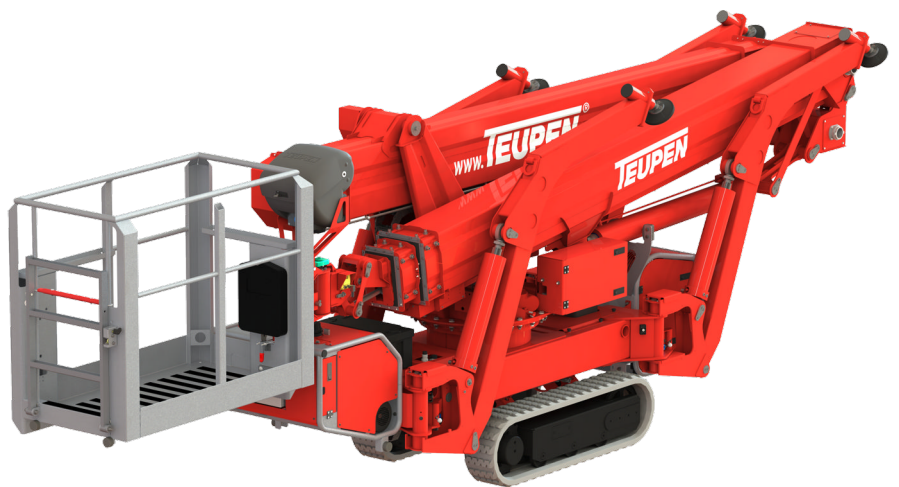


Serial number: _____



Translation of the original operating instructions

LE21GT

Aerial access platform

LEO21GT_GB

Manufacturer:

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Table of contents

Table of contents

1	General.....	9
1.1	Information about these instructions.....	9
1.2	Explanation of symbols.....	9
1.3	Limitation of liability.....	11
1.4	Copyright.....	12
1.5	Warranty provisions.....	12
1.6	Note regarding warranty card:.....	12
1.7	Customer service.....	13
2	Safety.....	15
2.1	Basic hazards.....	15
2.1.1	General hazards in the work station.....	15
2.1.2	Hazards due to electric energies.....	17
2.1.3	Hazards due to mechanical elements.....	19
2.1.4	Hazards due to hydraulic energies.....	20
2.1.5	Hazards due to high temperatures.....	21
2.1.6	Hazards due to chemical substances.....	21
2.1.7	Hazards due to traffic and vehicles.....	22
2.2	Proper use.....	23
2.3	Responsibility of the owner.....	24
2.4	Personnel requirements.....	25
2.4.1	Qualifications.....	25
2.4.2	Unauthorised persons.....	27
2.4.3	Training.....	27
2.5	Personal protective equipment.....	28
2.6	Safety devices.....	29
2.6.1	Position of the safety devices.....	30
2.6.2	Description of the installed safety devices.....	31
2.7	Symbols on the machine.....	34
2.8	How to act in case of fire or accidents.....	35
2.9	Environmental protection.....	36
3	Technical data.....	39
3.1	Dimensions.....	39
3.2	Work diagram.....	40
3.3	Productivity.....	40
3.4	Weight and loads.....	41
3.5	Drives.....	41
3.5.1	Combustion engines.....	41
3.5.2	Electric motor.....	41
3.6	Emissions.....	42

Table of contents

3.7	Operating conditions.....	42
3.8	Hydraulic system.....	42
3.9	Consumables.....	43
3.10	Type plate.....	43
4	Structure and function.....	45
4.1	Overview.....	45
4.1.1	Brief description.....	46
4.2	Assembly description.....	47
4.2.1	Platform.....	47
4.2.2	Outriggers.....	48
4.2.3	Working basket.....	48
4.2.4	Crawler chassis.....	49
4.2.5	Combustion engine.....	49
4.2.6	Electric motor.....	49
4.3	Operating elements and displays.....	50
4.3.1	Outrigger latching.....	50
4.3.2	Cable remote control.....	50
4.3.3	Control panel in working basket.....	52
4.3.4	Engine controller.....	54
4.3.5	Display screen on the control box.....	55
4.3.6	Emergency control.....	55
4.4	Connections.....	56
4.5	Work areas and danger zones.....	56
4.6	Accessories.....	56
4.6.1	Keys.....	56
4.6.2	Safety harness (optional).....	57
5	Transportation and storage.....	59
5.1	Safety instructions for transportation.....	59
5.2	Inspection on receipt of delivery.....	59
5.3	Transportation.....	60
5.4	Storage.....	64
6	Operation.....	67
6.1	Safety instructions for operation.....	67
6.2	Connecting the cable remote control.....	68
6.3	Switching the machine on/off.....	69
6.3.1	Switching the machine on/off at the mains supply.....	69
6.3.2	Switching machine on/off using the combustion engine.....	72
6.4	Shutting down in case of emergency.....	74
6.5	Principles of the graphic display.....	75

Table of contents

6.5.1 Overview.....	75
6.5.2 Possible assignment of the function keys	75
6.5.3 Examples of the operating modes.....	76
6.5.4 Main menu.....	79
6.5.5 Machine data.....	80
6.5.6 Service hotline.....	81
6.5.7 Settings.....	81
6.5.8 Additional information messages regarding machine status.....	86
6.6 Moving the machine.....	89
6.6.1 Moving the machine via the cable remote control.....	90
6.6.2 Moving the machine via the control panel	94
6.7 Setting the working position of the outrig- gers.....	96
6.8 Putting machine in work position.....	98
6.8.1 Bracing the machine via the cable remote control.....	99
6.8.2 Bracing the machine via the control panel.....	103
6.9 Operating the machine.....	106
6.9.1 Operating the machine via the cable remote control.....	107
6.9.2 Operating the machine via the control panel.....	108
6.9.3 Negotiating height differences on edges	111
6.10 Moving the machine into transport posi- tion.....	113
6.10.1 Moving the machine into the transport position via the cable remote control....	114
6.10.2 Moving the machine into the transport position via the control panel.....	118
6.11 Crawler chassis height and width adjust- ment.....	125
6.11.1 Mechanical height/width adjustment....	125
6.11.2 Hydraulic height adjustment (option)....	128
6.12 Replacing the working basket.....	133
6.13 Filling the fuel tank.....	137
6.14 Emergency mode.....	138
6.14.1 Platform operation in emergency mode.....	139
6.14.2 Operate the outriggers in emergency mode.....	143
6.15 Service mode.....	146

Table of contents

6.15.1	Switching the machine on/off using the engine controller.....	146
6.15.2	Platform operation in service mode.....	148
6.15.3	Outrigger operation in service mode....	151
6.15.4	Chain drive in service mode.....	153
6.16	Valve assignments.....	155
6.16.1	Valve assignment for platform.....	155
6.16.2	Valve assignment for outriggers.....	158
6.17	Resetting the combination for the locks. .	159
6.17.1	Resetting the combination on the shackle lock.....	159
6.17.2	Resetting the combination for the combination lock on the control panel.....	160
7	Maintenance.....	163
7.1	Safety instructions for maintenance.....	163
7.2	Maintenance schedule.....	168
7.3	General maintenance schedule.....	169
7.4	Maintenance work.....	170
7.4.1	Cleaning the machine.....	170
7.4.2	Tensioning the chain.....	171
7.4.3	Checking the hydraulic oil level.....	173
7.4.4	Checking the gear oil for the chain chassis.....	174
7.4.5	Replacing the hydraulic filter.....	176
7.4.6	Lubricating the boom section and ropes	178
7.4.7	Lubricating the rotary drive.....	181
7.4.8	Lubrication schedule.....	181
7.4.9	Rotating assembly tightening torques....	182
8	Faults.....	183
8.1	Safety instructions for fault clearance.....	183
8.2	Fault table.....	188
8.3	Fault code list.....	192
8.4	Notes about the rubber track.....	199
8.5	Fuses.....	201
8.5.1	Changing fuses.....	201
8.5.2	Fuse assignment.....	201
9	Disposal.....	205
10	Index.....	207
	Appendix.....	211
A	Circuit diagram.....	213
B	Hydraulic plan.....	215

Table of contents


C	Combustion engines	217
	C.1 Kubota diesel engine.....	219
D	List of the stickers/symbols	

Table of contents

General

1 General

1.1 Information about these instructions

These instructions enable the safe and efficient handling of the access platform (hereinafter referred to as "machine"). These instructions are a component of the machine and must be kept in the immediate vicinity of the machine so that they are accessible to the personnel at any time.

