1-4 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 1-4).
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 1-4).
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.

PERSONNEL BASKET

OPTION

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).

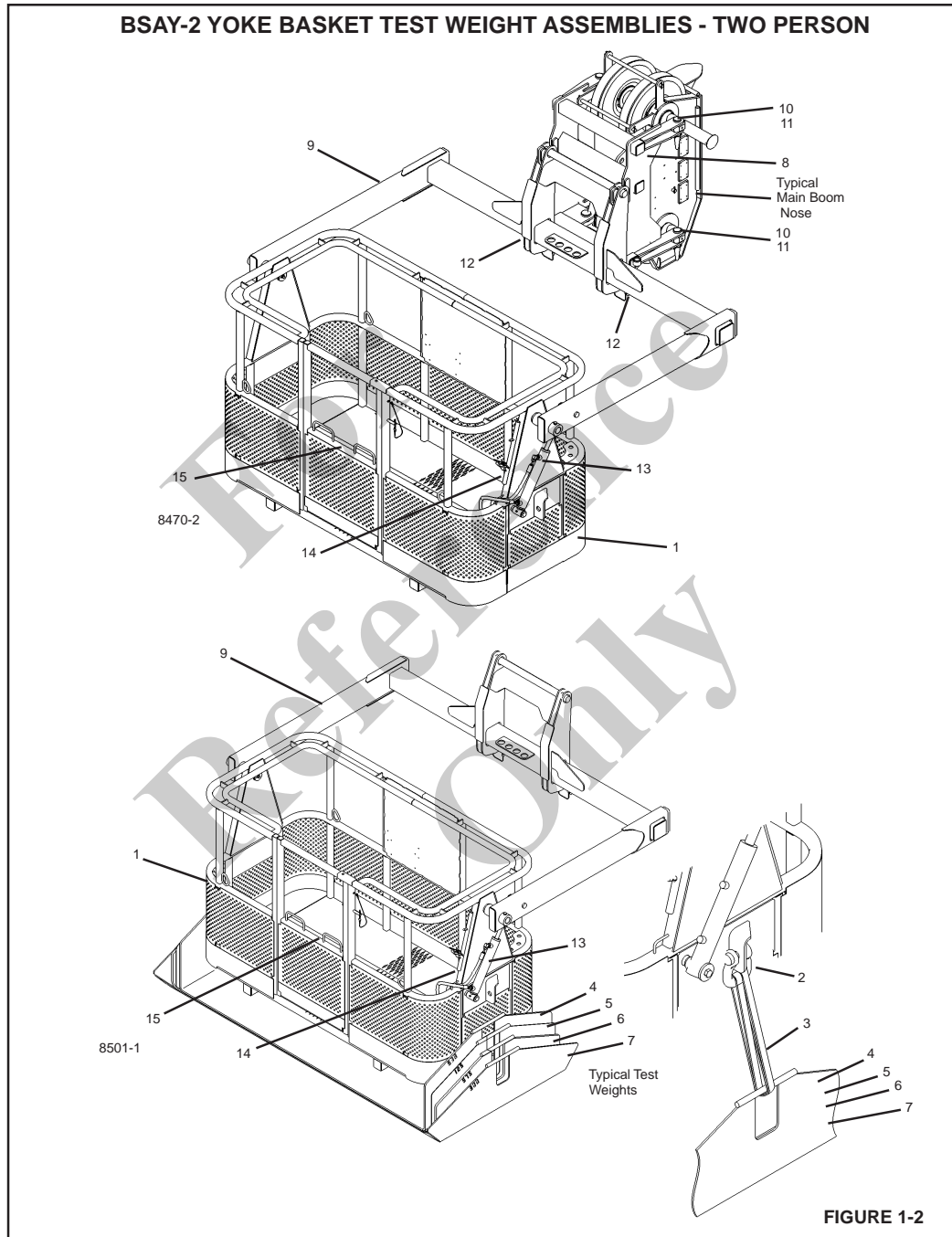
BSAY Yoke Basket Assembly Parts List (Figure 1-2)

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



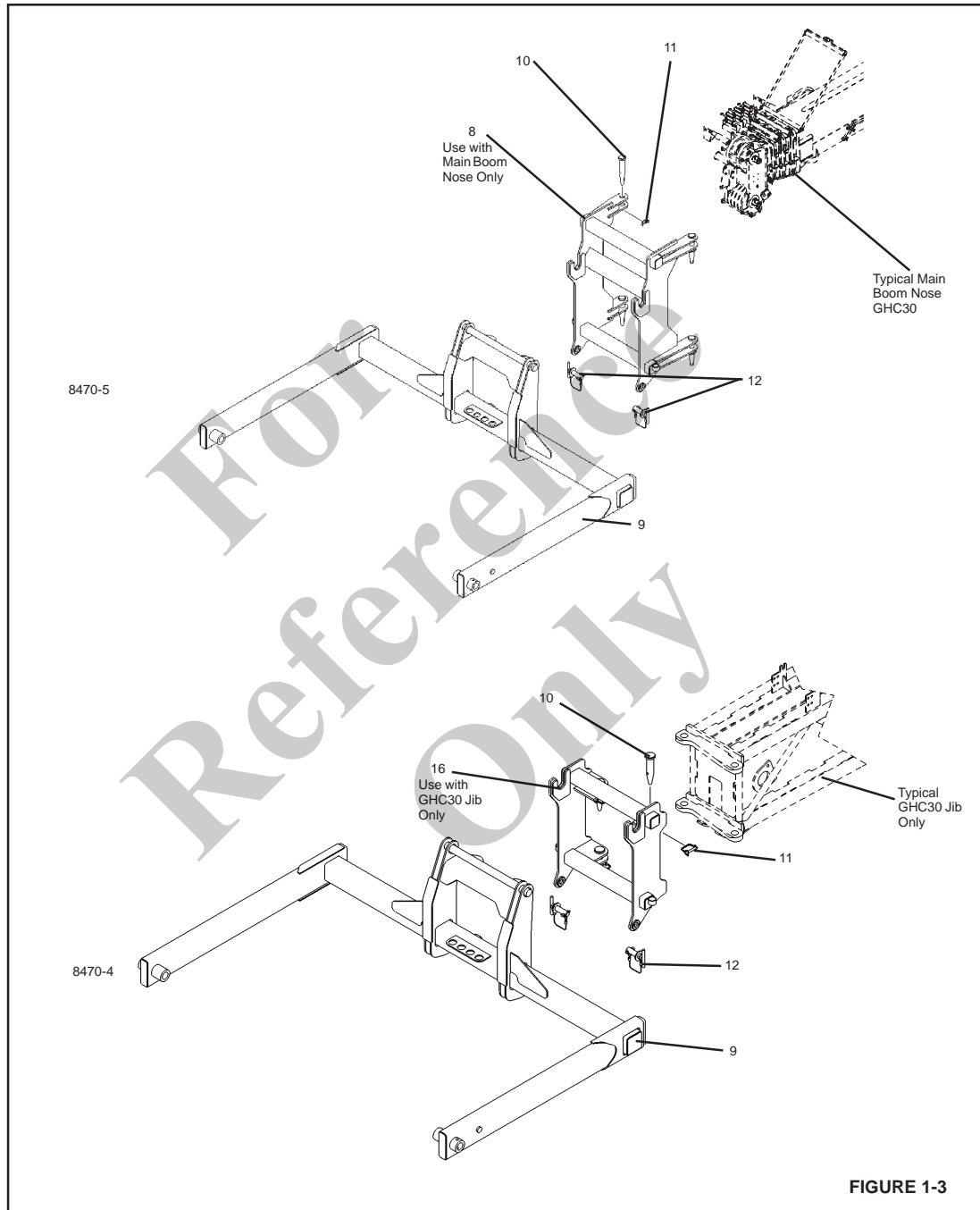
Grove

Published 13-11-2017, Control # 557-01

1-11

PERSONNEL BASKET

OPTION



1-12

Published 13-11-2017, Control # 557-01

OPTION

PERSONNEL BASKET

OPTION

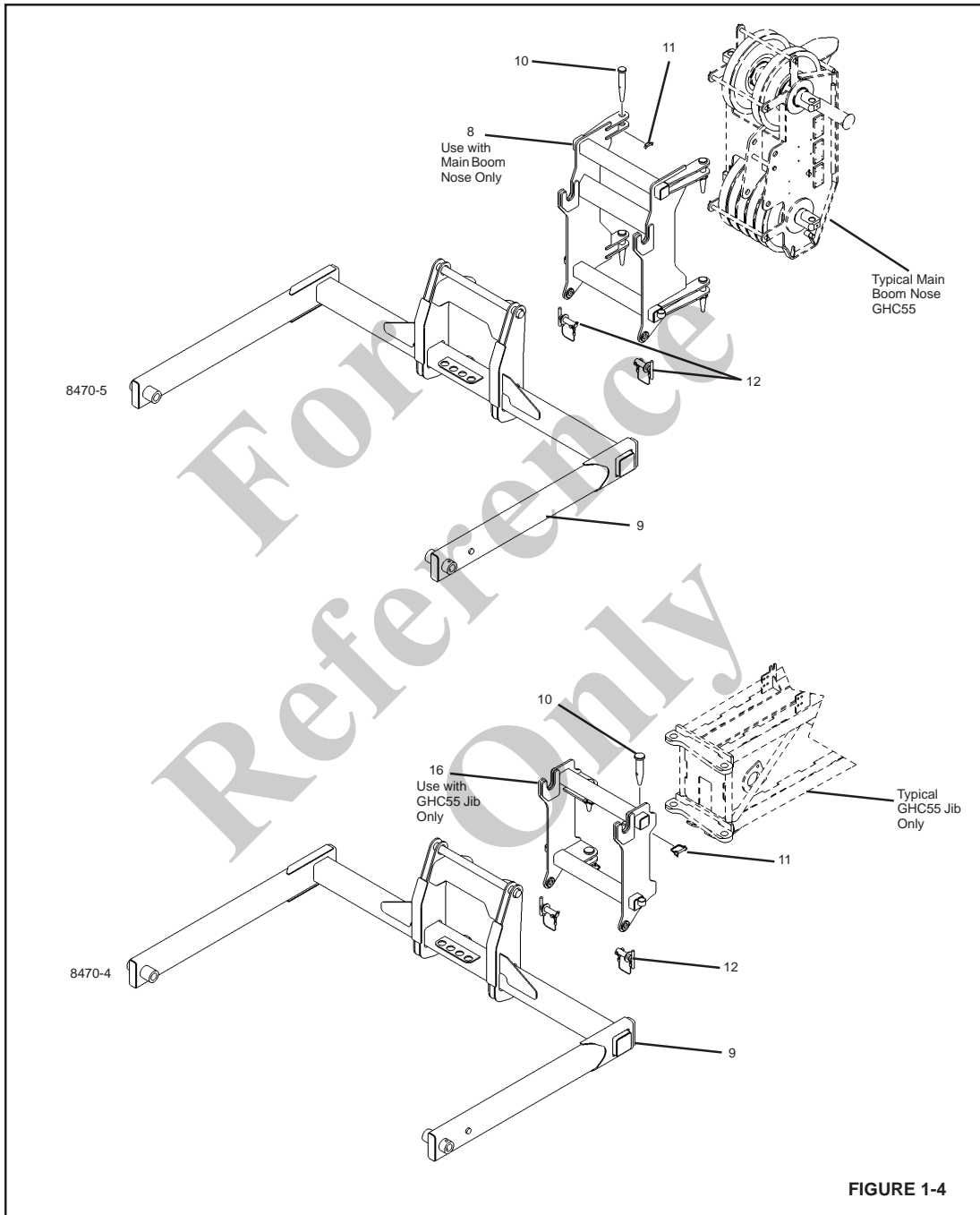
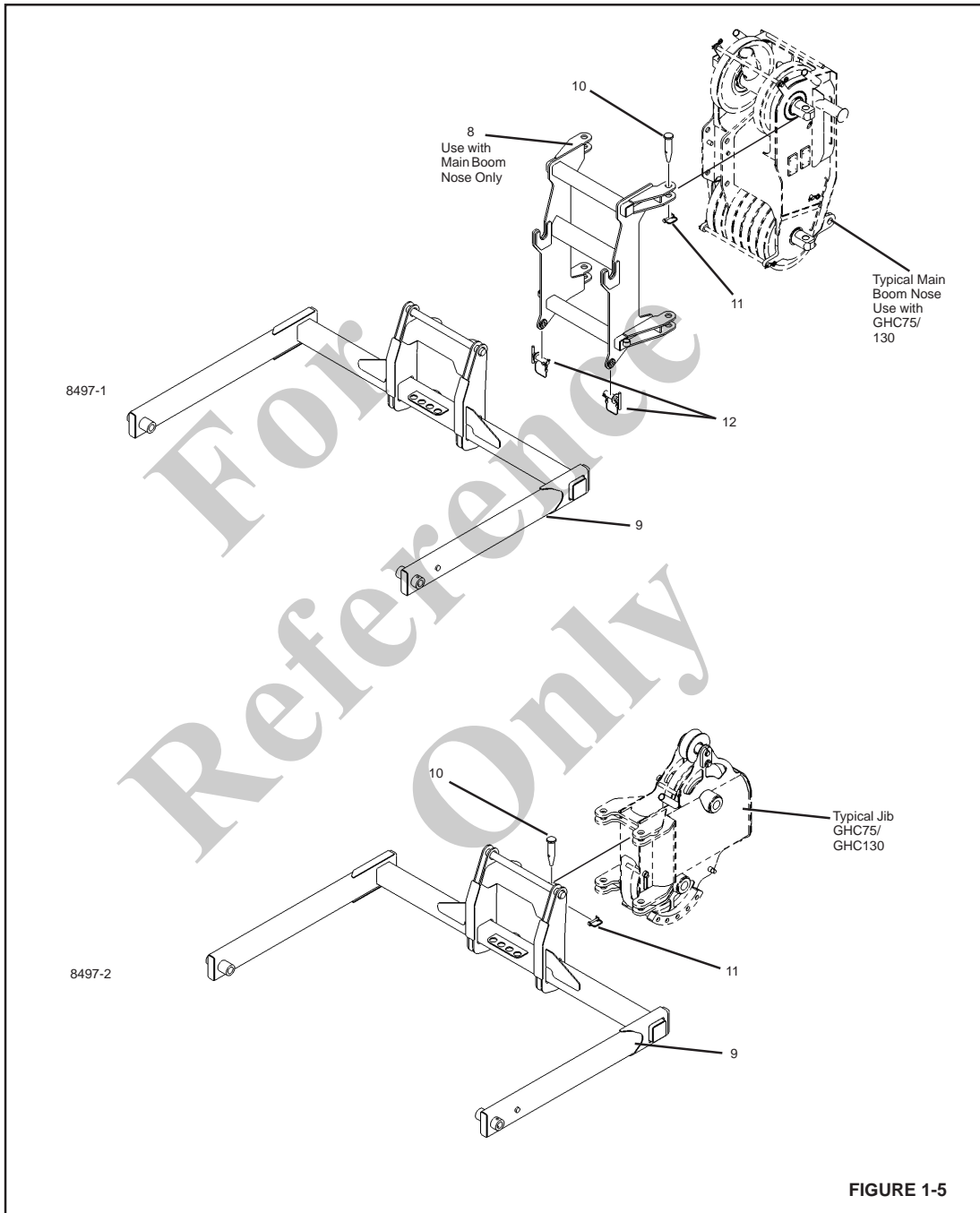


FIGURE 1-4

PERSONNEL BASKET

OPTION



1-14

Published 13-11-2017, Control # 557-01

OPTION

PERSONNEL BASKET

Yoke Basket

The basket can be attached to either the tip of the boom or the tip of the jib for the purpose of lifting personnel and their work equipment to elevated working heights.

! DANGER

Boom tip attachment can contact jib in stowed position when boom is fully retracted causing damage to boom. Boom attachments must be removed for retracted boom lifting operations.

The maximum capacity of the basket is 1200 pounds when attached to the tip of the boom and 500 pounds when attached to the tip of the jib. The maximum occupancy rating in all cases is two people.

NOTE: Refer to the crane Rated Capacity Charts. Verify capacity chart matches crane model and boom length.

! DANGER

Overloading basket or crane will result in death or serious injury.

Where no capacity ratings are shown on the rated charts, for example: at below 0° boom angle, operation is allowable with the boom fully retracted. All work with a personnel basket must be done on firm level ground ($\pm 0.30^\circ$), with the tracks fully extended and pinned, and crane equipped with full counterweight configuration.

The basket is equipped with a manually applied brake to keep basket from swinging when the basket is being loaded or after the desired work position is reached. The brake is intended to be disengaged when the basket is raised to the work position so that the basket hangs freely within 10 degrees of level until the work position is reached.