Before beginning any work, the trained personnel must have read through these instructions carefully and understood them. The basic requirement for safe working is adherence to all the specified safety instructions and operating instructions in these instructions.

In addition, the local accident prevention regulations and general safety provisions for the area of application of the machine apply.

Figures in these instructions serve the purpose of basic understanding and can deviate from the actual model.

1.2 Explanation of symbols

Warnings

Warnings are identified by symbols. These warnings are introduced by signal words, which express the severity of a danger.



DANGER!

This combination of symbol and signal word indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING!

This combination of symbol and signal word indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.



CAUTION!

This combination of symbol and signal word indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



NOTICE!

This combination of symbol and signal word indicates a potentially hazardous situation which, if not avoided, may result in property damage.



ENVIRONMENTAL PROTECTION!

This combination of symbol and signal word indicates potential danger to the environment.



Tips and recommendations



This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

Specific notes on safety

The following symbols are used in the safety information in order to highlight specific dangers:

Warning signs	Type of danger
	Warning – high-voltage.
	Warning – danger zone.







DANGER!

This combination of symbol and signal word indicates an immediately-dangerous situation due to electric shock. If an instruction so marked is not heeded, severe or even fatal injuries can be the consequence.

General

Additional markings

To emphasise instructions, results, lists, references and other elements, the following markings are used in these instructions:

Marking	Explanation
	Step-by-step instructions
	Results of action steps
	References to sections of these instructions and to other relevant documents
	Listing without fixed sequence
<i>[Buttons]</i>	Operating elements (e.g. buttons, switches), display elements (e.g. signal lamps)
<i>'Display'</i>	Screen elements (e.g. buttons, programming of function keys)

1.3 Limitation of liability

All details and instructions in these instructions were compiled taking into account the applicable standards and regulations, the state of technology, as well as our many years of knowledge and experience.

In the following cases, the manufacturer assumes no liability for damage:

- Failure to follow these instructions
- Use deviating from the proper use
- Use of untrained personnel
- Unauthorised changes
- Technical alterations
- Use of non-approved spare parts

For special models, with the usage of additional order options or due to the latest technical changes, the actual scope of delivery can deviate from the explanations and depictions provided here.

Applicable are the obligations agreed upon in the delivery contract, the general terms and conditions, as well as the delivery conditions of the manufacturer and the legal regulations valid at the time the contract was concluded.

1.4 Copyright

The contents of these instructions are copyrighted. Their use is permitted in the context of using the machine. Any use extending beyond this is not allowed without written permission from the manufacturer.

1.5 Warranty provisions

The warranty provisions are contained in the manufacturer's general terms and conditions.

1.6 Note regarding warranty card:

In order to be able to process warranty applications between the customer, service partner and Teupen as quickly as possible, it is absolutely necessary to fill out the warranty card which is at the front of the machine record and send it back to Teupen directly after hand-over of the machine to the customer. If the warranty card is not filled out properly, we cannot process the warranty application since important data which is necessary for the processing has not been made available to us.

General

Please send the warranty card to:

Teupen Maschinenbau GmbH

Service Point

Marie-Curie-Straße 13

D-48599 Gronau

Sample of a properly filled-out warranty card:

TEUPEN[®]
 ...work safely aloft

Gewährleistungskarte sofort nach Übergabe an den Betreiber ausfüllen und absenden. Sie unterstützen damit den optimalen Service von TEUPEN. Danke!
 Immediately after handover to the owner, fill out and send warranty card. This way you are supporting the possibility of Teupen giving its best service. Thank you.

Maschinen-Typ/Machine type	Serien-Nr./Serial nr.	Übernahmedatum/Handover date
Leo 23 GT	140500	01.01.2010

Standort der Maschine/Location of M.C

Firma/Firm	Mustermann	
Adresse/Address	Musterstraße 5a / 48599 Gronau - Deutschland	
Telefon, E-mail/Phone, E-Mail	+49 9999/ 88888	mustermann@muster.de
Ansprechpartner/Contact name	Peter Mustermann	
Händlername/Dealer name	Teupen Maschinenbau GmbH	

Teupen Maschinenbau E. Mustermann
 Unterschrift des Händlers/Signature of Dealer Unterschrift des Betreibers/Signature of Owner

Gewährleistungskarte / Warranty Card

Fig. 1: Sample warranty card

1.7 Customer service

Our customer service division is available to provide technical information. See page 2 for contact details.

In addition, our employees are always interested in acquiring new information and experience gained from practical application; such information and experience may help improve our products.

Safety

2 Safety

This section provides an overview of all safety aspects that are essential to the best possible protection of the personnel and the safe and trouble-free operation of the machine. Additional safety instructions for specific work tasks are contained in the sections regarding the individual life stages of the machine.

2.1 Basic hazards

The following section describes remaining risks which can arise from the machine even with proper use.

In order to reduce risks of personal injury and property damage and avoid dangerous situations, the safety instructions listed here and the safety instructions in the other sections of these instructions must be followed.

2.1.1 General hazards in the work station

Swivelling aerial access platform



WARNING!

Danger to life due to swivelling aerial access platform!

During operation, the aerial access platform can swivel out. This can cause severe injuries or even death.

- Never step under or into the swivel range of the aerial access platform.
- Only move the aerial access platform under supervision.
- Always operate the aerial access platform with at least two people.
- Always wear personal protective equipment.

Work in high places**WARNING!****Risk of falling!**

During work in high places, there is a risk of falling. This can cause severe injuries or even death.

- Always wear a safety harness (acc. to EN 361) when in the working basket and do not swing or move jerk.
- Do not climb onto the safety fence around the basket.
- Make sure that the machine is set up properly and holds securely.
- Make sure that when moving the working basket, no body parts are crushed, e.g. against a wall.
- At wind speeds above 12.5 m/s (wind strength 6 Bft), stop work immediately.
- Always wear personal protective equipment.

Exhaust gases**WARNING!****Danger to life from poisoning or suffocation due to exhaust gases!**

When inhaled, exhaust gases can lead to suffocation and cause severe poisoning as well as an illness of the respiratory system.

- Always ensure fresh air supply when working on the machine in combustion engine mode.
- Any person inhaling exhaust gases must be provided with fresh air immediately. Consult a physician.

Safety

2.1.2 Hazards due to electric energies

Electric current



DANGER!

Danger to life due to electric current!

Upon contact with voltage-conducting parts, there is an immediate danger to life due to electric shock. Damage to the insulation or individual components can present a danger to life.

- Do not work on or near high-voltage lines.
- Only have a trained electrician perform work on the electrical system.
- In case of damage to the insulation, switch off the power supply immediately and have the machine repaired.
- Never bypass fuses or take them out of operation. When changing fuses, adhere to the correct amperage.
- Keep humidity away from voltage-conducting parts. This can cause a short-circuit.
- Before performing work on voltage-conducting parts, pull the mains plug.

Batteries



WARNING!

Danger of injury due to incorrect handling of batteries!

In case of batteries are improperly handled, there is the danger that the batteries can explode or that liquids that are hazardous to health can egress from the batteries. The liquid egressing can cause severe burns upon skin contact, severe poisoning upon swallowing and blindness in case it comes in contact with eyes.

- Never short circuit the contacts (positive and negative poles) of the batteries!
- Never use or store batteries in places where the atmosphere is explosive or where temperatures can rise excessively.
- Never attempt to solder batteries, to repair them, to change their form, to remodel them or to dismantle them.
- Always protect batteries from access by unauthorised persons.
- In order to avoid fires, overheating, explosions or escape of fluids, do not subject batteries to heavy vibrations or shocks, place heavy weights on them or subject them to other damaging exposures. Liquids which emanate from batteries can get inflamed.
- Avoid contact with escaping liquids.

Measures to be undertaken upon contact with battery liquids:

- Wash skin with plenty of water and soap after contact.
- Rinse out with clear water under the eyelids for at least 15 minutes after contact. While doing so, do not direct the stream of water directly on the eyes and do not rub. Immediately summon medical assistance.

Safety

2.1.3 Hazards due to mechanical elements

Falling materials



WARNING!

Danger of injury due to falling materials!

During operation, material can fall down uncontrolled and cause severe injuries.

- Make others aware of the danger zone and block off the area.
- Do not enter the danger zone during normal operation.
- Never place objects on the working basket safety fence.

Supports and arms



WARNING!

Danger of crushing on supports and arms!

When bracing or swivelling the machine, there is a danger of crushing.

- Make sure that when bracing, no people, supply lines or other objects are in the area around the supports.
- Make sure that no people are in the danger zone when swivelling the machine.
- Make sure that no people are in the danger zone when moving into transport position.

Insufficient stability



WARNING!

Risk of injury due to insufficient stability!

Without sufficient stability, there is a risk of the machine toppling. This can cause serious or even fatal injuries.

- Make sure that the ground has sufficient load bearing capacity (↪ Chapter 3.4 'Weight and loads' on page 41).
- Do not exceed the maximum inclination (↪ Chapter 3.4 'Weight and loads' on page 41).

Crawler chassis**WARNING!****Danger of injury due to driving over body parts!**

With the crawler chassis, there is a danger of pinching off body parts and thus causing severe to fatal injuries.

- During operation, do not reach into running chains or chain wheels.
- During operation, maintain a sufficient safety distance.
- Pay attention to the change of direction.
- Do not drive over power lines.

2.1.4 Hazards due to hydraulic energies

Hydraulics**WARNING!****Danger to life from hydraulic forces!**

Hydraulically driven moving parts can cause grave injuries.

- Work on the hydraulic system must only be carried out by trained hydraulics technicians.
- Before starting work on the hydraulic system, ensure that it has been completely depressurised. The pressure accumulator must be completely relieved.
- During operation, do not reach into or handle moving parts.
- Do not open covers during operation.
- When in the danger zone, wear close-fitting protective work clothing with low tear strength.

Safety

2.1.5 Hazards due to high temperatures

Hot surfaces



WARNING!

Danger of injury due to hot surfaces!

Surfaces of engine components can get heated up considerably during operation. Skin contact with hot surfaces causes severe burns to the skin.

- Avoid contact with engine components such as exhaust components, silencers, coolers, radiators, pipes and engine blocks.
- Check before all work on engine components, as to whether these are hot. If necessary, allow them to cool.

2.1.6 Hazards due to chemical substances

Anti freeze agents



WARNING!

Health danger of anti freeze agents

The coolant of the diesel engine consists of a mixture of water and anti freeze agent. In case of body contact, swallowing or inhalation of aerosols, anti freeze agents can lead to severe health hazards.

- Avoid contact with anti freeze materials.
- Do not eat, drink or smoke while handling anti freeze materials. Wash hands before breaks and at the end of work.
- Always wear protective gloves while working with anti freeze agents.

Measures to be undertaken upon contact with anti freeze agents:

- Wash skin with plenty of water after contact.
- Rinse eyes thoroughly with water for at least 15 minutes and call a doctor.
- Rinse out mouth after swallowing and drink plenty of water afterwards. Summon a doctor.
- In case aerosols are inhaled, go out into fresh air.

Engine oil**WARNING!****Danger of injury through engine oil!**

Engine oil contains poisonous substances which can cause inflammations and / or are carcinogenic.

- Avoid all skin contact with engine oil.
- In case of accidental skin contact, wash the hands or affected area immediately with soap. Do not ever use petrol, gasoline, solvents or other chemical cleaning agents.

2.1.7 Hazards due to traffic and vehicles*Public street traffic***WARNING!****Danger to life due to parts protruding into the traffic area!**

A failure to heed flowing traffic can cause accidents with the most severe injuries or even death.

- Secure the danger zone around the aerial access platform completely and visibly (even in case of poor visual conditions).
- Always be prepared for possible traffic accidents, especially such kind as can be caused by third parties.

Safety

2.2 Proper use

The aerial access platform is designed and constructed exclusively for the proper use described here.

The aerial access platform is to be used exclusively to convey people and tools up to the maximum allowable working basket load (see sticker on working basket) to perform work in high places.

Proper use also includes adherence to all details in these instructions.

Any use beyond or differing from the proper use counts as a misuse.



WARNING!

Danger due to misuse!

Misuse of the aerial access platform can create dangerous situations.

- Do not use the aerial access platform to support loads.
- Do not use the aerial access platform as a crane, lift or side pull.
- Do not use the aerial access platform in or near unprotected active parts of electrical systems.
- Do not operate the aerial access platform in an atmosphere subject to explosion.

Claims of any type due to damage from misuse are excluded.

2.3 Responsibility of the owner

Owner

The term 'owner' refers to the person who himself operates the system for trade or commercial purposes, or who surrenders the system to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

The term 'owner' refers to the person who himself operates the device for trade or commercial purposes, or who surrenders the device to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

The term 'owner' refers to the person who himself operates the machine for trade or commercial purposes, or who surrenders the machine to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

The term 'owner' refers to the person who himself operates the system for trade or commercial purposes, or who surrenders the system to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

Duties of the owner

The machine is used in the commercial realm. Therefore, the owner of the machine is subject to the legal obligations relating to occupational safety.

In addition to the safety instructions in these instructions, the valid safety, accident prevention and environmental protection regulations applicable to the machine's area of application must be adhered to.

Here, the following points apply in particular:

- The owner must inform himself about the applicable occupational safety provisions and also determine in a risk assessment the risks which arise due to the specific working conditions in the place where the machine is used. He must implement these in the form of operating instructions for the operation of the machine.
- The owner must check during the entire time the machine is used whether the operating instructions he has created correspond to the current state of regulations; if necessary, he must adapt the operating instructions.

Safety

- The owner must clearly regulate and specify the responsibilities for installation, operation, fault repair, maintenance and cleaning.
- The owner must ensure that all employees who handle the machine have read and understood these instructions. In addition, the personnel must be trained by the owner and informed about the risks.
- The owner must provide the required protective equipment and ensure that the personnel wears the required protective equipment.

Furthermore, the owner is responsible for ensuring that the machine is always in technically-perfect condition. Therefore, the following points apply:

- The owner must ensure that the maintenance intervals described in these instructions are adhered to.
- The owner must check all safety equipment for perfect function before each commissioning or have it checked by an authorised person.

2.4 Personnel requirements

2.4.1 Qualifications



WARNING!

Danger of injury in case of insufficient qualification of the personnel!

If unqualified personnel undertakes work on the machine or is in the machine's danger zone, dangers arise which can cause severe injuries and significant property damage.

- Only have all activities performed by qualified personnel.
- Keep unqualified personnel away from the danger zones.

In these instructions, the qualifications listed below are named for the personnel for the various areas of activity:

Expert

An expert is somebody who, based on his professional training and experience, has sufficient knowledge of aerial platforms and is sufficiently familiar with the applicable state regulations, accident prevention regulations and generally-recognised rules of technology (e.g. employer's liability insurance rules, DIN standards, VDE regulations, technical rules of other member states of the European Union or other treaty states of the agreement about the European Economic Community) that he can assess the safe operational state of aerial platforms.

Hydraulics Specialist

The Hydraulics Specialist is trained for the special area of responsibility he is involved with and knows the relevant standards and regulations.

Based on his technical training and experience, the Hydraulics Specialist can perform work on hydraulic systems and can recognise and avoid potential hazards himself.

Qualified Electrician

Based on his technical training, knowledge, experience and knowledge of the applicable standards and regulations, the Qualified Electrician is able to perform work on electrical systems and recognise and avoid potential hazards himself.

The Qualified Electrician is specially trained for the area of responsibility he is involved with and knows the relevant standards and regulations.

The Qualified Electrician must comply with the requirements of the applicable legal regulations for accident prevention.

Qualified personnel

Qualified personnel is able to carry out assigned work and to recognize and prevent possible dangers self-reliantly due to its professional training, knowledge and experience as well as profound knowledge of applicable regulations.