Safety harnesses

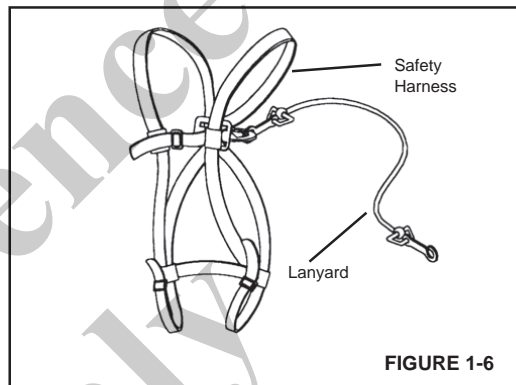
Safety harnesses are provided for basket occupants and should be secured to the harness attachment links located near the basket corners See (Figure 1-6).

! 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 1-4) and (Figure 1-5) 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 1-7).
 - 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.

PERSONNEL BASKET

OPTION

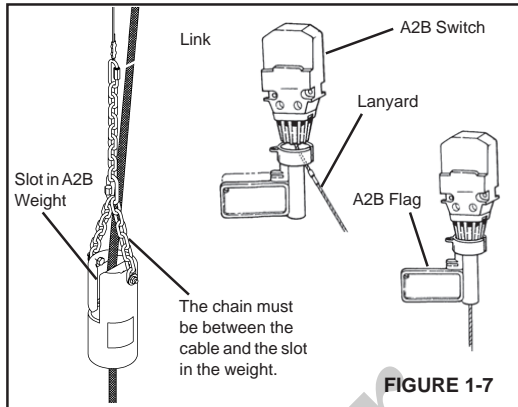


FIGURE 1-7

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 1-4) and (Figure 1-5).
3. Position the yoke (9) to the adapter (8) using attaching pin (12) see (Figure 1-4) and (Figure 1-5).

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 1-4).
4. Position the yoke (9) to the adapter (16) using attaching pins (10, 11 and 12) see (Figure 1-4).
5. On Model GHC75 and GHC130, position the yoke (9) directly to the jib using attaching pins (10 and 11) see (Figure 1-5).

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 1-10). 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 17. to attach the yoke basket to the main boom or jib.

OPTION

PERSONNEL BASKET

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 1-8) - 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 1-8) 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 1-8, 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.

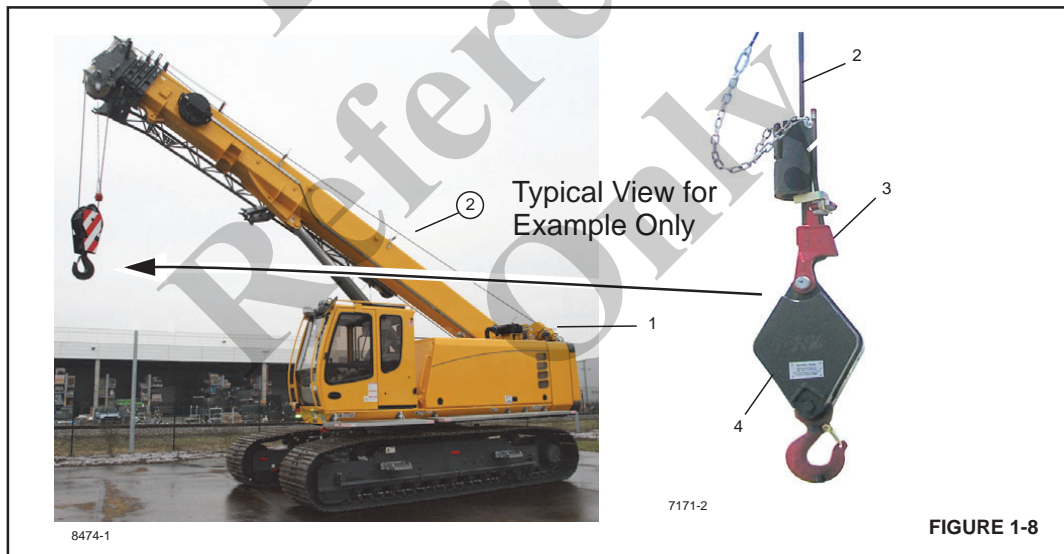


FIGURE 1-8

Yoke Basket Operation

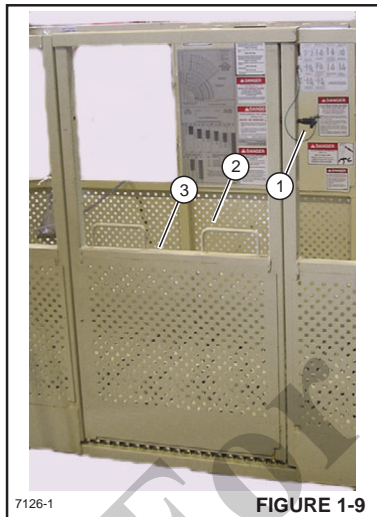
The following operating instructions are for the two man yoke basket option. These instructions will explain how to raise the yoke basket assembly to the level necessary to attach the basket adapter to the boom nose.

Perform the Installation instructions beginning on page 15 before starting these operating instructions.

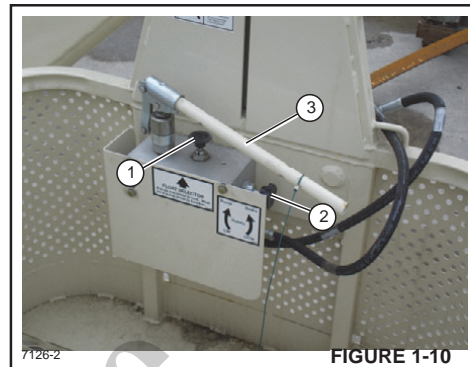
1. To enter the basket, remove the gate locking pin (1, Figure 1-9), pull up on the grab handle (2) and swing the gate (3) open.

PERSONNEL BASKET

OPTION



2. Connect the safety harness. Close the basket gate (3, Figure 1-9) 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 1-10) 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.



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 1-10) 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 1-10) should not be used when the crane is operating. The hand pump is to be used *only* when installing the yoke to the crane.

OPTION

PERSONNAL BASKET

Alphabetical Index

Basket Installation	1-15
Inspection and Testing.	1-6
Personnel Basket.	1-1
Safety.	1-1
TABLE OF CONTENTS.	1-1

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1-1

PERSONNAL BASKET

OPTION

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1-2

B.2 Pole claw

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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B.3 Wire ropes

Name	Data
Designation	Wire ropes
Type	Wire ropes
Number	.
Type of manual	Operation, installation, maintenance instructions
Manufacturer	.

For 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

Inhaltsverzeichnis / List of contents

1	HANDHABUNG, MONTAGE UND WARTUNG VON DRAHTSEILEN / HANDLING, ASSEMBLY AND MAINTENANCE OF WIRE ROPES	1
1.1	Die Seilauswahl / Rope selection	1
1.2	Wie sollten Drahtseile entladen werden? / How should wire ropes be unloaded?	1
1.3	Wie sollten Drahtseile gelagert werden? / How should wire ropes be stored?	2
2	DIE MONTAGE VON DRAHTSEILEN / ASSEMBLY OF WIRE ROPES	3
2.1	Das Abwickeln vom Ring / Unwinding from the coil	3
2.2	Das Abwickeln vom Haspel / Unwinding from the reel	3
2.3	Der Montagevorgang / Assembly	5
2.4	Das Umspulen vom Haspel auf die Seiltrommel / Rewinding from the reel to the rope drum	5
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	6
2.6	Das Auftrommeln unter Last / Winding on to drums under load	7
2.7	Das Einfahren des Drahtseiles / „Running in“ the wire rope	8
2.8	Das Ablängen von Drahtseilen / Cutting wire ropes to length	9
3	DIE WARTUNG VON DRAHTSEILEN / MAINTENANCE OF WIRE ROPES	11
3.1	Die Nachschmierung von Drahtseilen / Relubrication of wire ropes	11
3.2	Das Reinigen von Drahtseilen / Cleaning of wire ropes	12
3.3	Das Entfernen von gebrochenen Drähten / Removal of broken wires	13

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<hr/> Handhabung, Montage und Wartung von Drahtseilen / <i>Handling, assembly and maintenance of wire ropes</i> <hr/>	
3.4	Das Kürzen oder Rücken von Drahtseilen / Shortening or relocation of wire ropes 13
3.5	Das Wenden von Drahtseilen / Reversal of wire ropes 14
4	DIE INSPEKTION VON DRAHTSEILEN / INSPECTION OF WIRE ROPES 15
4.1	Warum muß ein Drahtseil inspiziert werden? / Why must a wire rope be inspected? 15
4.2	Wann muß ein Drahtseil inspiziert werden? / When must a wire rope be inspected? 15
4.3	Übersicht über die Ablegekriterien / Survey of discard criteria 16
4.4	Wo muß das Drahtseil inspiziert werden? / Where must a wire rope be inspected? 19
4.5	Die Ablegedrahtbruchzahl / Number of wire breaks for discard 20
4.6	Wie muß ein Drahtseil inspiziert werden? / How must a wire rope be inspected? 22
4.6.1	Hilfsmittel / Aids 22
4.6.2	Ermittlung der Drahtbruchzahlen / Determination of the numbers of wire breaks 23
4.6.3	Ermittlung des Seildurchmessers / Determination of the rope diameter 24
4.6.4	Messung der Seilschlaglänge / Measurement of the rope lay length 25
4.6.5	Überprüfung der Festigkeit des Drahtseilgefüges / Checking the strength of the wire rope structure 26
4.6.6	Überprüfung auf Strukturveränderungen / Checking for structural changes 27
4.6.7	Überprüfung von Seilrollen und Seiltrommeln / Checking rope pulleys and rope drums 27
5	SCHLUßBEMERKUNG / CONCLUDING REMARKS 31

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Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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.

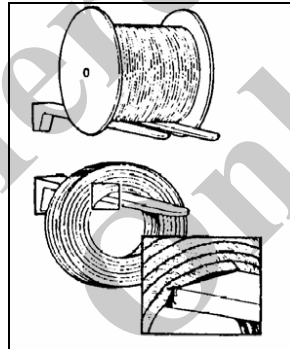
Im Umgang mit Drahtseilen sollten die folgenden Punkte beachtet werden:

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.

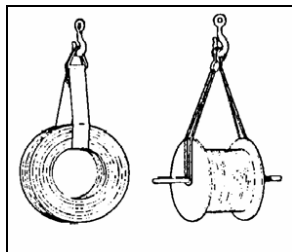
The following points should be noted when handling wire ropes:

1.2 Wie sollten Drahtseile entladen werden? / *How should wire ropes be unloaded?*

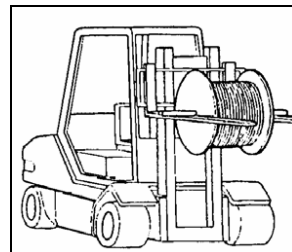


Die ersten Probleme im Umgang mit Drahtseilen treten häufig bereits bei der Anlieferung auf: die Gabel des Staplers fährt unter den Haspel oder in den Seilring hinein und beschädigt die Drahtseiloberfläche.

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-



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

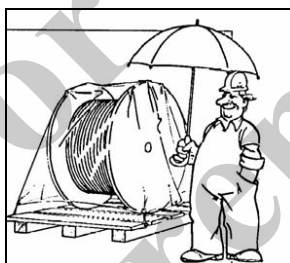
Das auf Ringen oder Haspeln angelieferte Drahtseil sollte nach Möglichkeit überhaupt nicht direkt mit einem Lasthaken oder der Gabel eines Staplers in Berührung kommen, sondern beispielsweise mit Hilfe von breiten textilen Hebebändern angehoben werden.

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.



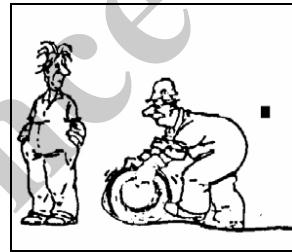
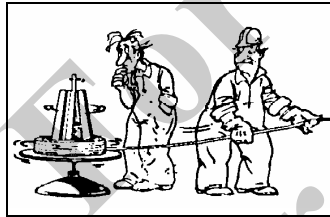
Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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*

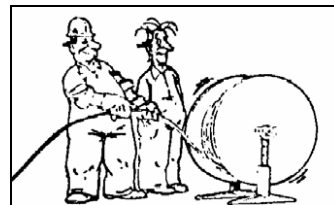
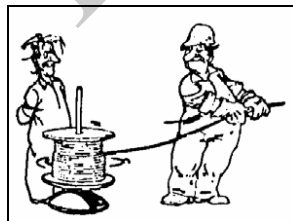


Ein auf einem Ring angeliefertes Drahtseil wird entweder von einem Drehteller abgewickelt oder am Boden ausgerollt. In letzterem Fall sollte der Boden möglichst sauber sein, da beispielsweise Sand, der am Schmiermittel des Drahtseiles haften bliebe, auf der Anlage zwischen Drahtseil und Seilrolle zu 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*

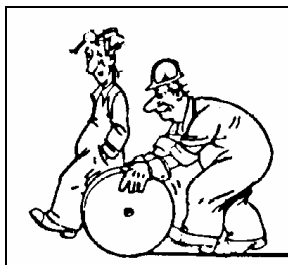


Ein auf einem Haspel aufgewickeltes Drahtseil wird ebenfalls vorzugsweise von einem Drehteller oder aber von einem Bock abgewickelt.

A wire rope wound on a reel is likewise preferably unwound by a turntable or a payoff stand.

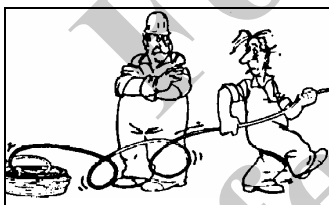


Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes



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.

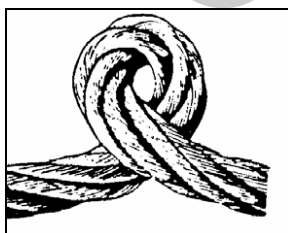
Unreeeling on the ground, which is repeatedly recommended in the pertinent literature, is not very satisfactory in practice because the reel unwinds an increasingly smaller amount of rope than the distance it covers, i.e. with this approach you are forced to pull the wire rope along behind you.



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 aufgezwungene 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 Klanckenbildung sind nicht mehr betriebssicher und müssen abgelegt werden.

Wire ropes with kink formation are no longer reliable and must be discarded.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

**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 Seileinscherung 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 Einscherung 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.

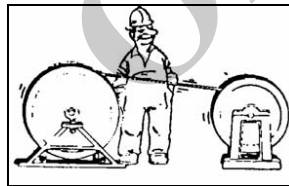
With some equipment it may be advisable first to discard the old wire rope and then assemble the new one; with other equipment, in particular larger units, it is advisable to draw in the new wire rope with the old one.

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.

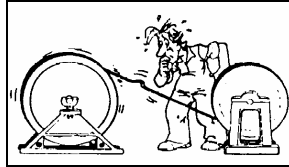
Wenn der Seilstrang unterhalb der Seiltrommel aufläuft, sollte der Montagehaspel so aufgestellt werden, daß der von ihm ablaufende Seilstrang, ebenfalls unterhalb des Haspels abläuft, und umgekehrt.

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.



Handhabung, Montage und Wartung von Drahtseilen /
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 dreifitzige Faserseile. Bei Verwendung konventioneller Drahtseile ist darauf zu achten, daß sie zumindest die gleiche Schlagrichtung wie das einzuziehende Drahtseil haben.

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.

Dieses Verfahren ist aber auch aus anderen Gründen sehr problematisch: Die Schweißverbindung erzielt zwar bei Verwendung spezieller Elektroden im Zerreiversuch im geraden Strang zufriedenstellende Werte, kann aber dennoch wegen der großen Länge der starren Verbindungszone infolge der Biegebeanspruchung beim Lauf über Rollen brechen

Wenn diese Verbindung Anwendung findet, sollte sie zusätzlich durch einen Seilstrumpf gesichert werden.

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.

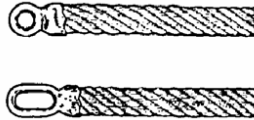
If the new wire rope is drawn in with the aid of the old rope, the two rope ends are often butt-welded to each other. A joint of this type can transmit the twist built up in the rope drive from the old rope to the new one and already severely damage the latter during assembly.

This procedure is also highly problematical for other reasons: when special electrodes are used, the welded joint may well achieve satisfactory results as a straight strand in the tensile test, but because of the considerable length of the rigid joint zone there is a possibility of it breaking due to bending stresses when running over pulleys.

If this joint is used, it should be secured in addition by a rope stocking.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes



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 Mehrlagenspulpung, und hier besonders bei Verwendung der sogenannten Lebussspulung, 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.

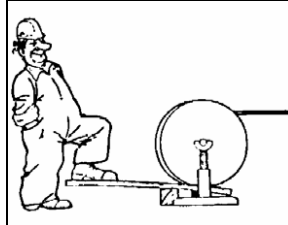
If the lower layers are too loose, the higher ones may be drawn in between lower rope sections under load. This may lead to serious rope damage.

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.