Safety

Specialist staff

Specialist staff are members of staff who are able to carry out the tasks assigned to them and detect and prevent possible hazards independently as a result of their specialist training, knowledge and experience and their knowledge of the valid regulations.

Trained people

The trained people have been trained in demonstrable fashion in a training session by the owner about the proper use without additional prior knowledge of the method of functioning and possible hazards which can arise from the aerial access platform.

Personnel may only include people who are at least 18 years of age and of whom it can be expected that they perform their work reliably. People whose reactions are influenced, e.g. by drugs, alcohol or medications, are not permitted.

2.4.2 Unauthorised persons



WARNING!

Risk to life for unauthorised persons due to hazards in the danger and working zone!

Unauthorised persons who do not meet the requirements described here will not be familiar with the dangers in the working zone. Therefore, unauthorised persons face the risk of serious injury or death.

- Unauthorised persons must be kept away from the danger and working zone.
- If in doubt, address the persons in question and ask them to leave the danger and working zone.
- Cease work while unauthorised persons are in the danger and working zone.

2.4.3 Training

The customer has been trained by the owner. The personnel must be trained by the owner accordingly.

2.5 Personal protective equipment

Personal protective equipment serves to protect people against hazards to their safety and health while working.

The personnel must wear the personal protective equipment while working on and with the machine which is referred specially to in the individual sections of these instructions.

Description of the personal protective equipment

The personal protective equipment is explained below:



Occupational safety clothing

Occupational safety clothing is close-fitting work clothing with a low tear strength, with close-fitting sleeves and no protruding parts. It primarily is used to prevent being caught up in moving parts of the machine. Do not wear rings, chains or other items of jewellery.



Safety goggles

Safety goggles are used to protect the eyes from flying parts and splashed liquids.



Safety harness

The safety harness is used to provide protection from falling in situations in which there is an increased risk of falls. There is an increased risk of falls when certain heights are exceeded and the work location is not safeguarded by a railing.

Wear the safety harness so that the safety rope is connected to the safety harness and a fixed attachment point. It may be necessary to provide a fall attenuator.

Safety harnesses must only be used by specially trained personnel.



Safety helmet

The safety helmet provides protection from falling or flying parts and materials.

Safety



Safety shoes

Safety shoes are used to provide protection from heavy, falling objects and slipping on slippery surfaces.

2.6 Safety devices



WARNING!

Danger to life from nonfunctional safety devices!

If safety devices are not functioning or are disabled, there is a danger of grave injury or death.

- Check that all safety devices are fully functional and correctly installed before starting work.
- Never disable or bypass safety devices.
- Ensure that all safety devices are always accessible.

2.6.1 Position of the safety devices

View from the left

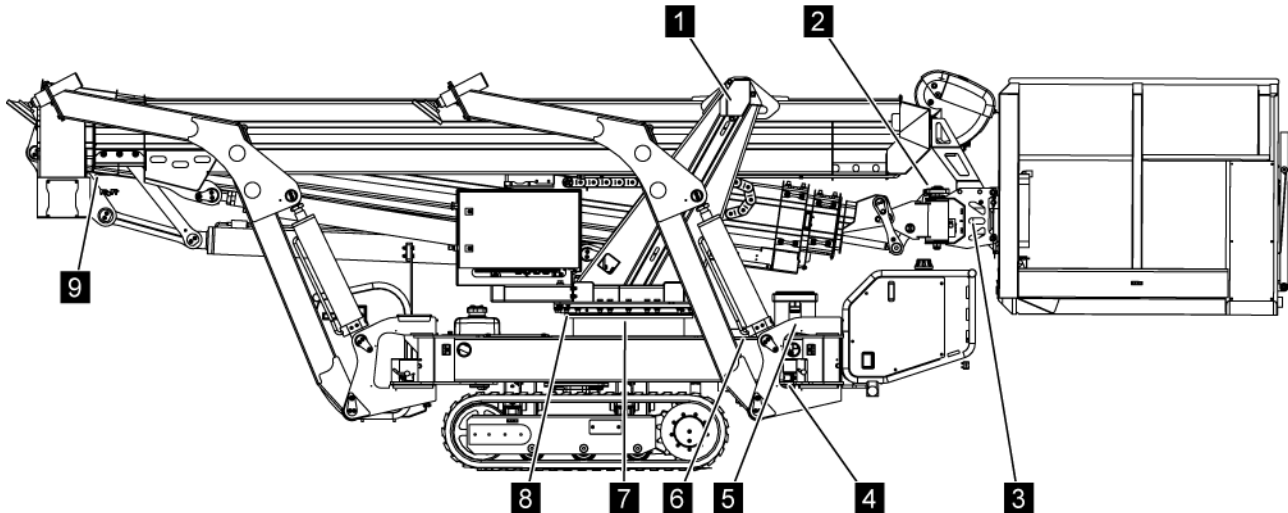


Fig. 2: Position of the safety devices

- | | |
|---|---|
| 1 Rotary angle sensor, lower boom (2x) | 6 Valves, chassis emergency operation |
| 2 Rotary angle sensor, working basket | 7 Tilt sensor |
| 3 Basket scale | 8 Rotary angle sensor, pivoting (2x) |
| 4 Outrigger locking mechanism limit switch (1x per outrigger) | 9 Limit switch, lower boom telescoped in (2x) |
| 5 Outrigger position limit switch (1x per outrigger) | |

Safety

View from the right

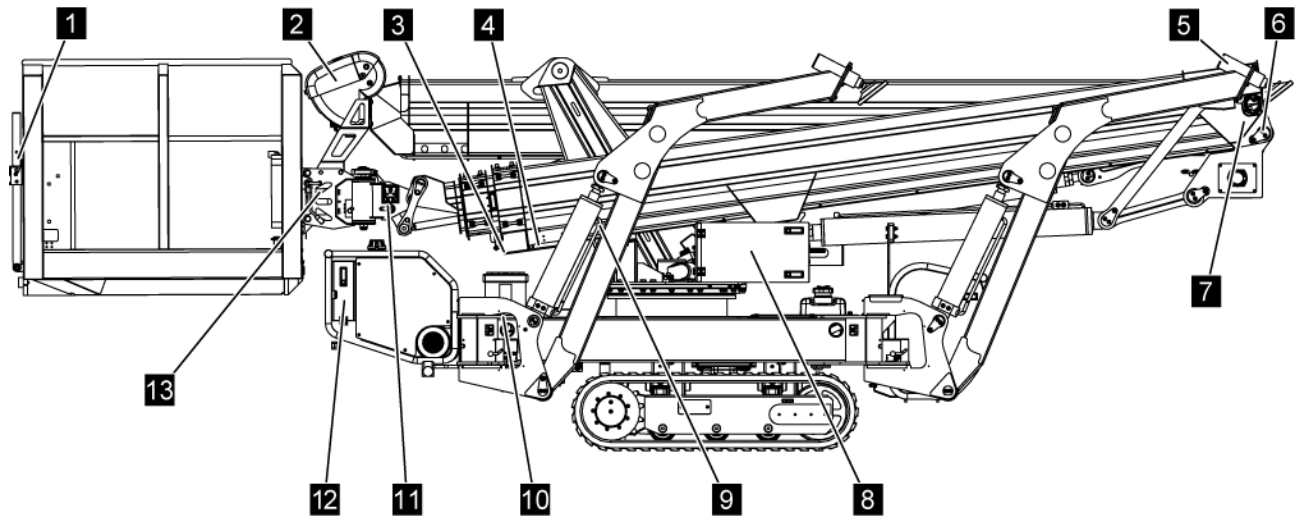
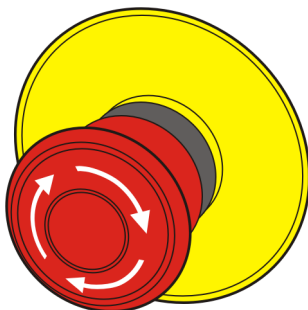


Fig. 3: Position of the safety devices

- | | |
|--|---|
| 1 Initiator, basket ladder monitoring (optional) | 8 Platform valves |
| 2 Emergency Stop Button on control panel | 9 Limit switch, upper boom transport position |
| 3 Limit switch, upper boom telescoped in | 10 Circular level |
| 4 Limit switch, retraction rope rope break | 11 Tilt sensor (basket level) |
| 5 Limit switch, floor pressure (1x per out-rigger) | 12 Battery cut-off switch |
| 6 Rotary angle sensor, upper boom (2x) | 13 Initiator, basket secured |
| 7 Limit switch, rope break (extension rope) | |

2.6.2 Description of the installed safety devices

Emergency Stop Button



The machine is shut down by pressing the Emergency Stop Button. After the Emergency Stop Button has been pressed and in order to switch the machine on again, the Emergency Stop Button has to be released by turning it.

Fig. 4: Emergency Stop Button

**WARNING!****Risk of fatal injury from switching back on in an uncontrolled manner!**

Switching the machine back on in an uncontrolled manner can cause serious or even fatal injuries.

- Before switching back on again, make sure that the cause for the emergency stop has been cleared and that all safety devices have been installed and are fully functional.
- Do not release the Emergency Stop Button until there is no longer any risk.

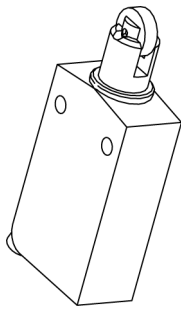
Limit switch

Fig. 5: Limit switch (similar to illustration)

Limit switch retrieve the correct positioning of certain components. For example, the limit switches can prevent the inadvertent movement of the machine.

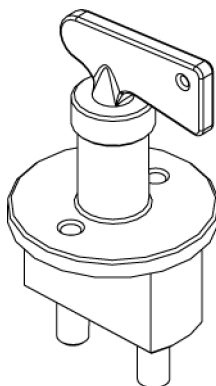
Battery main switch

Fig. 6: Battery main switch

The battery main switch is always near the battery. The batteries can be disconnected from the vehicle's electrical system by means of the main battery switch. This is recommended, for example before longer duration storage of the machine.

Safety

Tilt sensor and circular level (bubble level)

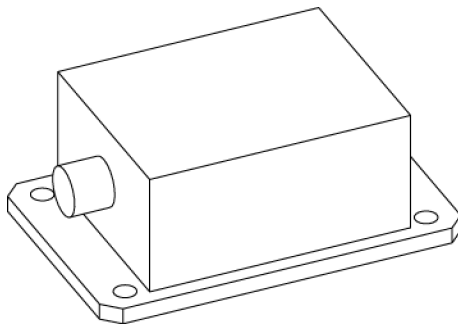


Fig. 7: Tilt sensor

During automatic bracing, the aerial access platform is aligned horizontally automatically with the help of the tilt sensor (Fig. 7).

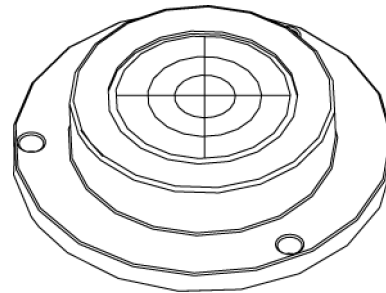


Fig. 8: Circular level

The maximum permissible inclination is 1°; this must be checked visually with the circular level (Fig. 8).

Valves for emergency and service mode

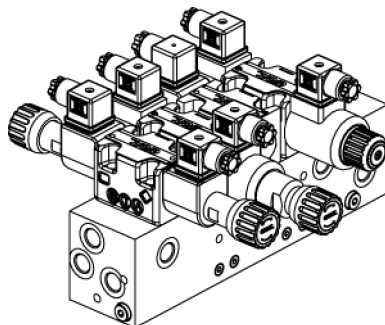


Fig. 9: Example: Valve block

The aerial access platform can be operated in emergency mode/service mode in case power failure or for maintenance purposes. Various valves (Fig. 9) can be used to trigger and move the respective assemblies with the hand pump.

Rotary angle sensor

The rotary angle sensors monitor the angle of the lift boom holder, lower boom, upper boom and the working basket. Depending on the conditions, fault messages may be issued, the lowering speed may be regulated and the correct position for lowering into the transportation position may be displayed as a result.

2.7 Symbols on the machine



WARNING!

Risk of injury due to illegible symbols!

Over time, stickers and signs may become soiled or become illegible in other ways. As a result hazards may not be recognised and it may not be possible to follow the necessary operating instructions. This will result in a risk of injury.

- Always keep all safety, warning and operating instructions in fully legible condition.
- Replace damaged signs or stickers immediately.



Replacement stickers can be ordered from the manufacturer. Please specify the item number with your order. See page 2 for contact details.

Example of an article number

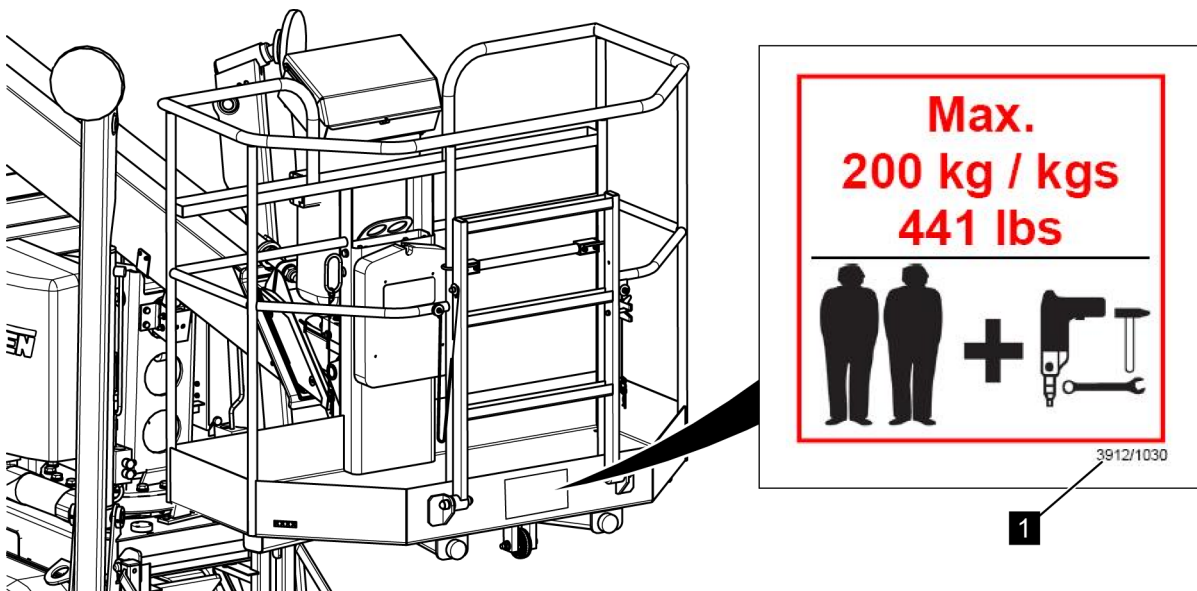


Fig. 10: Example of an article number

Each sticker has an article number (example: Fig. 10/1). This article number may be found in various positions on the sticker. The article numbers always comprise a numerical sequence "39XX", followed by a 4-digit number. In the example Fig. 10: 3912/1030.

Safety

A list of the stickers and symbols used and their respective positions is included in the appendix (↩ *Appendix D 'List of the stickers/symbols' on page 261*).

2.8 How to act in case of fire or accidents

Preventative measures

- Always be prepared for fire and accidents!
- Always keep first aid equipment (first aid kit, blankets, etc.) and fire extinguisher fully functional and on hand.
- Familiarise staff with the procedures for reporting accidents and first aid and rescue equipment.
- Keep access routes for rescue vehicles clear.

Measures in the case of fire or accidents

- Immediately trigger an emergency stop with the emergency stop device.
- If there is no risk to your own health, rescue people from the danger zone.
- Provide first aid as necessary.
- Alert the fire brigade and/or rescue service.
- In case of outbreak of fire: If there is no risk to your own health, attempt to put out the fire with fire extinguishers and continue fighting the fire until the fire services arrive.
- Inform the responsible party at the location of use.
- Free the access routes for rescue vehicles.
- Direct the rescue vehicles.

2.9 Environmental protection



ENVIRONMENTAL PROTECTION!