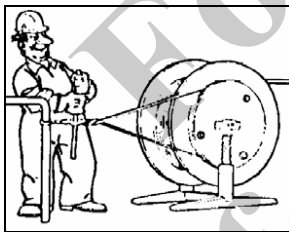


Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

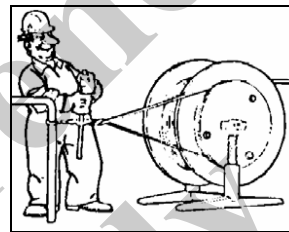


Während es in vielen Fällen ausreicht, das Drahtseil normal aufzulegen, um es dann abzutrommeln und mit Hilfe einer äußeren Last wieder aufzutrommeln, ist dies in anderen Fällen, zum Beispiel im Falle eines Turmdrehkranes, der seine höchste Kletterhöhe noch nicht erreicht hat, nicht möglich. In diesen 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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

**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.

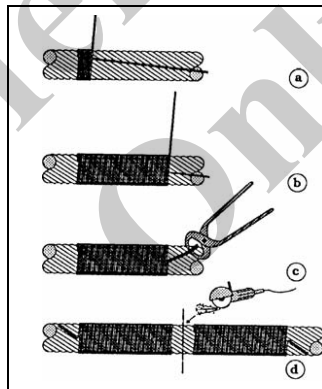
In allen Fällen müssen die Drahtseile neben der Trennstelle sorgfältig abgebunden werden, um ein Aufspringen der Seilenden oder eine Veränderung der Seil- und Litzenschlaglängen zu verhindern. Dies gilt ganz besonders beim Ablängen von drehungsarmen oder drehungsfreien Drahtseilen, deren Litzen oft bewußt 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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

3 Die Wartung von Drahtseilen / Maintenance of wire ropes

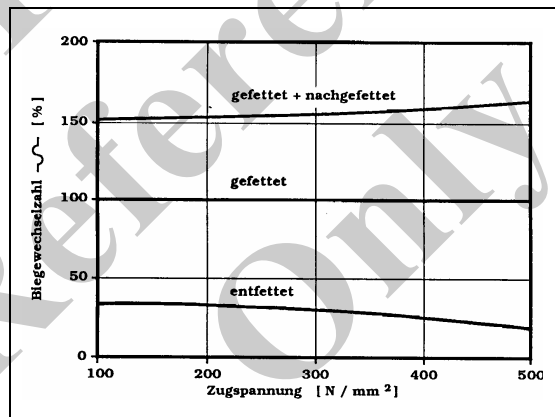
Drahtseile müssen nach DIN 15020 „regelmäßig gewartet werden, wobei die auszuführenden Arbeiten abhängen von der Art des Hebezeuges, dessen Benutzung und der Seilart.“ Durch eine regelmäßige Wartung kann die Lebensdauer eines Drahtseiles erheblich vergrößert werden.

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 Aufliegezeit 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



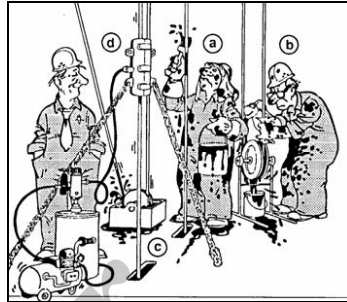
Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

• **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 Drahtseilnachschiemung 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",

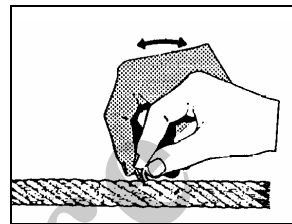
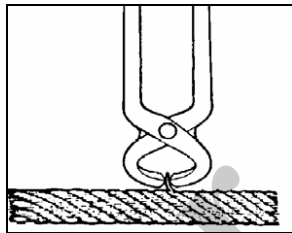


Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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 abgeknipt 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 Auftriegezeit 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.



Handhabung, Montage und Wartung von Drahtseilen /
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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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 Drahtbrücken 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.

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.

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.

15020 Part 2 recommends in point 3.4 "Monitoring" a daily visual inspection of wire ropes and rope end fastenings for any damage DIN.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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 Auflagezeit 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) Durchmesser verringering. 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 Durchmesser verringering 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.*



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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 Durchmessererringerung 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



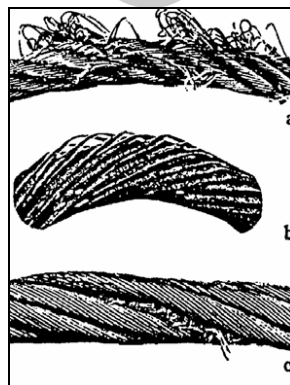
a) Korkezieherartige Verformungen. Ein Drahtseil muß abgelegt werden, wenn eine korkezieherartige Verformung eine Wellenhöhe von 1/3 des Seildurchmessers erreicht.

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.*



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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.

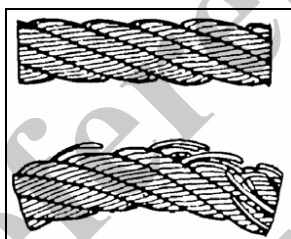
e) Knot formations. In the case of prominent knot formation (local thickening in the rope) a wire rope must be discarded.

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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

**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 Seilendbefes-
tigungen 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 Biegewechselzah-
len 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.*



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

f) Seilscheiben. Seilscheiben sind, sofern dies möglich ist, auf ihre Gängigkeit hin zu prüfen. Der Rillengrund der Scheiben, der im Durchmesser etwa Seilennndurchmesser 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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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*

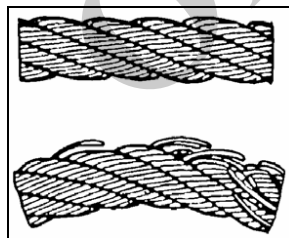


Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

4.6.3 Ermittlung des Seildurchmessers / Determination of the rope diameter

Die Messung des Seildurchmessers sollte bereits am fabrikneu 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 Durchmesser verringering 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.

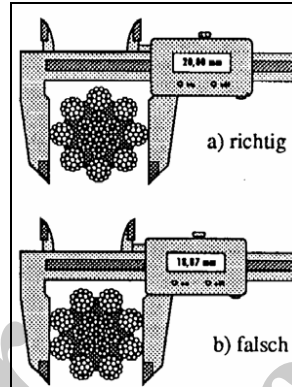
The rope diameter should be measured several times on the brand-new rope. Firstly, it can be established by this measurement whether the new rope is within the tolerance of rope nominal diameter + 0 % to rope nominal diameter + 5 % specified in the standards (if special winding systems are used the permissible 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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes



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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

**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, Korbildungen oder Schlaufenbil- dungen finden sich aber sehr häufig außerhalb des Hauptarbeitsbereiches der Seile, da die Seil- rollen die verursachenden Litzen- 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 Ablegekriterien. Wenn auch nur die geringsten Zweifel an der Betriebssi- cherheit des Drahtseiles vorliegen, sollte das Seil abgelegt werden.

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 corkscrows, 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 tempo- rarily inaccessible.

Abrasion marks on structural parts may be useful indi- cations 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.

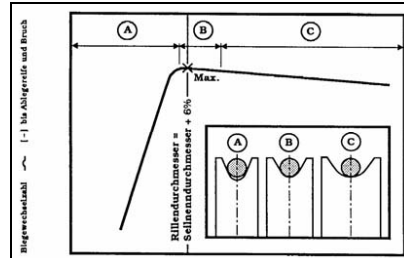
**4.6.7 Überprüfung von Seilrollen und Seiltrommeln /
Checking rope pulleys and rope drums**

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.

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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes



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 Seilennendurchmesser. Der optimale Durchmesser im Rillengrund liegt bei etwa 1,06 bis 1,08 mal Seilennendurchmesser. 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 Seilennendurchmesser, 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.



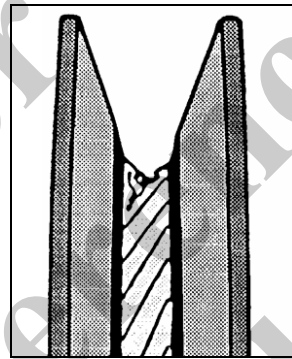
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Die beengten Platzverhältnisse auf vielen Anlagen erschweren oft die Begutachtung. Wenn keine Möglichkeit besteht, die Anschmiegung der Schablone von der Seite her zu kontrollieren, kann man die Schablone durch die Rille ziehen und die Beurteilung 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.

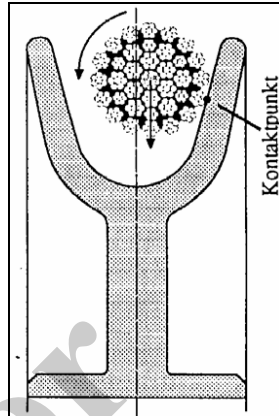


Während der Messung der Rille überprüfen wir gleichzeitig die Tiefe des Rillengrundes und seine Oberflächenbeschaffenheit. Eingrabungen und andere Oberflächenveränderungen setzen die Seillebensdauer oft stark herab. Wenn sich im Rillengrund ein Negativprofil des aufliegenden Drahtseiles herausgebildet 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.

GROVE
Manitowoc

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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 Hauspringens 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.



Handhabung, Montage und Wartung von Drahtseilen /
Handling, assembly and maintenance of wire ropes

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.

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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.

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B.4 Camera system

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Designation	Camera system
Type	Camera system
Number	4010040000
Type of manual	Operation, installation instructions
Manufacturer	Motec GmbH

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MD3072B

Art.-no. 401 0040 000

MD3072B-Quad

Art.-no. 401 0041 000

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Contents

GB	1.0	Product Description	10
	1.1	Important notes on the product	10
	1.2	Declaration of conformity	11
	1.3	Technical data	11
	1.4	Optional accessories.....	12
	2.0	Safety Instructions	12
	2.1	Product Safety	12
	2.2	Potential Dangers	12
	3.0	Operating and Display Elements.....	13
	4.0	Commissioning.....	14
	4.1	Operating Modes.....	14
	4.2	Malfunctions	16
	5.0	Maintenance	16
	5.1	Service Information	16
	6.0	Environmental Protection	16

General information about this manual

Thank you for buying Motec products. As part of our continuous attempts to improve customer satisfaction, Motec offers latest product information at <http://www.motecgmbh.de>.

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

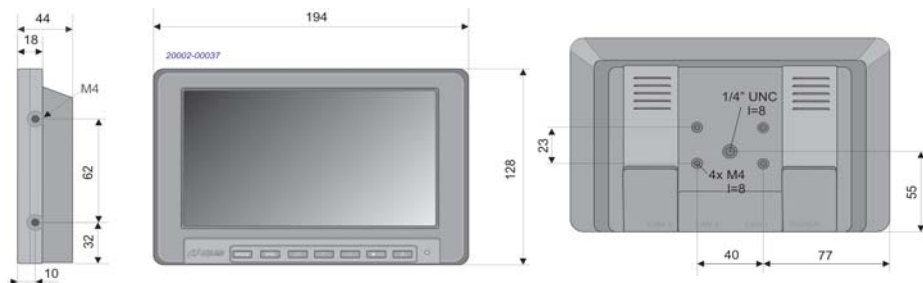
GB

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 V _{pp} (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



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 installation the system components. Observe all safety instructions provided for the machine/vehicle. Additional dangers may arise when connecting this product to other products:

- Do not install cables in the vicinity of engines or other sources of heat.
- Protect the cables against damage by means of cable ducts or protective hoses..
- Make sure not to drill the cables.
- Cables must not be painted or get in contact with solvents.
- Loop the cable in case it is too long.

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.

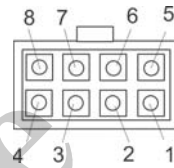


Press the Mode key to toggle to the individual display modes (single image, split screen (2), split screen (3), split screen (4) and timer mode.

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

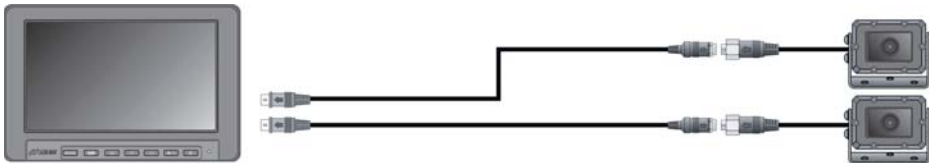
4.1.1 Single Camera Operation

A single camera is connected to C1 in this operating mode.



4.1.2 Twin Camera Operation

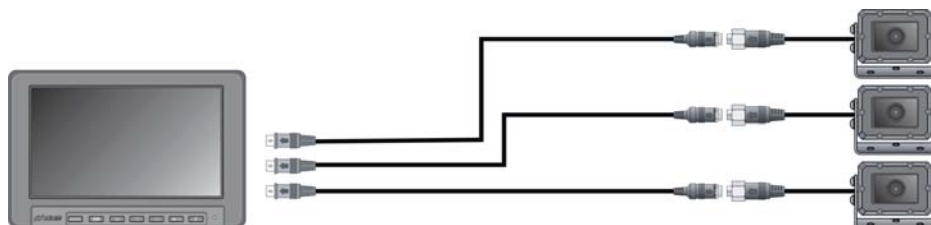
Two cameras are connected in this operating mode. Camera 1 has the highest priority, i.e. images of camera 1 will be displayed on the screen if both cameras have been selected simultaneously.



4.1.3 Three Camera Operation

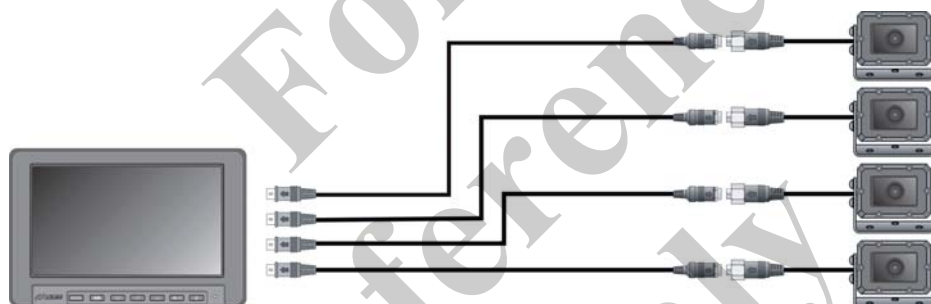
Three cameras are connected in this operating mode. Camera 1 has the highest priority, i.e. images of camera 1 will be displayed on the screen if other cameras have been selected simultaneously. Camera 2 has a higher priority than camera 3.

GB



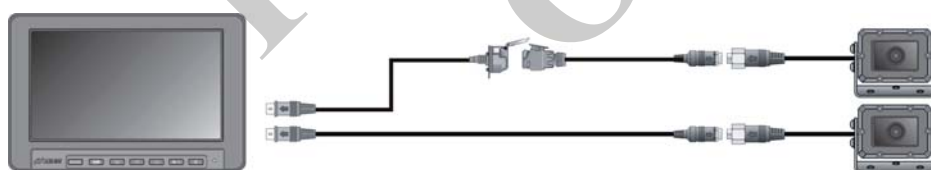
4.1.4 Four Camera Operation

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

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- Service -
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GERMANY

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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



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B.5 Radio remote 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



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Inhalt / Index

Betriebsanleitung



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

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Author: ABITRON Germany / Austria GmbH

3

Allgemeine Betriebsanleitung

	Seite		Seite
1. Einleitung	5	7. Ladegerät- und Akkuhandhabung	12
1.1 Die Betriebsanleitung		7.1 Wechseln und Aufladen der Akkus	
1.2 Wie die Anleitung anzuwenden ist		7.2 Anzeigen und Fehlermeldungen des ABITRON Ladegerätes BCM-1	
1.3 Produktions- und Systemnummern			
2. Sicherheitsmaßnahmen	6	8. Batteriehandhabung	13
2.1 Sicherheit dieser Funkfernsteuerung		8.1 Wechseln der Alkali-Batterien (Größe AA -Mignon)	
2.2 Sicherheitshinweise		8.2 ABITRON Batteriefach	
2.3 Autorisierte Bediener			
2.4 Gefahrenquellen		9. Diagnose	14
2.5 Sicherheitsmaßnahmen und Vorkehrungen im Arbeitsbereich		10. Allgemeine technische Daten	16
2.6 Schutzeinrichtungen		10.1 System	
2.7 Verhalten im Notfall		10.2 Sender	
3. Sicherheitseinrichtungen	7	10.3 Empfänger	
3.1 Sender		10.4 Akku und Ladegerät	
3.2 Empfänger		10.5 Technische Unterlagen	
3.3 System		10.6 Allgemein	
4. Installation	8	11. Wartung, Garantie, Entsorgung	18
4.1 Positionieren der Empfangseinheit		11.1 Wartung	
4.2 Installation der Ausgangsverdrahtung		11.2 Garantie und Gewährleistung	
4.3 Korrekte Montage der Empfangseinheit / Antenne		11.3 Entsorgung	
4.4 Kennzeichnung		11.4 Befähigte Personen nach Betriebssicherheitsverordnung	
5. Kontrolle vor der Inbetriebnahme	10	11.5 Ersatzteile	
5.1 Hinweis zur Bedienung		12. Abkürzungen und Begriffserklärungen	19
5.2 Sichtkontrollen		12.1 Abkürzungen	
5.3 Vor der Inbetriebnahme		12.2 Begriffserklärungen	
5.4 Funktionstest der Stopptaste		13. Erklärung zum Einbau- und Sicherheitstest	20
6. Inbetriebnahme	11		
6.1 Einschaltvorgang für Sender OHNE Schlüsselschalter			
6.2 Einschaltvorgang für Sender MIT Schlüsselschalter			
6.3 Statusanzeige im Empfänger			
6.4 Betrieb mit Kabelsteuerung (optional)			

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 beigefügt 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.