Risk to the environment due to incorrect handling of materials which can harm the environment!

In case of incorrect handling of materials which can harm the environment, especially improper disposal, there can be significant damage to the environment.

- Always heed the notes below about the handling of materials which can harm the environment and their disposal.
- If materials which can harm the environment accidentally escape into the environment, take suitable measures immediately. In case of doubt, inform the responsible local authority about the damage and ask what suitable measures to take might be.

The following materials that might harm the environment are used:

Cleaning liquids

Cleaning liquids incorporating solvents contain toxic substances. They must not be allowed to escape into the environment. Disposal must be carried out by a specialist disposal company.

Lubricants

Lubricants such as greases and oils contain toxic substances. They must not be allowed to escape into the environment. Disposal must be carried out by a specialised disposal company.

Hydraulic oil

Hydraulic oil may not be allowed to escape into the environment. Hydraulic oil can cause long-term damage to bodies of water. Disposal must be handled by a professional disposal company.

Fuels

Fuels contain poisonous substances. They may not be allowed to escape into the environment. Disposal must be handled by a professional disposal company.

Safety

Cooling water with frost protection

Cooling water and frost guards contain toxic substances. They must not be allowed to escape into the environment. Disposal must be carried out by a specialist disposal company.

Rechargeable batteries or batteries

Rechargeable batteries and batteries contain toxic heavy metals. They are subject to special waste treatment and must be handed in to municipal collection points or disposed of by a specialist company.

Technical data

3 Technical data

3.1 Dimensions

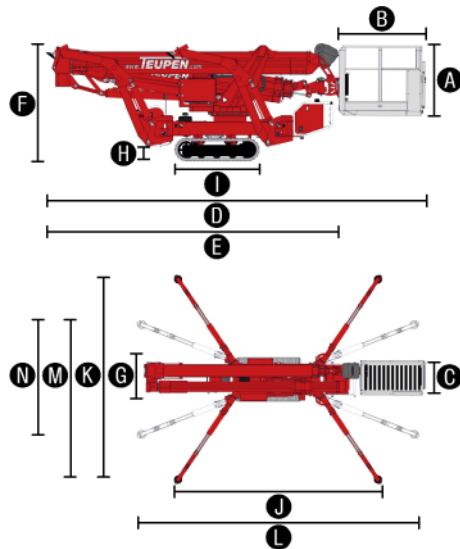


Fig. 11: Dimensions

Data	Value	Unit
Working height (max.)	21.00	m
Side reach at 250 kg	12.25	m
Overhead reach (max.), point of articulation	9.40	m
Working basket height (A)	1.10	m
Working basket length (B)	1.40	m
Working basket width (C)	0.77	m
Overall length (D)	6.40	m
Overall length without working basket (E)	5.00	m
Overall height (F)	1.99	m
Overall width (min.) (G)	0.98	m
Ground clearance (max.) (H)	0.40	m
Chain chassis length (I)	1.45	m
Chain width	0.20	m
Length of standard bracing area (J)	4.70	m
Width of standard bracing area (K)	4.70	m
Length of bracing area, narrow one-sided (L)	6.30	m
Width of bracing area, narrow one-sided (M)	3.60	m
Width of bracing area, narrow two-sided (N)	2.50	m
Bracing pad \varnothing	0.18	m

3.2 Work diagram

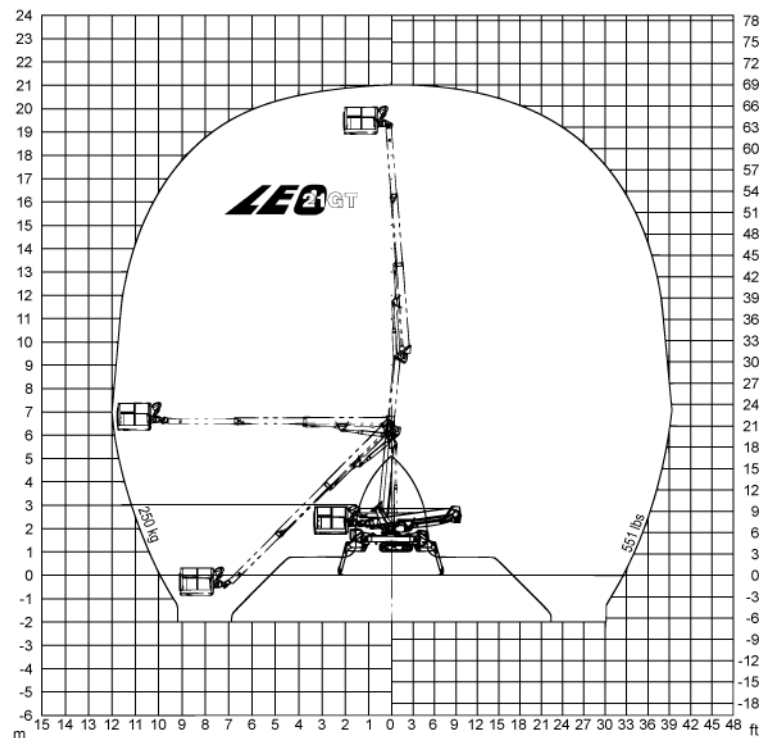


Fig. 12: Work diagram

3.3 Productivity

Data	Value	Unit
Basket load (max.)	250	kg
Rotating working basket	180	°
Rotation range (max.)	450	°
Chassis height and width adjustment	19/46	cm
Gradeability (max.)	19 (34)	° (%)
Slope angle	19 (34)	° (%)
Travel speed	4.0	km/h

Technical data

3.4 Weight and loads

Data	Value	Unit
Total weight	2980	kg
Payload while driving	4.63	kN/m ²
Payload in working position (wide bracing)	1.57	kN/m ²
Point load under bracing pad (max.)	23.7	kN

3.5 Drives

3.5.1 Combustion engines

Petrol: Vanguard OHV 16 HP

Data	Value	Unit
Power	11.93 (16)	kW (PS)
Tank capacity	12.0	l

Diesel (optional): Kubota Z 602

Data	Value	Unit
Power	10.8 (14.7)	kW (PS)
Tank capacity	12	l

3.5.2 Electric motor

EMG-ECS 90 LX4

Data	Value	Unit
Voltage	230	V
Frequency	50	Hz
Current consumption	12.9	A
Power	2.2	kW

Technical data

Cable lengths

Data	Value	Unit
Maximum cable length with cable cross section 3 x 2.5 mm ²	40	m
Maximum cable length with cable cross section 3 x 4.0 mm ²	80	m

3.6 Emissions

Data	Value	Unit
Noise when driven by electric motor	< 70	dB(A)
Noise when driven by combustion engine	< 89	dB(A)

3.7 Operating conditions

Data	Value	Unit
Maximum permissible wind speed during operation	12.5 (6)	m/s (Bft)
Temperature range	-15 to +40	°C

3.8 Hydraulic system

Response pressure of the pressure control valves

Data	Value	Unit
Platform functions (max.)	175	bar
Outrigger functions (max.)	175	bar
Chain chassis (max.)	210	bar

Filling quantities

Data	Value	Unit
Filling quantity of the hydraulic system	approx. 95	l
Filling quantity of the hydraulic tank	approx. 45	l

Technical data

3.9 Consumables

Consumable	Type	TEUPEN article number	Filling quantity	Unit
Gear oil	Gear oil	3917/0122 *	max. 1	l
Hydraulic oil	Plantohyd 32-S	3917/0066 *	approx. 95	l
Multi-purpose grease	-	3917/0095 (cartridge)	0.5	kg
High-performance lubricant	-	3917/0130 (bucket)	1	kg

* upon order, please specify order quantity in litres

Oil recommendations

The hydraulic system of the aerial access platform is filled with the above mentioned hydraulic oil at the factory. It is recommended that you continue to use this hydraulic oil or that you replace it with one of the following hydraulic oils:

Operation temperature	BP	Esso	Fuchs	Shell
-15 to +40 °C	BP Energol HLP-D 22	HLPD-OEL 22	Renolin MR 5	Shell Hydrol DO 22

3.10 Type plate

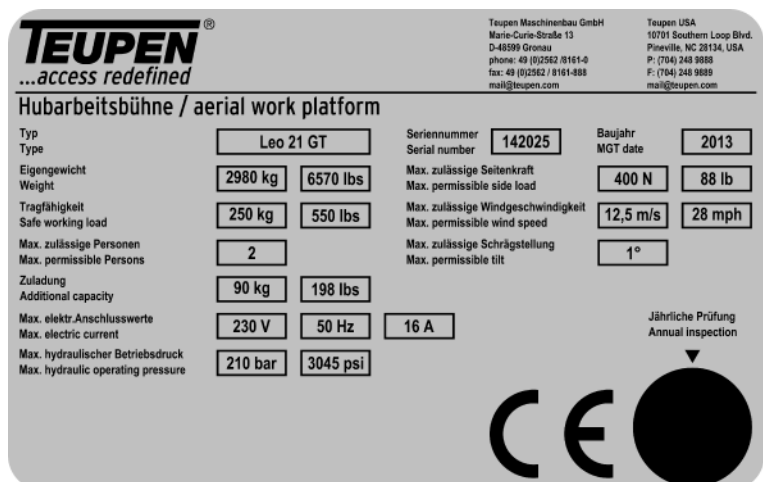


Fig. 13: Example of a type plate

The type plate is situated on the side of the chassis and contains the following information:

- Manufacturer
- Type
- Serial number
- Year of manufacture
- Net weight
- Load bearing capacity
- Permitted number of people
- Additional load
- Maximum permissible lateral force
- Maximum permissible wind speed
- Maximum electrical connected loads
- Maximum permissible tilt
- Maximum hydraulic operating pressure
- Time of the annual check
- CE mark

Structure and function

4 Structure and function

4.1 Overview

Overview, left

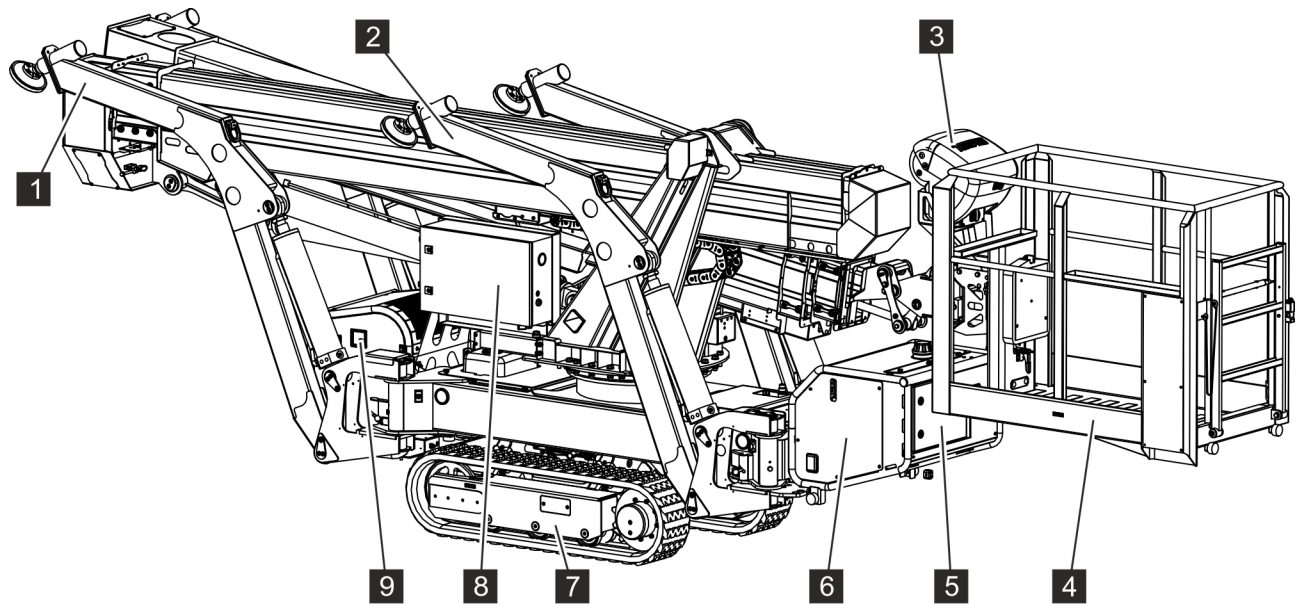
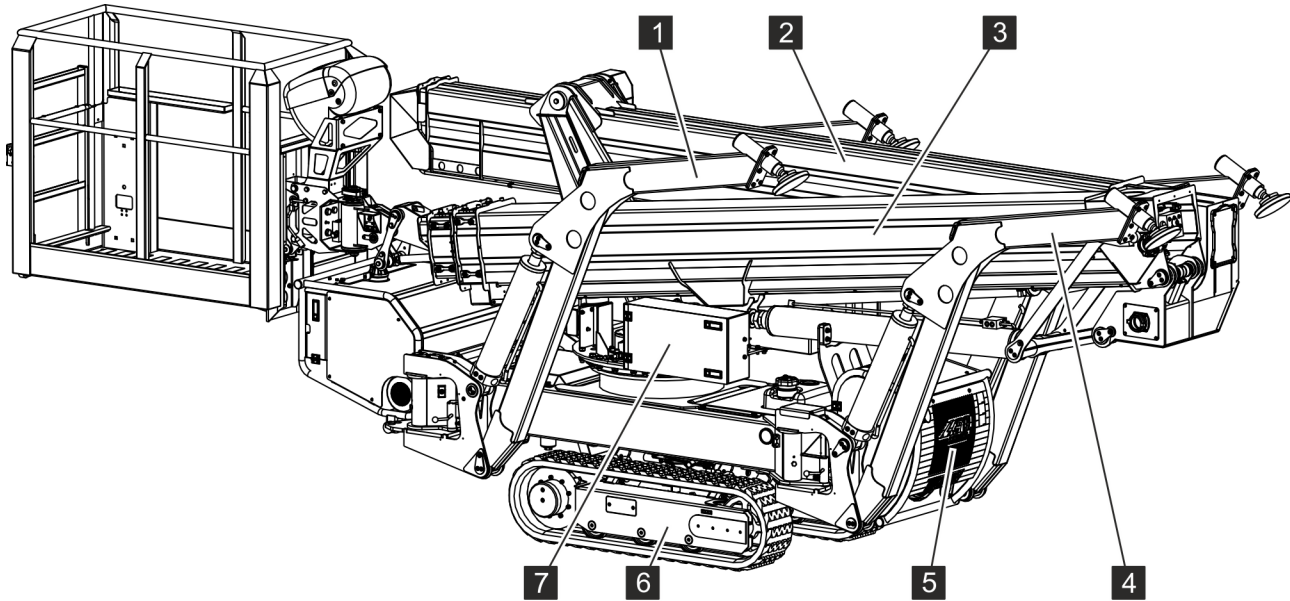


Fig. 14: Overview, left

- | | | | |
|---|--|---|---|
| 1 | Outrigger 2 | 6 | Cover, hydraulic aggregate and electric motor |
| 2 | Outrigger 1 | 7 | Left crawler chassis |
| 3 | Control head with control panel and socket | 8 | Control box |
| 4 | Working basket | 9 | Engine controller |
| 5 | Control box | | |

Overview, right*Fig. 15: Overview, right*

- | | | | |
|---|-------------|---|--------------------------|
| 1 | Outrigger 4 | 5 | Cover, combustion engine |
| 2 | Lower boom | 6 | Right crawler chassis |
| 3 | Upper boom | 7 | Hydraulic control box |
| 4 | Outrigger 3 | | |

4.1.1 Brief description

The aerial access platform is used to perform work at heights. Controlling is performed from the working basket (Fig. 14/4) using a control panel (Fig. 14/3) or from the ground using a cable remote control. In order to put the aerial access platform in work position, the chassis is lifted using the outriggers 1 to 4 (Fig. 14/1, 2 and Fig. 15/1, 4) with automatic bracing or manually. Platform operation cannot be started until the chassis has been correctly levelled (visual inspection using circular level).