Item-No.:	Cert:	RF-Band:
1	4	7
Production-No.:	Supply \equiv	RF-Setting:
2	5	8
System-No.:	Supply \sim	Current \equiv
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 überlistensicheren 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.

Nothaltsstromkreis:

Im Empfänger ist ein spezieller Sicherheitsstromkreis eingebaut. Durch einen redundanten Aufbau funktioniert dieser selbstüberwachend.

Stopp:

Sobald der Empfänger das Nothaltsignal 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!

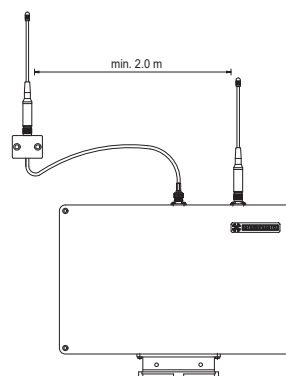
Um einen bestmöglichen Betrieb zu gewährleisten, folgen Sie dieser Antennen-Montageanleitung!

Generell:

- Es dürfen nur von ABITRON freigegebene Antennen verwendet werden.
- Sender sowie Empfänger dürfen nicht ohne Antenne betrieben werden.

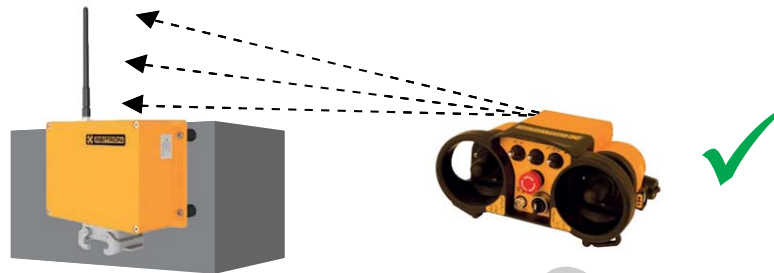
Für Rückmeldeanlagen:

- Abstand zwischen der Sender- und Empfängerantenne von mindestens 2 m einhalten.

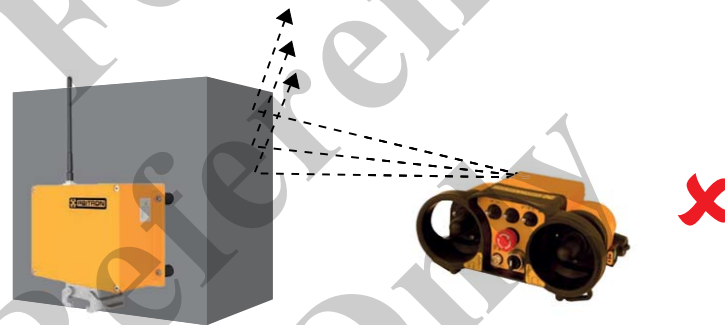


4. Installation

Die Antenne ist vertikal zu montieren. Es sollte von allen Positionen des Bedieners Sichtkontakt zur Antenne bestehen.

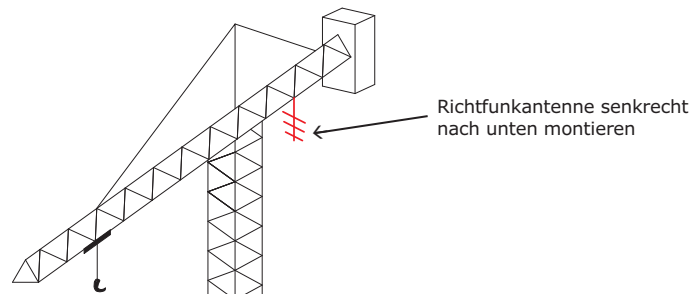


Achten Sie beim Positionieren der Empfangseinheit darauf, dass die Antenne möglichst frei steht und sich keine abschirmenden Materialien um die Antenne befinden. Falls eine solche Montage der Empfangseinheit nicht möglich ist, verwenden Sie bitte eine Antennenverlängerung, um die Antenne an einer geeigneten 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 (Halterungsbügel 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

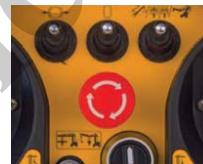
1. Akku oder Batterien einlegen.
2. Der Sender wird mit dem grünen Starttaster gestartet (2x betätigen für Systemstart).
3. Sender mit Tip-Betrieb werden mit einem Funktionstaster gestartet.
4. Die grüne LED muss blinken.
5. Wenn die Taste nicht mehr betätigt ist, wird die Bewegung gestoppt.
6. Bei rot 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 Stoptasters (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 Stoptaster

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



Fehlererkennungen 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 Stopptaster ist gedrückt oder defekt.	Lösen Sie den Stopptaster. 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 Kreuzkulis
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!



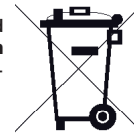
Sind eventuell elektrische Kontakte oxidiert, so verwenden Sie kein Anti-Oxidationsmittel oder ähnliches! **Wenden Sie sich in diesem Fall zur sofortigen Auswechslung der betroffenen Teile an Ihren Händler.** Die Benutzung von chemischen Mitteln in der Funkfernsteuerung verursacht Schäden an den inneren 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 Funkfernbedienung, 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

	Page		Page
1. Introduction	22	7. Battery Charger and Rechargeable Batteries	29
1.1 Operating Manual		7.1 Replacing and Charging Rechargeable Batteries	
1.2 How to use this Manual		7.2 Display and Error Messages of the ABITRON Battery Charger BCM-1	
1.3 Production and System Numbers			
2. Safety Precautions	23	8. Battery Handling	30
2.1 Safety of this Radio Remote Control System		8.1 Replacing Alkaline Batteries (Size AA - Round Cell)	
2.2 Safety Information		8.2 ABITRON Battery Compartment	
2.3 Authorized Operators			
2.4 Sources of Risk		9. Diagnostics	31
2.5 Safety Precautions in the Working Area			
2.6 Protection Devices		10. General Technical Data	33
2.7 In Case of Emergency		10.1 System	
3. Protection Devices	24	10.2 Transmitter	
3.1 Transmitter		10.3 Receiver	
3.2 Receiver		10.4 Rechargeable Battery and Battery Charger	
3.3 System		10.5 Technical Documents	
4. Installation	25	10.6 General	
4.1 Positioning of the Receiver Unit		11. Maintenance, Guarantee, Disposal	35
4.2 Installation of the Output Wiring		11.1 Maintenance	
4.3 Proper Installation of the Receiver Unit / Antenna		11.2 Guarantee and Warranty	
4.4 Identification		11.3 Disposal	
5. Check before Operation	27	11.4 Qualified Persons according to the Ordinance on Industrial Safety and Health	
5.1 Note for Operation		11.5 Spare Parts	
5.2 Visual Inspection		12. Abbreviations and Definitions	36
5.3 Prior to Operation		12.1 Abbreviations	
5.4 Functional Test of the Stop Button		12.2 Definitions	
6. Startup Procedure	28	13. Installation and Safety Test Declaration	37
6.1 Startup Procedure for Transmitters WITHOUT Key Switch			
6.2 Startup Procedure for Transmitters WITH Key Switch			
6.3 Receiver Status Display			
6.4 Operation with Cable Control			

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!

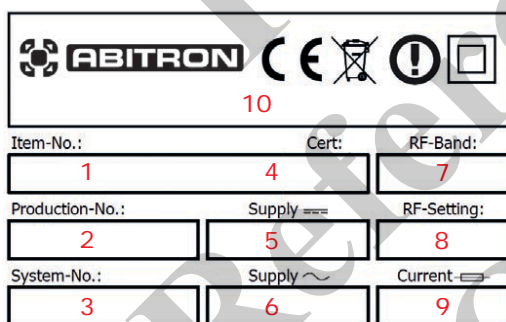
Read the manual of all system components carefully in full before operating the system. The content will make yourself familiar with the safety instructions and the controls during standard operation and maintenance. Keep the manual in a place where the operator can access it at any time.

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	14	Manufacturer code Month of production Year of production
		1000001	Continous number (ABIG)
		7000001	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 unit on the electric system of the machine may only be performed by a qualified person, familiar with the electrical circuitry of the machine and the technical features of the radio remote control.**
- **Both, the transmitter and the receiver have to be powered down during installation work.**
- **All instructions, concerning the health of persons within the immediate vicinity of installation, all valid local regulations and fire regulations have to be observed strictly.**
- **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!

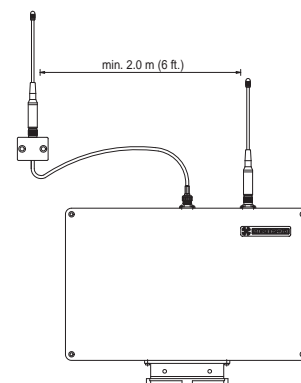
To guarantee an optimal operation, follow the instructions given below to mount the antennas.

General:

- Only antennas, that have been approved by ABITRON, may be used.
- Neither the receiver nor the transmitter may be used without antenna.

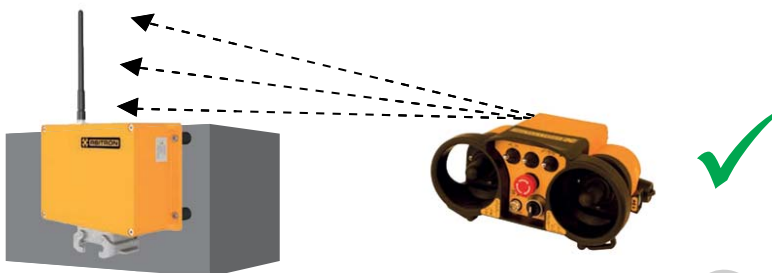
For Feedback-Systems:

- Keep a minimum distance of 2 m (6 ft.) between the receiver antenna and the transmitter antenna.

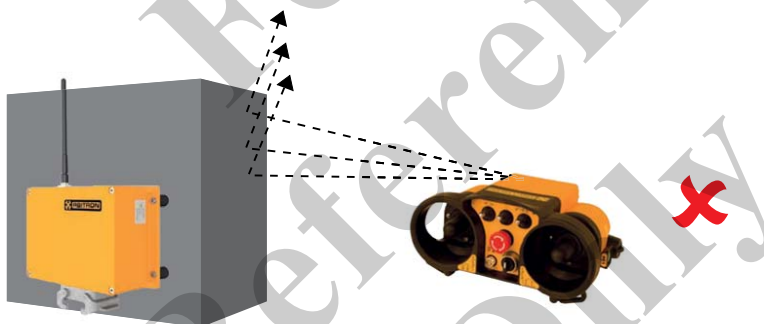


4. Installation

The antenna must be mounted vertically. You should have visual contact from all positions to the antenna.

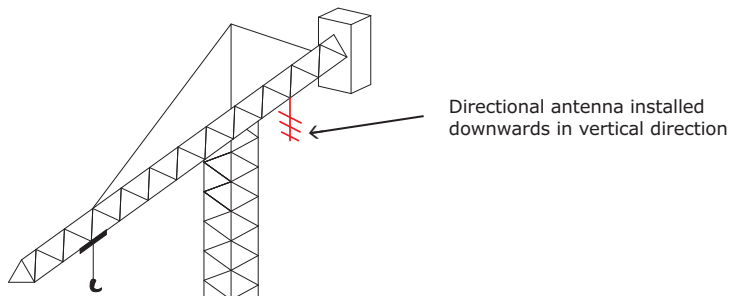


Please note when positioning the receiver unit that the antenna is free of shielding materials. If such a mounting of the receiver unit is not possible, please use an antenna extension to mount the antenna in a suitable position.



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

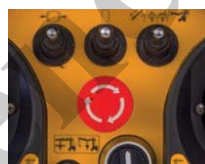
1. Insert a battery or rechargeable battery.
2. The transmitter will be started by activating the green start button (press twice for system start).
3. Transmitter with inching operation will be started by activating a function button.
4. The green LED has to flash.
5. If the function button is released, 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



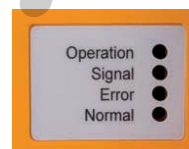
Red stop button

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



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, Langemarktstr. 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
 Niederspannungsrichtlinie: 2014/35/EU
 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:

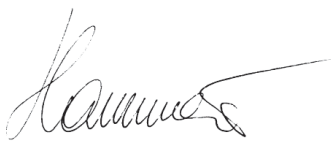
EN ISO 13849-1	2016	EN 60950-1	2006
EN 62061	2005	EN 61000-6-2	2005
EN 13557	2008	EN 61000-6-4	2007
EN 14492	2009	EN 300 220	2007
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EN 60529	1991		

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
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 Nr. 44 205 13146710¹
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Langquaid, am 4. August 2016



Daniela Hammerer
 Geschäftsführer



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RED Directive: 2014/53/EU
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...
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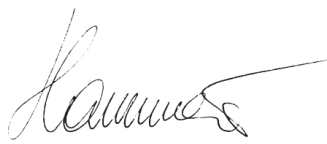
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Authorized for the documentation: Mathias Friedl
Wiesnerstraße 20
4950 Altheim

Safety Category, Performance Level, SIL Level and additional information see Cover Sheet.

Notified Body: TÜV NORD CERT GmbH, Langemarktstr. 20, 45141 Essen
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Langquaid, 4th August 2016



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www.abitronremote.com

B.6 Large roller bearings, slewing gears, 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 slewing gear
- 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

B.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.

GHC

Appendix - PFEIFER Pouch Socket System



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.



Never exceed the working load limit of the reeving eye.



PFEIFER swaged sleeve rotary locked Type 12A
PFEIFER resin socket rotary locked Type 14A
Tested according to 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.



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).



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Appendix - PFEIFER Pouch Socket System

Fig. 7

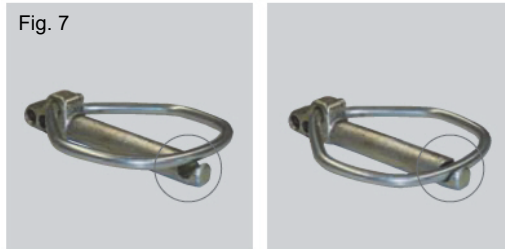


Fig. 8

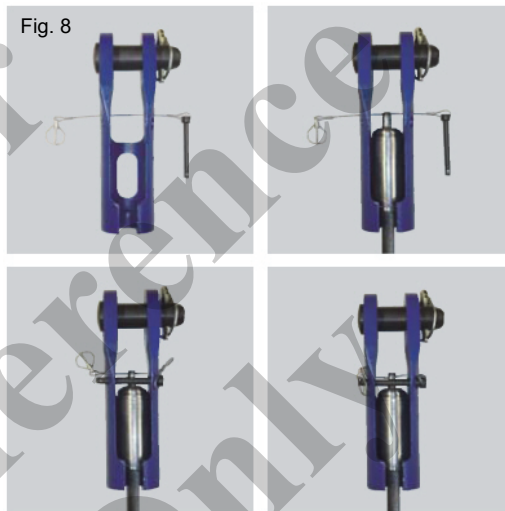


Fig. 9

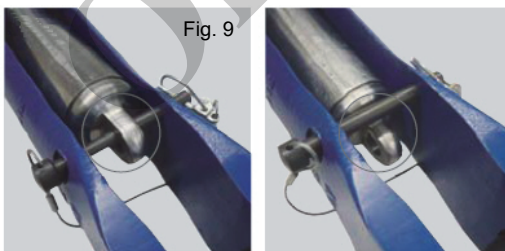


Fig. 10



Grove

Published 11-18-2015, Control # 602-00

10 - 427

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 Hebetchnik GmbH authorized service personnel.

Nominal Size NG	Part Number	Working Load Limit
16, 19, 22, 26, 29, 32, 36	233596	10 kN
40, 44, 48	233597	20 kN
52	233598	30 kN

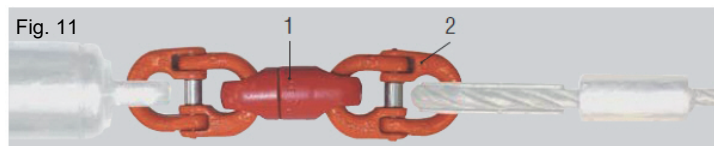


Fig. 11

1. Swivel
2. Connecting link

Appendix - PFEIFER Pouch Socket System

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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.

GHC

Appendix - PFEIFER Pouch Socket System



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.

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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

Grove

Published 11-18-2015, Control # 602-00

10 - 431

B.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.

Cleaning the cooling system - Safety instructions



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.

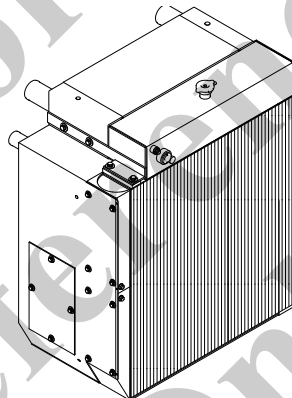


Figure 1 Combination cooler, figure similar

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.

Cleaning the cooling system - Coolant cooler



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.



Cleaning the cooling system - Charge-air cooler



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.

B.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 | <ul style="list-style-type: none">• 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

06/15 - 2



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 $k_m = 0.125$.



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	$k_m = 0.125$	<p>Graphic representation for light load spectrum: A step function showing 100% load for 10% of the time, 40% load for 30% of the time, and 10% load for 60% of the time.</p>
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	$k_m = 0.5$	<p>Graphic representation for heavy load spectrum: A step function showing 100% load for 50% of the time and 50% load for 50% of the time.</p>
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	$k_m = 1$	<p>Graphic representation for very heavy load spectrum: A step function showing 100% load for 90% of the time and 20% load for 10% of the time.</p>

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.

06/15 - 4



- 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).

06/15 - 6



- Of this period, the winch was in operation for approx. 40%, resulting in $T_2 = 480$ h.

This results in a used portion S_2 of the theoretical period of use in the 2nd inspection interval as follows:

$$S_1 = \frac{0,125}{0,125} \times 160 \text{ h} = 160 \text{ h}$$

Remaining theoretical period of use:

$$D_2 = 3040 \text{ h} - 1920 \text{ h} = 1120$$

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 $T_3 = 300$ h.

This results in a used portion S_3 of the theoretical period of use in the 3rd inspection interval as follows:

$$S_3 = \frac{0,25}{0,125} \times 300 \text{ h} = 600 \text{ h}$$

Remaining theoretical period of use:

$$D_3 = 1120 \text{ h} - 600 \text{ h} = 520 \text{ h}$$

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
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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

Last general overhaul performed on: _____

Design data for winch (see operating manual)

Drive group: M 3

Load spectrum: Q 1 (L1)

Load spectrum factor km: 0.125

Theoretical period of use D: 3200 h

S_i = Used portion of the theoretical period of use since last inspection

D_i = Remaining theoretical period of use

D_{i-1} = Remaining theoretical period of use after the previous inspection

k_{en} = Load spectrum factor used as basis for the winch calculations.

Q 1 (L1) = 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 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 _i : $S_i \frac{k_{mi}}{k_m} \times T_i$	Remaining theoretical period of use D _i = D _{i-1} - S _i	Name of tester	Signature	Remark
i		k _{mi}	[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/NDW/inde

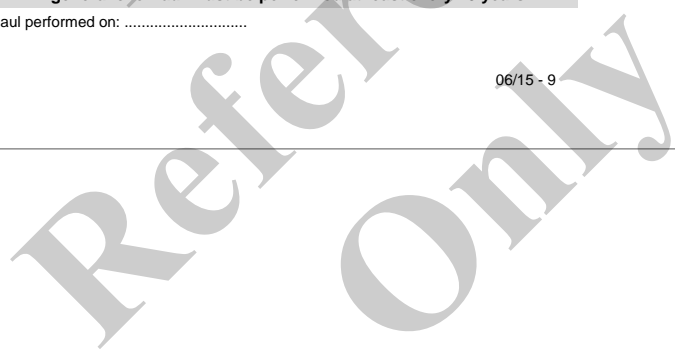




Table 1: Table for determining the remaining theoretical period of use for winch no. 1 (main hoisting winch)

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_m = 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

06/15 - 10

Reference Only

B.10 Operating fluids and lubricants

Name	Data
Designation	Operating fluids and lubricants
Type	Operating fluids and lubricants
Number	664965
Type of manual	List of operating fluids and lubricants
Manufacturer	.

For Reference Only

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Reference
Only

ID no.: 664965
Release date: 7 January 2015
Current revision status: 3

Printed copies of this List of Operating Fluids and Lubricants are not subject to change management.

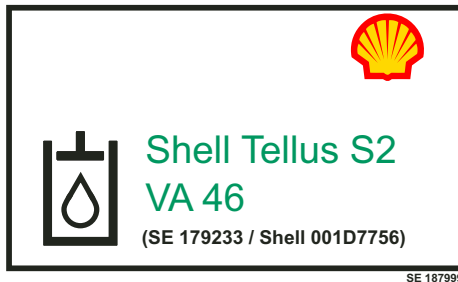
**List of Operating
Fluids and Lubricants
en**

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Reference
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Betriebsstoffliste Version 4, en, Grove, 1, en_GB

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

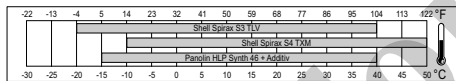


Fig. 2: Temperature ranges - hydraulic oil

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.

Table of contents

Table of contents

1	Hydraulic systems	6
1.1	Material handling machines, duty cycle crawler cranes without free-fall winches.....	6
1.1.1	Hydraulic oils for an extended change interval.....	6
1.1.2	Hydraulic oils without an extended change interval...	7
1.2	Duty cycle crawler cranes with free-fall winches.....	8
1.2.1	Hydraulic oils for an extended change interval.....	8
1.3	Crawler cranes, telescopic cranes, multicranes, harbor cranes, balance material handling machines....	9
1.3.1	Hydraulic oils for an extended change interval.....	9
1.3.2	Hydraulic oils without an extended change interval.	10
1.4	Multihandler 305, 310.....	11
1.4.1	Hydraulic oils without an extended change interval.	11
1.5	Powerpack SP100.....	11
2	Diesel engine	12
2.1	Diesel engine oil.....	12
2.1.1	Caterpillar diesel engine	12
2.1.2	Cummins diesel engine.....	13
2.1.3	Deutz diesel engine.....	15
2.1.4	Scania diesel engine.....	18
2.2	Coolant.....	20
2.3	Fuel.....	20
2.4	Diesel flow improvers.....	20
2.5	AdBlue [®] , diesel exhaust fluid for Tier 4 Final diesel engines.....	20
3	Electric motor	21
3.1	Lubrication.....	21
3.2	Coolant - heating circuit.....	21
4	Gearbox	22
4.1	Slewing gear.....	22
4.1.1	Gear oil.....	22
4.1.2	Brake fluid.....	22
4.1.3	Lubricating grease - roller bearings.....	23
4.2	Pump distributor gearbox.....	23
4.2.1	Gear oil.....	23
4.3	Winch gear.....	24
4.3.1	Gear oil.....	24
4.3.2	Grease lubricating points.....	24
4.4	Power shift transmission.....	25
4.4.1	Gear oil (diesel engine oil).....	25
4.4.2	Grease lubricating points.....	25
4.5	Travel gear Multihandler 305, 310.....	25
4.5.1	Gear oil.....	25

Table of contents

4.6	Axles.....	26
4.6.1	Wheel hub transmission.....	26
4.6.2	Axle differential transmission.....	26
4.6.3	Countershaft transmission.....	27
4.7	Crawler travel drive.....	27
4.7.1	Gear oil.....	27
4.8	Rail drive	28
4.8.1	Gear oil.....	28
5	Lubrication.....	29
5.1	Grease - central lubrication system.....	29
5.2	Grease - slewing ring roller bearings.....	29
5.3	Grease - slewing gear, inner gearing.....	30
5.4	Grease - slewing ring, outer gearing.....	30
5.5	Grease - manual lubricating points.....	31
5.6	Grease - undercarriage, telescoping.....	31
5.7	Grease - telescopic boom, telecranes.....	32
5.8	Lubricants - wire ropes.....	32
6	Air conditioning system and switchgear cabinet air-conditioning.....	33
6.1	Air conditioning system.....	33
6.1.1	Refrigerant.....	33
6.1.2	Refrigerant oil	33
6.2	Antifreeze - switchgear cabinet air-conditioning.....	33
7	Windshield washer system.....	34
7.1	Antifreeze.....	34
8	Starter batteries.....	35
8.1	Battery terminal grease.....	35
8.2	Battery terminal spray.....	35

Hydraulic systems

1 Hydraulic systems

1.1 Material handling machines, duty cycle crawler cranes without free-fall winches

1.1.1 Hydraulic oils for an extended change interval

When the following hydraulic oils are used, the change intervals can be extended depending on the results of regularly performed hydraulic oil analyses (Shell LubeAnalyst).

The machine must be equipped with the HydroClean system.

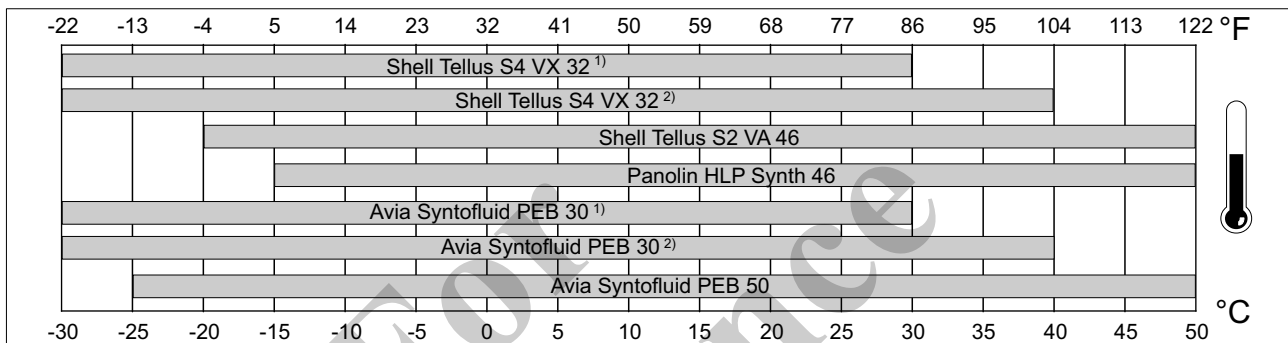


Fig. 3: Temperature ranges

1) A;B;C;D Series

2) E Series

Recommendation	ID no.	Specification	Alternative
Shell Tellus S4 VX 32	SE: 157284 Shell: 001D7769	DIN 51524-3 HVLDP (ISO VG 32) PAO	Avia Syntofluid PEB 30
Shell Tellus S2 VA 46	SE: 179233 Shell: 001D7756	DIN 51524-3 HVLDP (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	

1.1.2 Hydraulic oils without an extended change interval

The hydraulic oils listed below can be used if the hydraulic oils recommended under [Chapter 1.1.1](#) „Hydraulic oils for an extended change interval“ on page 6 are not available. When these hydraulic oils are used, the change interval of 2000 operating hours must be observed.

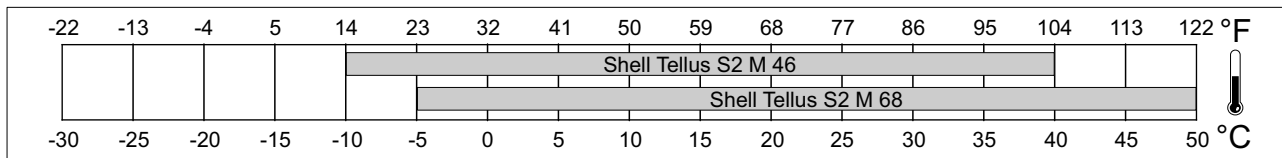


Fig. 4: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Tellus S2 M 46	SE: 149201 Shell: 001D7744	DIN 51524-2 HLP/HLP-D; (ISO VG 46)	Agip OSO-D46; Castrol Hyspin DHV 46
Shell Tellus S2 M 68	SE: 179852 Shell: 001D7745	DIN 51524-2 HLP/HLP-D; (ISO VG 68)	Agip OSO-D68; Castrol Hyspin DHV 68

Hydraulic systems

1.2 Duty cycle crawler cranes with free-fall winches

1.2.1 Hydraulic oils for an extended change interval

When the following hydraulic oils are used, the change intervals can be extended depending on the results of regularly performed hydraulic oil analyses (Shell LubeAnalyst).

The machine must be equipped with the HydroClean system.

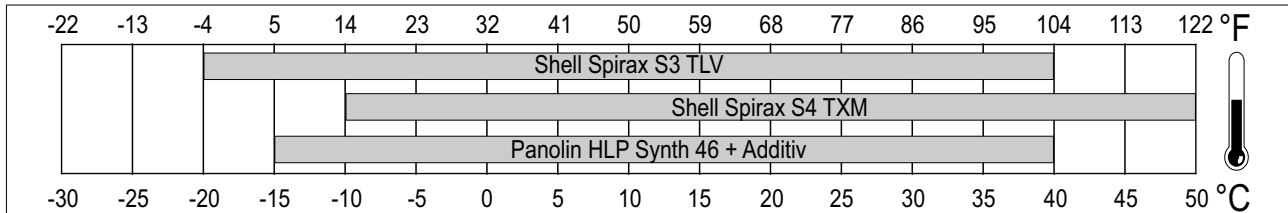


Fig. 5: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Spirax S3 TLV	SE: 179231 Shell: 001D8244	Oil-specific suitability test	
Shell Spirax S4 TXM	SE: 179232 Shell: 001D8246	Oil-specific suitability test	OMV Austromatic HGN ²⁾ Castrol Agri Trans Plus 80W ²⁾
Rapidly biodegradable hydraulic oil:			
Panolin HLP Synth 46 + additive ¹⁾	SE: 149198	ISO 15380 HEES saturated; oil-specific suitability test	
¹⁾ Additive:			
Panolin Anti QR	SE: 185727		
²⁾ When these hydraulic oils are used, the change interval of 2000 operating hours must be observed.			

1.3 Crawler cranes, telescopic cranes, multicroanes, harbor cranes, balance material handling machines

1.3.1 Hydraulic oils for an extended change interval

When the following hydraulic oils are used, the change intervals can be extended depending on the results of regularly performed hydraulic oil analyses (Shell LubeAnalyst).

The machine must be equipped with the HydroClean system.

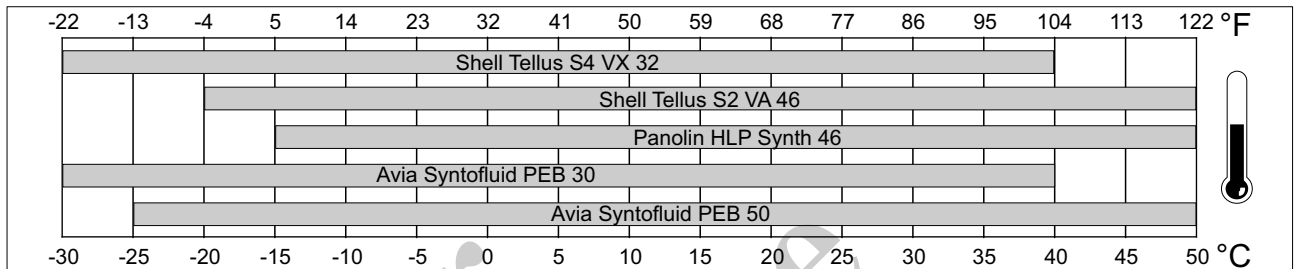


Fig. 6: Temperature ranges

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	

Hydraulic systems

1.3.2 Hydraulic oils without an extended change interval

The hydraulic oils listed below can be used if the hydraulic oils recommended under [Chapter 1.3.1](#) „Hydraulic oils for an extended change interval“ on page 9 are not available. When these hydraulic oils are used, the change interval of 2000 operating hours must be observed.

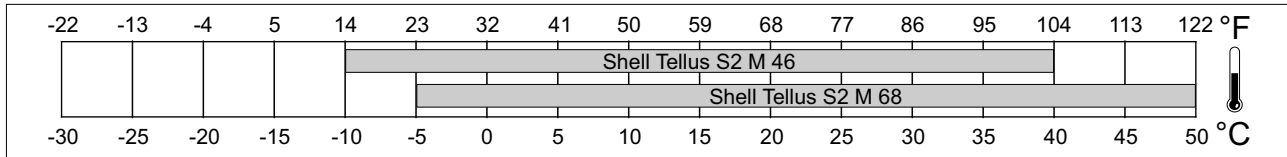


Fig. 7: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Tellus S2 M 46	SE: 149201 Shell: 001D7744	DIN 51524-2 HLP/HLP-D; (ISO VG 46)	Agip OSO-D46; Castrol Hyspin DHV 46
Shell Tellus S2 M 68	SE: 179852 Shell: 001D7745	DIN 51524-2 HLP/HLP-D; (ISO VG 68)	Agip OSO-D68; Castrol Hyspin DHV 68

1.4 Multihandler 305, 310

1.4.1 Hydraulic oils without an extended change interval

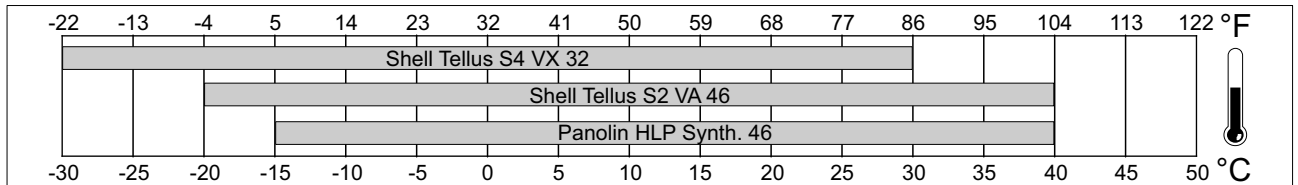


Fig. 8: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Tellus S4 VX 32	SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP-D (ISO VG 32) PAO	
Shell Tellus S2 VA 46	SE: 179233 Shell: 001D7756	DIN 51524-3 HVLP-D (ISO VG 46)	Agip Precis HVLP-D
Rapidly biodegradable hydraulic oil:			
Panolin HLP Synth 46	SE: 149198	Rapidly biodegradable; ISO 15380 HEES saturated	Avia Syntofluid PEB 30

1.5 Powerpack SP100

Fill the Powerpack SP100 with the same hydraulic oil that is used in the machine's hydraulic system.

Diesel engine

2 Diesel engine

2.1 Diesel engine oil

2.1.1 Caterpillar diesel engine

2.1.1.1 Emissions levels Tier 2 and Tier 3

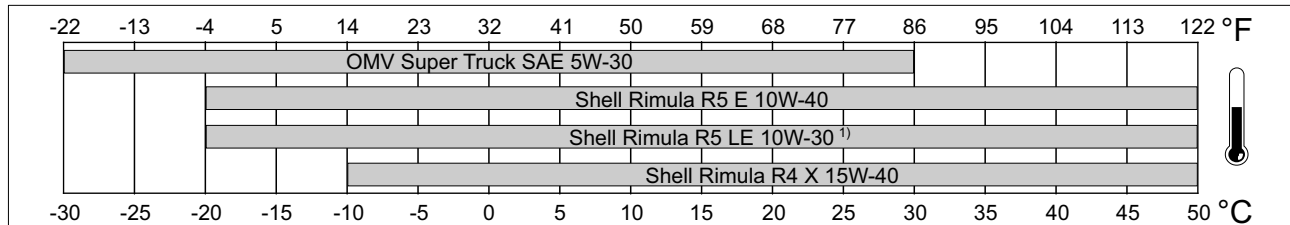


Fig. 9: Temperature ranges

Recommendation	ID no.	Specification	Alternative
OMV Super Truck SAE 5W-30	SE: 124846	API CI-4; CAT ECF-2	
Shell Rimula R5 E 10W-40	SE: 181934 Shell: 001C4591	API CI-4	
Shell Rimula R5 LE 10W-30 ¹⁾	SE: 179228 Shell: 001D7309	API CJ-4; CAT ECF-3	Castrol Enduron Global 10W-40
Shell Rimula R4 X 15W-40	SE: 181933 Shell: 001E7746	API CI-4; CAT ECF-2	

¹⁾ Observe the fuel restrictions in the operating manual of the diesel engine manufacturer.

2.1.1.2 Emissions levels Tier 4 Interim and Tier 4 Final

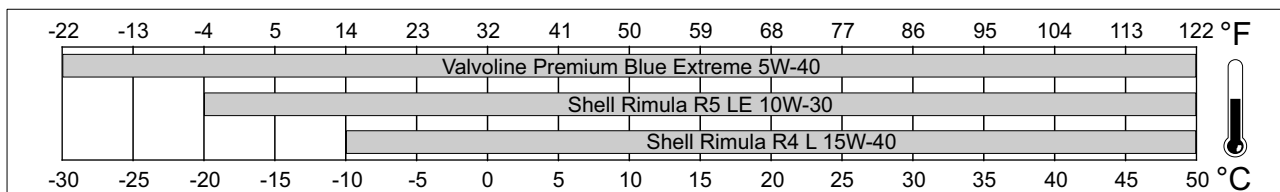


Fig. 10: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Valvoline Premium Blue Extreme 5W-40	SE: 157283	API CJ-4; CAT ECF-3	Shell Rotella T6 5W-40; Motorex Nexus FE 5W-30; Eni i-Sigma top MS 5W-30
Shell Rimula R5 LE 10W-30	SE: 179228 Shell: 001D7309	API CJ-4; CAT ECF-3	Eni i-Sigma top MS 10W-30; Castrol Enduron Global 10W-40
Shell Rimula R4 L 15W-40	SE: 181932 Shell: 001C4590	API CJ-4; CAT ECF-3	

2.1.2 Cummins diesel engine

2.1.2.1 Emissions levels Tier 2 and Tier 3

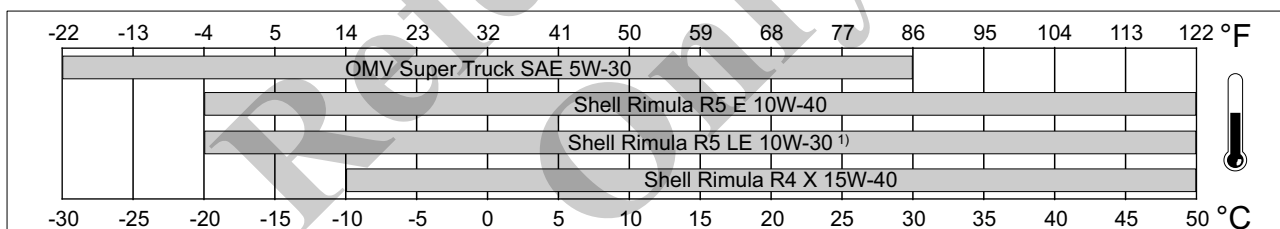


Fig. 11: Temperature ranges

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 Rimula R5 LE 10W-30 ¹⁾	SE: 179228 Shell: 001D7309	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⁾ Observe the fuel restrictions in the operating manual of the diesel engine manufacturer.

Diesel engine

2.1.2.2 Emissions levels Tier 4 Interim and Tier 4 Final

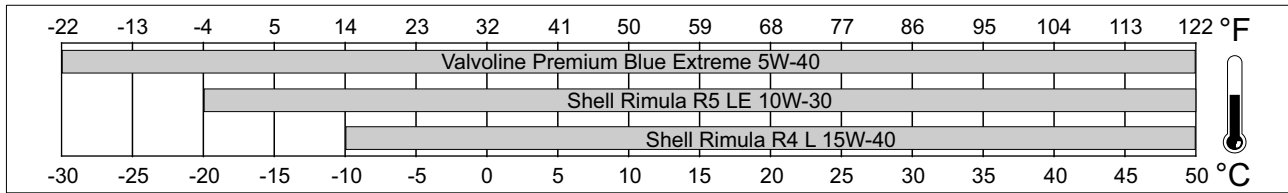


Fig. 12: Temperature ranges

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 Rimula R5 LE 10W-30	SE: 179228 Shell: 001D7309	API CJ-4; Cummins CES20081	Eni i-Sigma top MS 10W-30; Castrol Enduron Global 10W-40
Shell Rimula R4 L 15W-40	SE: 181932 Shell: 001C4590	API CJ-4; Cummins CES20081	

For Reference Only

2.1.3 Deutz diesel engine

2.1.3.1 Emissions levels Tier 2 and Tier 3

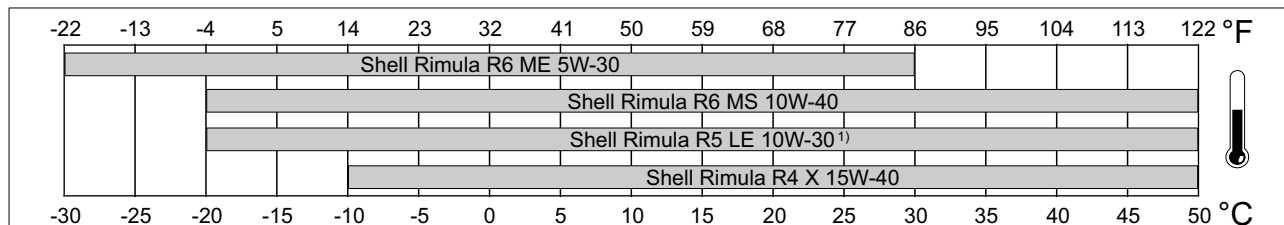


Fig. 13: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Rimula R6 ME 5W-30	SE: 182085 Shell: 001C4595	Deutz DQC IV-10	OMV Super Truck SAE 5W-30
Shell Rimula R6 MS 10W-40	SE: 181936 Shell: 001E7457	ACEA E7; Deutz DQC IV-10	OMV Super Truck SAE 10W-40
Shell Rimula R5 LE 10W-30 ¹⁾	SE: 179228 Shell: 001D7309	API CJ-4; Deutz DQC III-10 LA	
Shell Rimula R4 X 15W-40	SE: 181933 Shell: 001E7746	API CI-4; Deutz DQC III-10	

¹⁾ Observe the fuel restrictions in the operating manual of the diesel engine manufacturer.

Diesel engine

2.1.3.2 Emissions level Tier 4 Interim

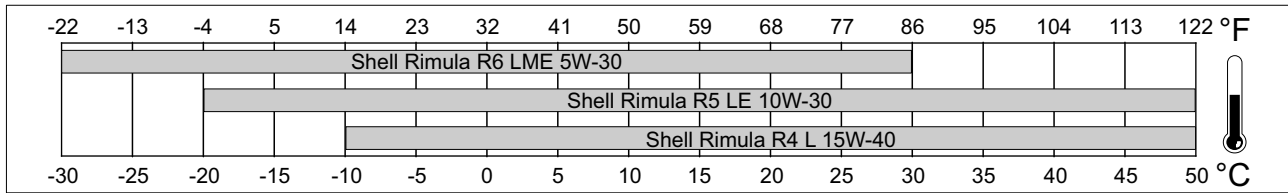


Fig. 14: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Rimula R6 LME 5W-30	SE: 182086 Shell: 001C4597	ACEA E7; Deutz DQC IV-10 LA	Motorex Nexus FE 5W-30; Eni i-Sigma top MS 5W-30
Shell Rimula R5 LE 10W-30	SE: 179228 Shell: 001D7309	API CJ-4; Deutz DQC III-10 LA	
Shell Rimula R4 L 15W-40	SE: 181932 Shell: 001C4590	API CJ-4; Deutz DQC III-10 LA	

For Reference Only

For
Reference
Only

Diesel engine

2.1.4 Scania diesel engine

2.1.4.1 Emissions level Tier 3

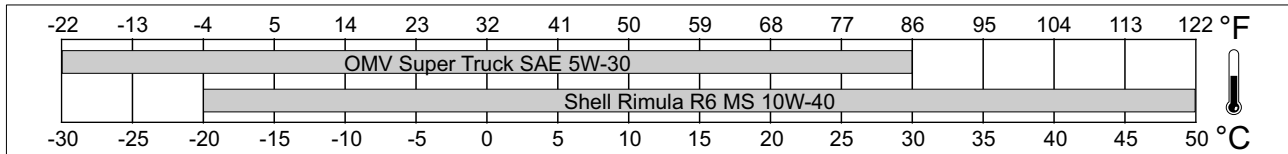


Fig. 15: Temperature ranges

Recommendation	ID no.	Specification	Alternative
OMV Super Truck SAE 5W-30	SE: 124846	API CI-4; ACEA E7	
Shell Rimula R6 MS 10W-40	SE: 181936 Shell: 001E7457	ACEA E7; Scania LDF-3	OMV Super Truck SAE 10W-40

2.1.4.2 Emissions level Tier 4 Interim

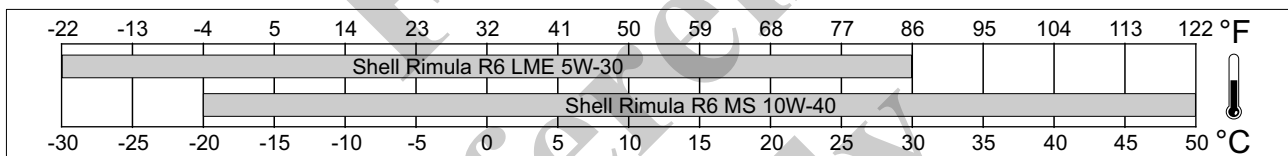


Fig. 16: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Rimula R6 LME 5W-30	SE: 182086 Shell: 001C4597	ACEA E7	
Shell Rimula R6 MS 10W-40	SE: 181936 Shell: 001E7457	ACEA E7; Scania LDF-3	OMV Super Truck SAE 10W-40

2.1.4.3 Emissions level Tier 4 Final

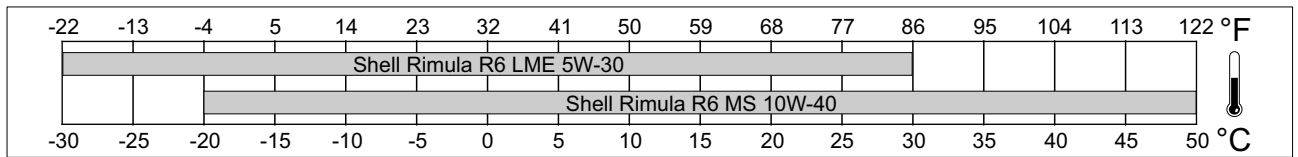


Fig. 17: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Rimula R6 LME 5W-30	SE: 182086 Shell: 001C4597	ACEA E7	
Shell Rimula R6 MS 10W-40	SE: 181936 Shell: 001E7457	ACEA E7; Scania LDF-3	OMV Super Truck SAE 10W-40

For Reference Only

Diesel engine

2.2 Coolant

Engine	Recommendation	ID no.	Specification	Mixing ratio
Caterpillar	CAT ELC	SE: 175268	CAT ELC	As specified in the operating manual ¹⁾
Cummins	Cummins ES Compleat	SE: 181966	Cummins CES 14603	As specified in the operating manual ¹⁾
Deutz	Cummins ES Compleat	SE: 181966	Cummins CES 14603	As specified in the operating manual ¹⁾
Scania	Scania (Ready Mix)	SE: 182087	Scania	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 Interim	Diesel fuel DIN EN 590, ASTM D975 ULSD 1D, 2D	≤ 15 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.

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 AdBlue[®], diesel exhaust fluid for Tier 4 Final diesel engines

Recommendation	ID no.	Specification
AdBlue [®]	SE: 149060	ISO 22241; DIN 70070; AUS 32

3 Electric motor

3.1 Lubrication

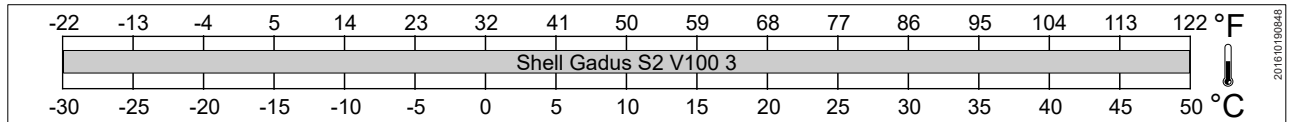


Fig. 18: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Gadus S2 V100 3	SE: 182536 Shell: 001D8464	DIN 51825; K3K-30; NLGI 3	Esso UNIREX N3

3.2 Coolant - heating circuit

Recommendation	ID no.	Specification	Mixing ratio
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).

Gearbox

4 Gearbox

4.1 Slewing gear

4.1.1 Gear oil

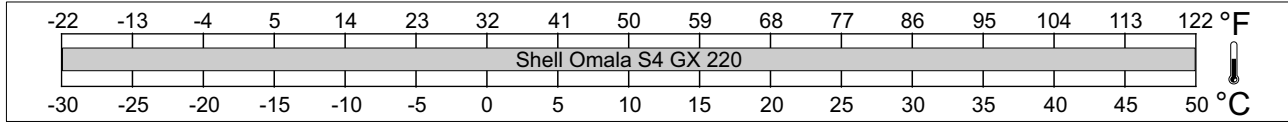


Fig. 19: Temperature range

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

4.1.2 Brake fluid

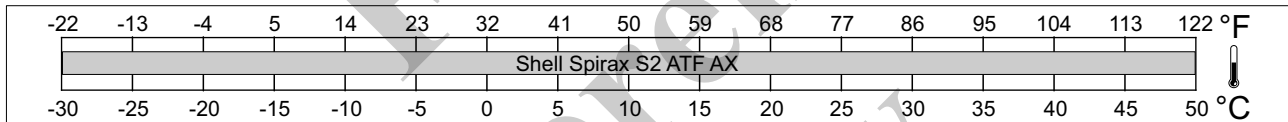


Fig. 20: Temperature range

Recommendation	ID no.	Specification	Alternative
Shell Spirax S2 ATF AX	SE: 179229 Shell: 001D8295	ATF oil; DEXRON II D 21523	Avia Fluid ATF 86

4.1.3 Lubricating grease - roller bearings

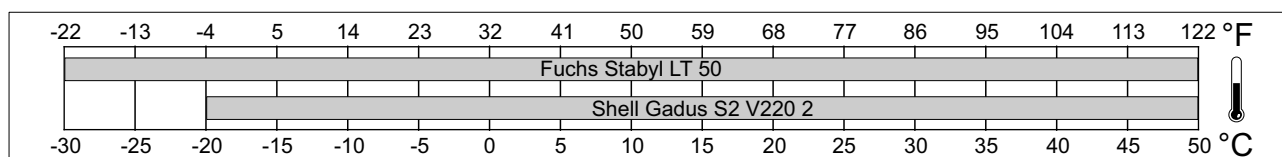


Fig. 21: Temperature ranges

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; Castrol Olit 2 EP; OMV Signum CX2

4.2 Pump distributor gearbox

4.2.1 Gear oil

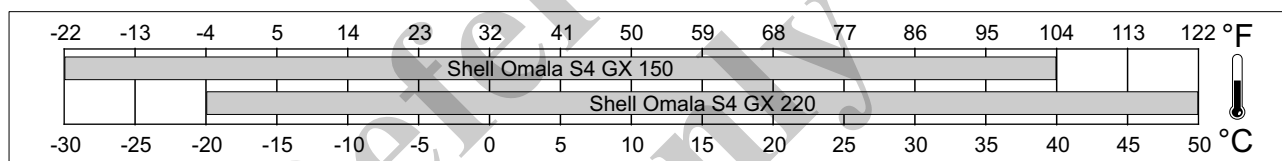


Fig. 22: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Omala S4 GX 150	SE: 181931 Shell: 001D7850	CLP HC (PAO) 150; DIN 51517 T3	Castrol Alphasyn EP 150
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

Gearbox

4.3 Winch gear

4.3.1 Gear oil

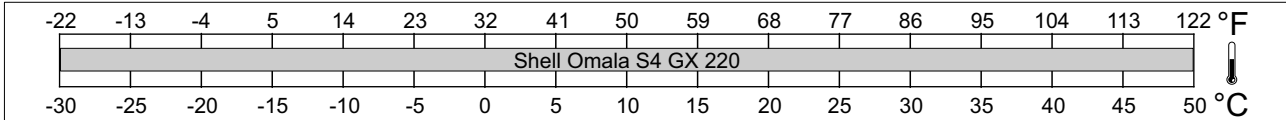


Fig. 23: Temperature range

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

4.3.2 Grease lubricating points

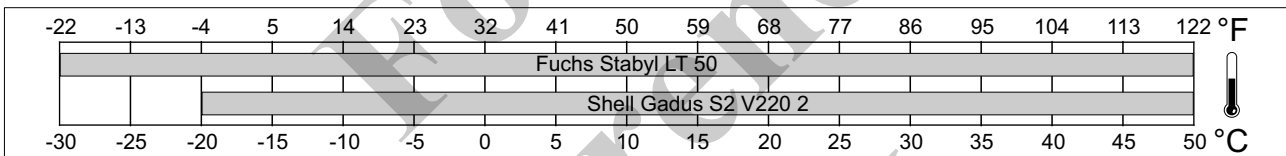


Fig. 24: Temperature ranges

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; Castrol Olit 2 EP; OMV Signum CX2

4.4 Power shift transmission

4.4.1 Gear oil (diesel engine oil)

Fill power shift transmission with diesel engine oil.

All diesel engine oils listed in may be used.

4.4.2 Grease lubricating points

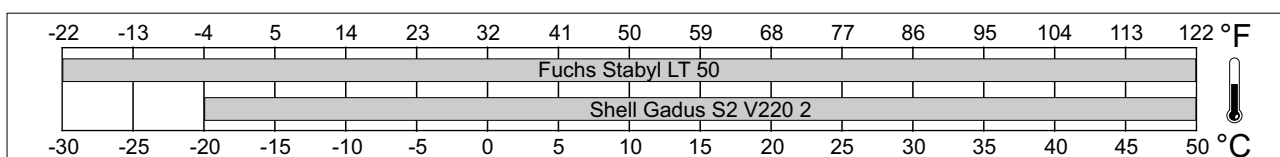


Fig. 25: Temperature ranges

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	KP2K-20 in acc. with DIN 51825 without MoS2n / (ISO-L-XBCHB2 in acc. with ISO 6743-9)	AUTOL TOP 2000; Castrol Olit 2 EP; OMV Signum CX2

4.5 Travel gear Multihandler 305, 310

4.5.1 Gear oil

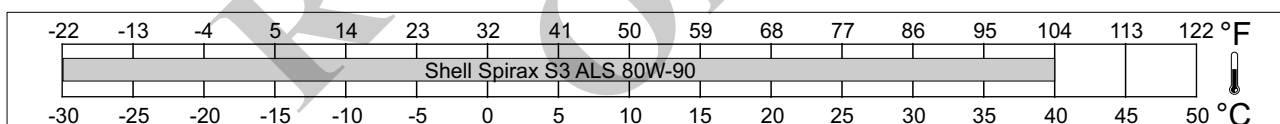


Fig. 26: Temperature range

Recommendation	ID no.	Specification	Alternative
Shell Spirax S3 ALS 80W-90	SE: 179230 Shell: 001D8843	API GL5 LS; ZF-TE ML-05 C,D,F,G,H	Eni ROTRA MP/S 85W-90; Castrol Axle Z Limited Slip 85W-90; OMV gear oil LS SAE 85W-90

Gearbox

4.6 Axles

4.6.1 Wheel hub transmission

4.6.1.1 Gear oil

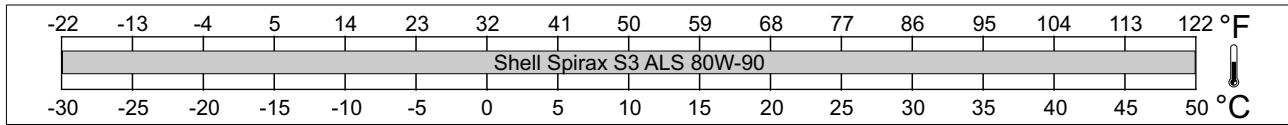


Fig. 27: Temperature range

Recommendation	ID no.	Specification	Alternative
Shell Spirax S3 ALS 80W-90	SE: 179230 Shell: 001D8843	API GL5 LS; ZF-TE ML-05 C,D,F,G,H	Eni ROTRA MP/S 85W-90; Castrol Axle Z Limited Slip 85W-90; OMV gear oil LS SAE 85W-90

4.6.2 Axle differential transmission

4.6.2.1 Gear oil

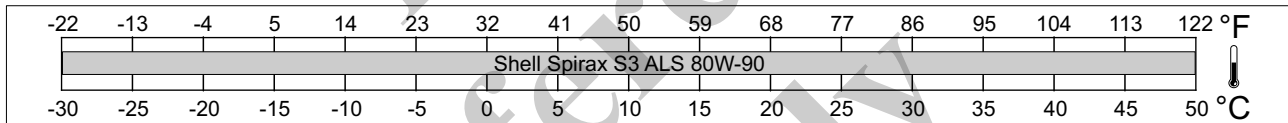


Fig. 28: Temperature range

Recommendation	ID no.	Specification	Alternative
Shell Spirax S3 ALS 80W-90	SE: 179230 Shell: 001D8843	API GL5 LS; ZF-TE ML-05 C,D,F,G,H	Eni ROTRA MP/S 85W-90; Castrol Axle Z Limited Slip 85W-90; OMV gear oil LS SAE 85W-90

4.6.3 Countershaft transmission

4.6.3.1 Gear oil

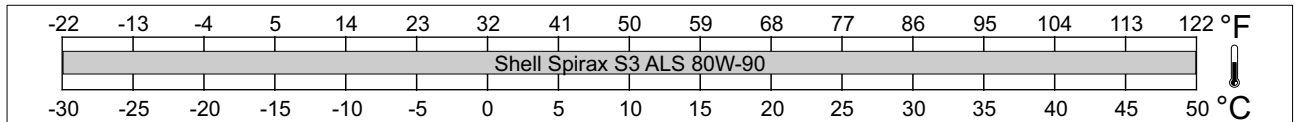


Fig. 29: Temperature range

Recommendation	ID no.	Specification	Alternative
Shell Spirax S3 ALS 80W-90	SE: 179230 Shell: 001D8843	API GL5 LS; ZF-TE ML-05 C,D,F,G,H	Eni ROTRA MP/S 85W-90; Castrol Axle Z Limited Slip 85W-90; OMV gear oil LS SAE 85W-90

4.6.3.2 Hydraulic oil - parking brake

Fill parking brake with the same hydraulic oil that is used in the machine's hydraulic system.

4.7 Crawler travel drive

4.7.1 Gear oil

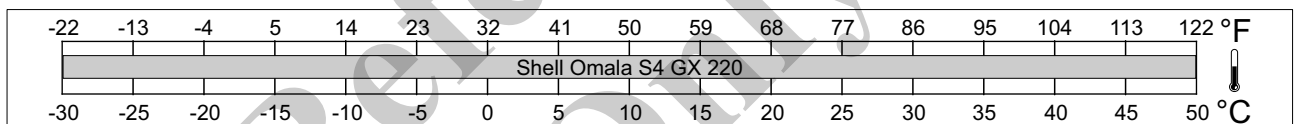


Fig. 30: Temperature range

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

Gearbox

4.8 Rail drive

4.8.1 Gear oil

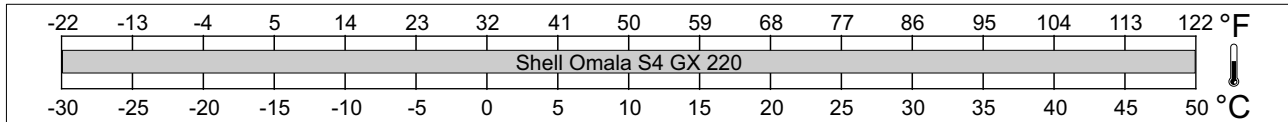


Fig. 31: Temperature range

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

For
Reference
Only

5 Lubrication

5.1 Grease - central lubrication system

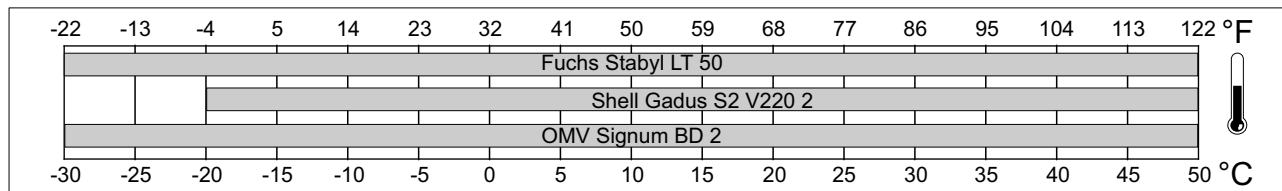


Fig. 32: Temperature ranges

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

5.2 Grease - slewing ring roller bearings

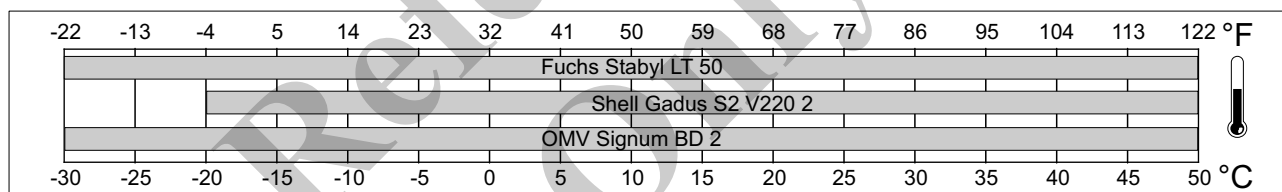


Fig. 33: Temperature ranges

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

Lubrication

5.3 Grease - slewing gear, inner gearing

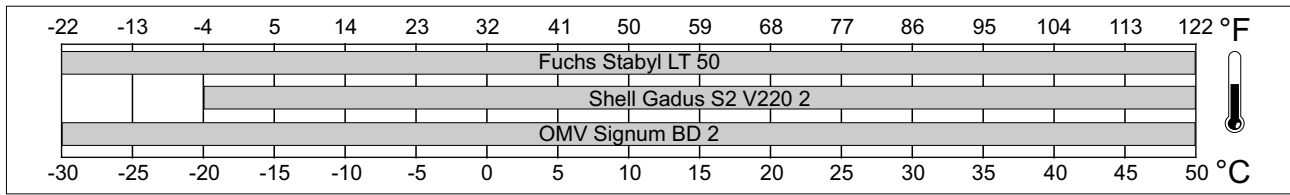


Fig. 34: Temperature ranges

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

5.4 Grease - slewing ring, outer gearing

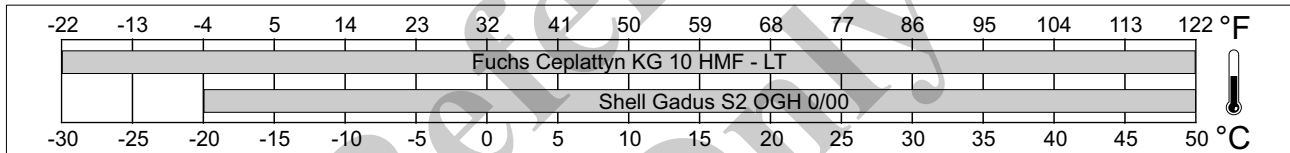


Fig. 35: Temperature ranges

Recommendation	ID no.	Specification	Alternative
Fuchs Ceplattyn KG 10 HMF - LT	SE: 156982	DIN 51502 - KPHC2N-50; NLGI 2	
Shell Gadus S2 OGH 0/00	SE: 179222 Shell: 001D8506	DIN 51 502 OG PF 0 S-30; NLGI 0	OKS 490

5.5 Grease - manual lubricating points

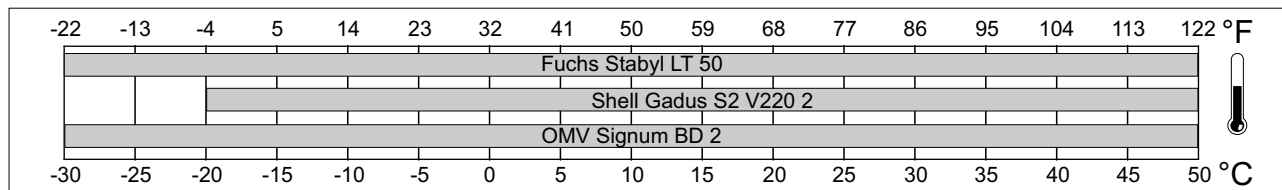


Fig. 36: Temperature ranges

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

5.6 Grease - undercarriage, telescoping

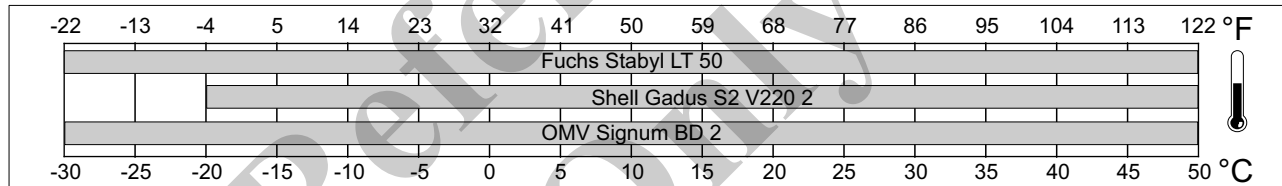


Fig. 37: Temperature ranges

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

Lubrication

5.7 Grease - telescopic boom, telecranes

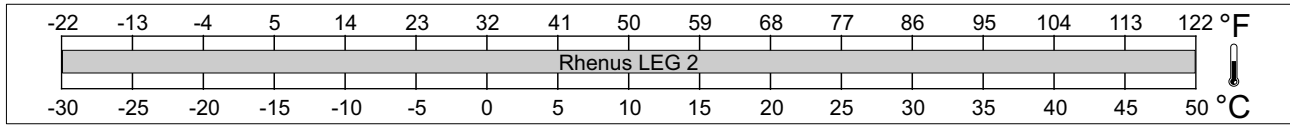


Fig. 38: Temperature range

Recommendation	ID no.	Specification	Alternative
Rhenus LEG 2	SE: 185733	DIN 51502, KPF 2 N-30; NLGI 2	

5.8 Lubricants - wire ropes

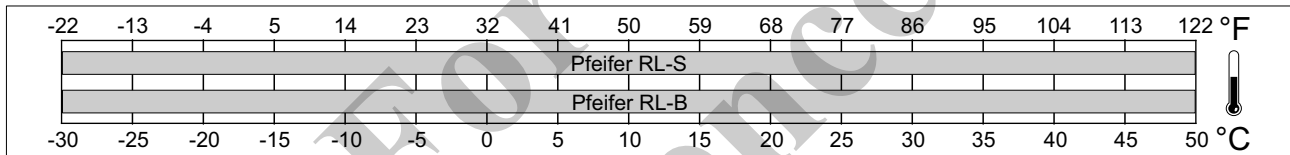


Fig. 39: Temperature ranges

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	

6 Air conditioning system and switchgear cabinet air-conditioning

6.1 Air conditioning system

6.1.1 Refrigerant

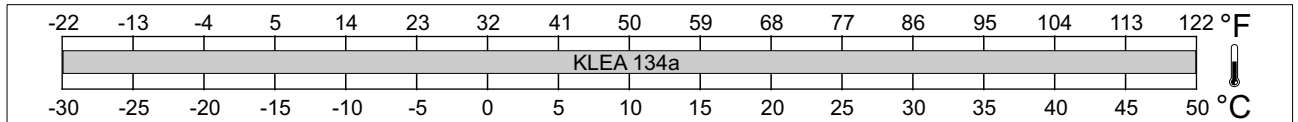


Fig. 40: Temperature range

Recommendation	ID no.	Specification	Alternative
KLEA 134a	SE: 185737	R134a	

6.1.2 Refrigerant oil

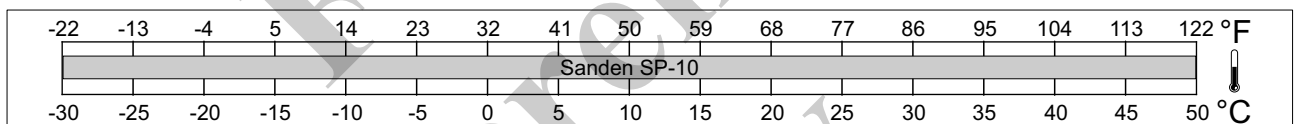


Fig. 41: Temperature range

Recommendation	ID no.	Specification	Alternative
Sanden SP-10	SE: 185732		

6.2 Antifreeze - switchgear cabinet air-conditioning

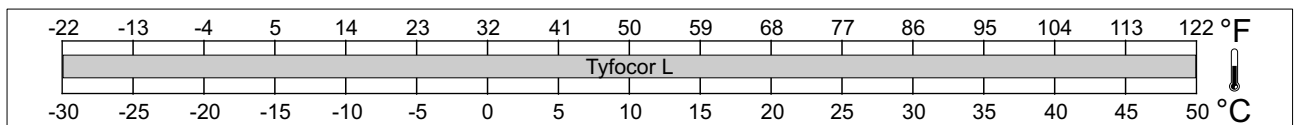


Fig. 42: Temperature range

Recommendation	ID no.	Specification	Alternative
Tyfocor L	SE: 185731		

Windshield washer system

7 Windshield washer system

7.1 Antifreeze

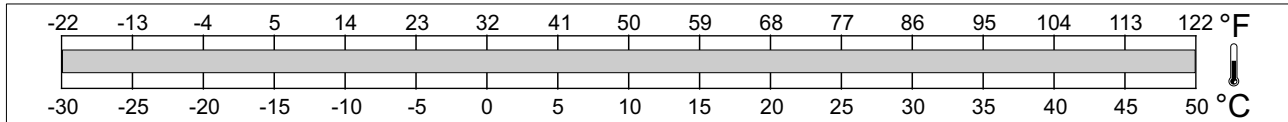


Fig. 43: Temperature range

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

8 Starter batteries

8.1 Battery terminal grease

Recommendation	ID no.	Specification	Alternative
Battery terminal grease	SE: 071706		

8.2 Battery terminal spray

Recommendation	ID no.	Specification	Alternative
Battery terminal spray	SE: 113732		

For
Reference
Only

B.11 Operating console

Name	Data
Designation	Operating console
Type	vSCALE D3
Number	50-700-19-6003
Type of manual	Operation instructions, installation instructions, maintenance instructions
Manufacturer	Hirschmann Automation and Control GmbH

For Reference Only

vSCALE D3

Operating console
Working Area Limiter
Sennebogen Telescopic Crane



Contents

Safety instructions	1
Product description	2
Installation / Wiring	3
Commissioning	4
Operation	4
Maintenance / Repair	6
Technical data	7

User manual

Issue A - 03/2015

This document has the order no.

50-700-19-6003_en



CONTENTS

1 Safety instructions5

1.1 EC conformity declaration5

2 Product description.....6

2.1 Product identification6

2.2 Overview of functional elements.....7

3 Installation and wiring.....8

3.1 Installation.....8

3.1.1 Surface mounting8

3.1.2 Recessed mounting9

3.2 Electrical connection.....12

3.2.1 Central connector –X113

3.2.2 Ethernet connection14

3.2.3 Camera connection (not used).....14

4 Commissioning.....15

4.1 Switching device on and off.....15

5 Operation.....16

5.1 Functional elements.....16

5.2 Function keys (soft keys).....17

5.3 Working area limiter.....18

5.3.1 Height limitation.....19

5.3.2 Radius limitation20

5.3.3 Luffing angle limitation21

5.3.4 Slewing angle limitation.....22

5.4 Error messages23

6 Maintenance and Repair24

7 Technical Data25

VERSION OVERVIEW

Issue	Date	Description	Editor
A	2015-03-20	Translation from original German Issue A First issue Working Area Limiter for Sennebogen telescopic crane	cb. / rk.



Introduction

INTRODUCTION

- About this manual** This manual is a component of the equipment or system supplied by Hirschmann Automation and Control GmbH. Keep this manual in a safe place and ensure that it is available to all users.
- Liability disclaimer** The contents of this manual are subject to change. Hirschmann Automation and Control GmbH does not provide any guarantee for this material, including the associated guarantee regarding marketability and suitability for certain intended purposes. Hirschmann Automation and Control GmbH accepts no liability for errors in the contents of the manual or for direct or indirect damage in connection with the provision and use of the manual.
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- Trademarks** The rendition of common names, trade names, trademarks etc. in this documentation should not be construed to mean that such names, even without special identification, are free in the sense of trademark and trademark protection legislation and hence usable by anyone.
- Use for the intended purpose** This device / system is intended exclusively for the tasks described in this manual. Any other use shall be construed as being inappropriate. The manufacturer accepts no liability for damage caused by inappropriate or impermissible use. This device / system may only be used if it is in perfect technical condition.
- Qualification of the operating personnel** Only appropriately qualified personnel may work with this device / system, i.e. persons:
- who are familiar with the operation or installation and commissioning
 - who know the current regulations for the prevention of accidents
- Manufacturer** **HIRSCHMANN**
Automation and Control GmbH
Hertzstr. 32-34
76275 Ettlingen
Germany
Phone: +49 (0)7243 709-0



Introduction

Marking of notices

Dangers and other important notices are marked as follows in this user manual:



WARNING

Warning of direct threat of personal injury and damage to property.
Instructions on precautions to avert the danger.



CAUTION

Warning of dangerous situations. Also warns of damage to property.
Instructions for averting the danger.

IMPORTANT

Warning of possibly damaging situation for the product.
Instructions for avoiding the possibly damaging situation.



NOTE

Usage instructions and information, but no dangerous situation.



HINT

Supplementary comments and recommendations for the user.

Safety instructions

1 Safety instructions



WARNING

Imminent threat of personal injury and damage to property due to incorrect system settings!

The settings can only be carried out by operators who are completely familiar with the operation and functions of the crane and the SLI.

The correctness of these settings must be guaranteed before starting the crane operations!

IMPORTANT

Connection to the wrong power supply will cause damage to the device.

The device may only be connected to a DC voltage source of 9 V to 36 V!

1.1 EC conformity declaration



The technical design and construction of the **vSCALE D3** console corresponds to requirements of the EMC directive 2004/108/EC and therefore carries the CE symbol.

The device complies with the following harmonised standards:
EN 12895:200, EN 13309:2010, EN ISO 14982: 2009

The full conformity declaration is available from the manufacturer on request.



Product description

2 Product description

The **vSCALE D3** console is the operable component of the **working area limiter** of the programmable safe load indicator and contains following functions:

- Luffing angle limiting
- Height limiting
- Radius limiting
- Slewing angle limiting

The **vSCALE D3 console is used for:**

- programming and inputting limits
- displaying the current limits of the crane

Scope of manual

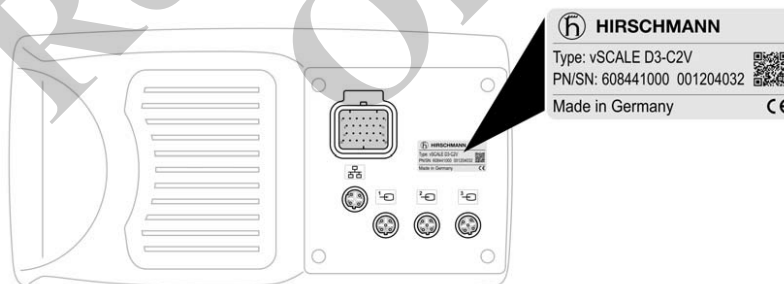
This user manual contains information about installation, commissioning, operation and sensor calibration and about repairs and maintenance.

2.1 Product identification

The type plate carries the unique identification of the operating console. It is located on the back of the device.

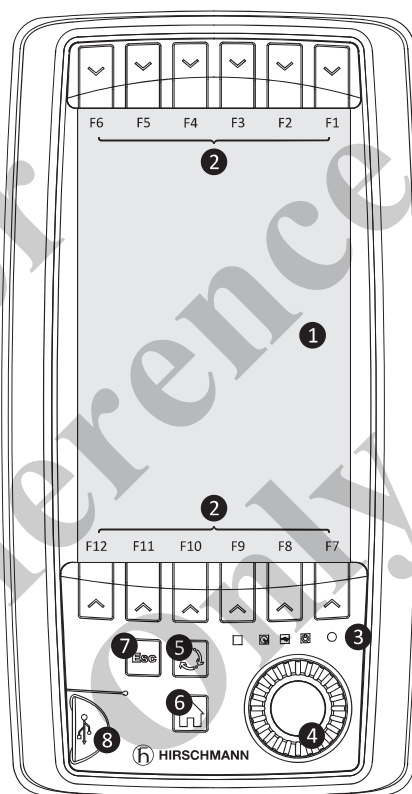
Please ensure you make a note of all the information on your type plate for queries about this product.

Type plate
(Example)



Product description

2.2 Overview of functional elements



- 1 TFT colour display
- 2 Function keys **F1 - F12**
- 3 Light sensor and status displays (LED)
- 4 Rotary control (encoder) with pushbutton function
- 5 Function key (SYSTEM) for system settings (*not used here*)
- 6 Function key (Home) for return to SLI main menu
- 7 Function key (Esc) for return or abort (*not used here*)
- 8 Front- USB 2.0 interface (use for service purposes)



Installation and wiring

3 Installation and wiring

This chapter contains instructions for mounting and installation of the console.

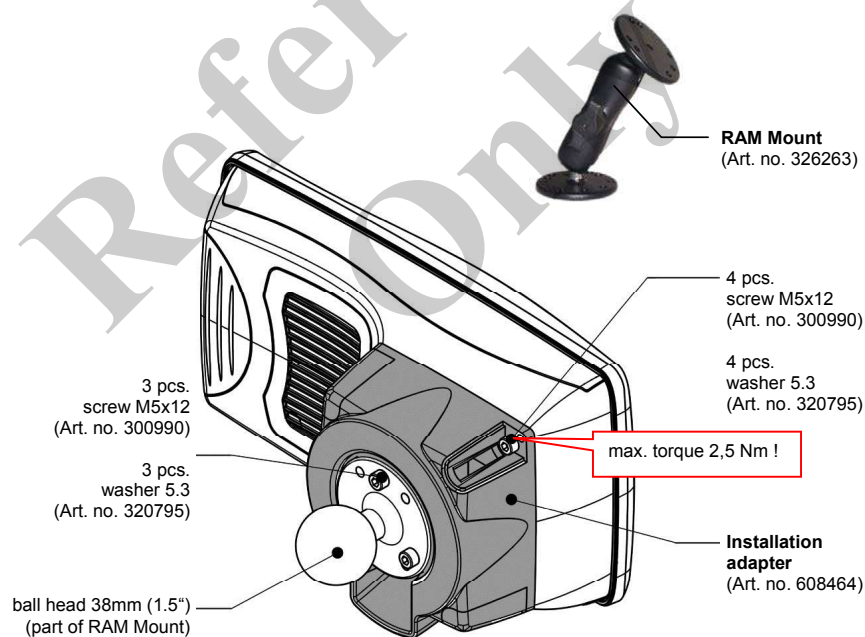
For the electrical wiring of the system and the console, please refer to the relevant connection and wiring diagram, which is not part of this manual.

3.1 Installation

The console is intended for vertical surface mounting or recessed mounting. Depending on installation type, corresponding installation accessories are required which may be supplied with the device depending on the version type.

3.1.1 Surface mounting

For surface mounting you will require the optionally available installation adapter and the RAM Mount™ articulated mounting.





Installation and wiring

3.1.2 Recessed mounting

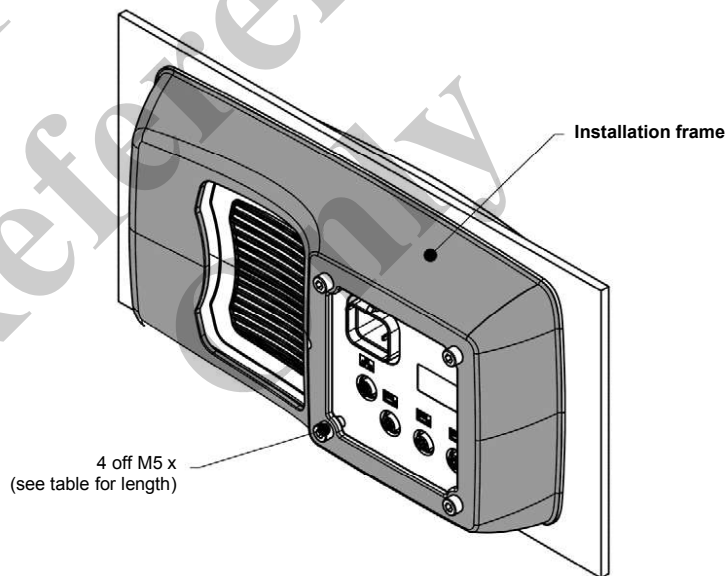
An installation frame, which is available as an accessory, is provided for recessed mounting in operating panels or instrument panels.

- Installation frame: Art. no. 608465



NOTE

Please note that the material thickness of the operating panel may not exceed 10 mm!

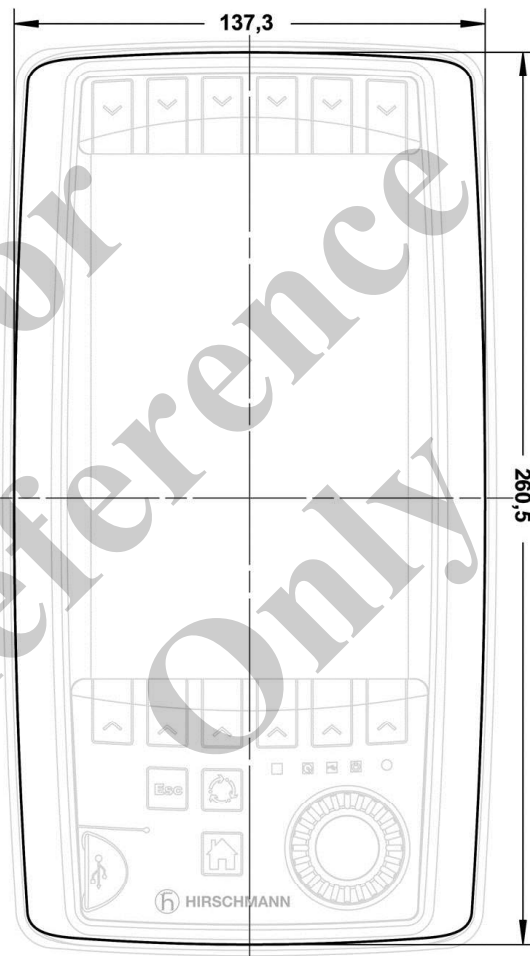


Material thickness	Screw length
1...3 mm	M5 x 12
4...6 mm	M5 x 16
7...10 mm	M5 x 20



Installation and wiring

Cut-out dimensions The dimensions for the cut-out in the operating panel can be taken from the following sketch:



For Reference Only

Template On request you can also print out the templates (last page in this manual).

qSCALE S6

Overload protection Sennebogen



Contents

Fault codes

1

Fault Code Table

2

Fault Code Table

Issue A - 03/2018

This document has the order no.

35-000-19-3004_en

TABLE OF CONTENTS

1	Fault codes	5
1.1	General	5
2	Fault Code Table	6
2.1	FMI list	21

For
Reference
Only

VERSION OVERVIEW

Issue	Date	Description	Originator
A	16/03/2018	Original German edition	rk

INTRODUCTION

To this document	This document is an additional part of the device or system supplied by WIKAL Mobile Control GmbH & Co. KG. Keep this document in a safe place and make sure that it is available to all users.
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Proper use	This device / system is intended solely for the tasks described in this handbook. Any other use or use beyond the aforementioned is considered improper. The manufacturer is not liable for damage caused by improper or inadmissible use. This device / system may only be used in perfect technical condition.
Qualification of the operating personnel	Only suitably qualified personnel may work with this device / system, that is, persons: <ul style="list-style-type: none">▪ who are familiar with operation, installation and start-up▪ who know the current accident prevention regulations
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 WIKAL. 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?

Feedback on the handbook

Comments, suggestions for improvement, additional suggestions:

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General comments:

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Dear user,

please return both sides of this feedback filled out:

- as a fax to: +49 (0)7243 709 3222
- by mail to: WIKA Mobile Control GmbH & Co. KG
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Many Thanks!



Notes

For
Reference
Only