The bracings can be set in four bracing positions:

- Wide two-sided
- Narrow one-sided, left
- Narrow one-sided, right
- Narrow two-sided

Structure and function

The left-hand (Fig. 14/8) and right-hand (Fig. 15/6) chassis can be adjusted independently of each other either mechanically or hydraulically (optional) and are height-adjustable.

The working basket (Fig. 14/4) is kept horizontal at all times by an electro-hydraulic compensation system.

Power is supplied either from the mains supply (construction side supply point) using an extension cable or by the combustion engine.

4.2 Assembly description

4.2.1 Platform

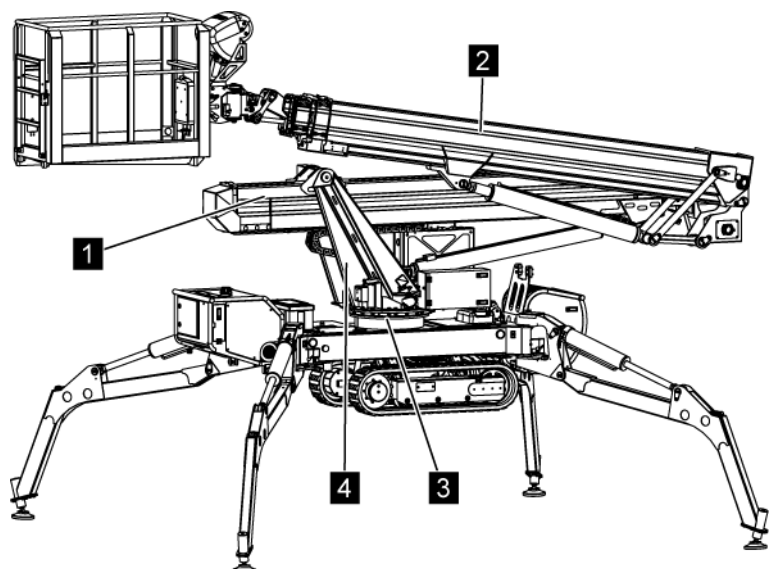


Fig. 16: Platform

The working platform essentially comprises the rotating assembly (Fig. 16/3), the lift boom holder (Fig. 16/4), the telescoping lower boom (Fig. 16/1) and the telescoping upper boom (Fig. 16/2).

4.2.2 Outriggers

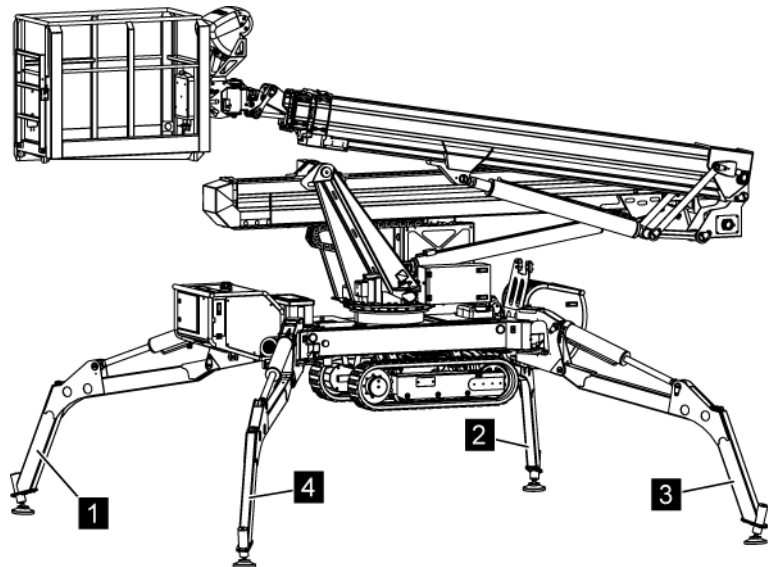


Fig. 17: Outriggers

With the help of the outriggers (Fig. 17/1 to 4), the chassis is lifted and the aerial access platform is thus put into the work position. The outriggers are numbered consecutively according to the position numbers. They can be adjusted independently of one another in two different working positions, narrow or wide.

4.2.3 Working basket

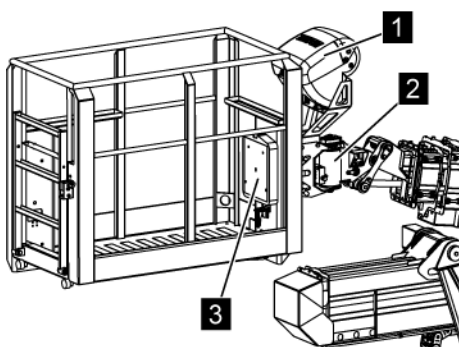


Fig. 18: Working basket

In the working basket there is space for a maximum of two persons. The control panel is located in the control head (Fig. 18/1). The operating instructions with hydraulic plan and electrical circuit diagram are located in the document box (Fig. 18/3). The hydraulic motor (Fig. 18/2) is used to swivel the working basket.

Structure and function

4.2.4 Crawler chassis

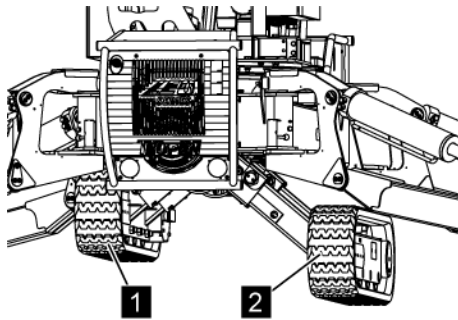


Fig. 19: Crawler chassis

In the transport position, the aerial access platform can be moved with the help of the crawler chassis. Only a grease gun is required for the chain tensioning. When adjusting the chassis mechanically, the height and width of the crawler chassis can be adjusted independently in 3 stages. If using the optional hydraulic chassis adjustment function, the height and width adjustments can be made infinitely variably.

In Fig. 19 the left-hand chassis (1) is completely retracted and the right-hand chassis (2) is completely extended.

4.2.5 Combustion engine

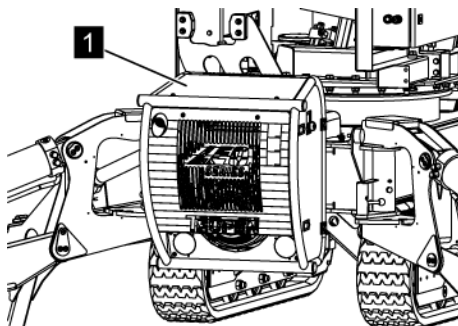


Fig. 20: Combustion engine cover

The combustion engine (Fig. 20/1), together with the hydraulic aggregate, supplies the necessary hydraulic pressure.

4.2.6 Electric motor

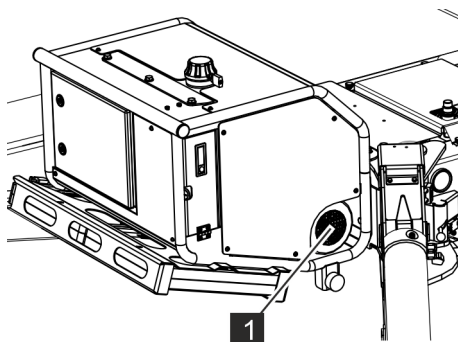
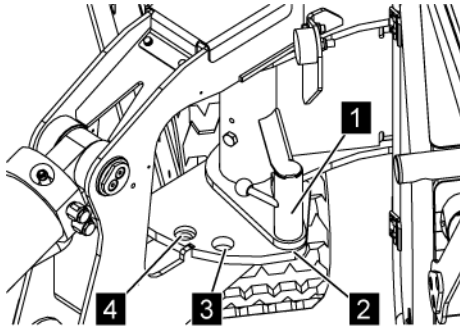


Fig. 21: Electric motor

As an alternative to the combustion engine, the necessary hydraulic pressure can be generated by the electric motor (Fig. 21/1). The connection is provided by the customer through a 230 V connection.

4.3 Operating elements and displays

4.3.1 Outrigger latching



The individual outriggers can be latched in the transport position (Fig. 22/4), in the narrow (Fig. 22/3) or the wide (Fig. 22/2) work position using the latching bolt (Fig. 22/1).

Fig. 22: Outrigger latching
(example, outrigger 3)

4.3.2 Cable remote control

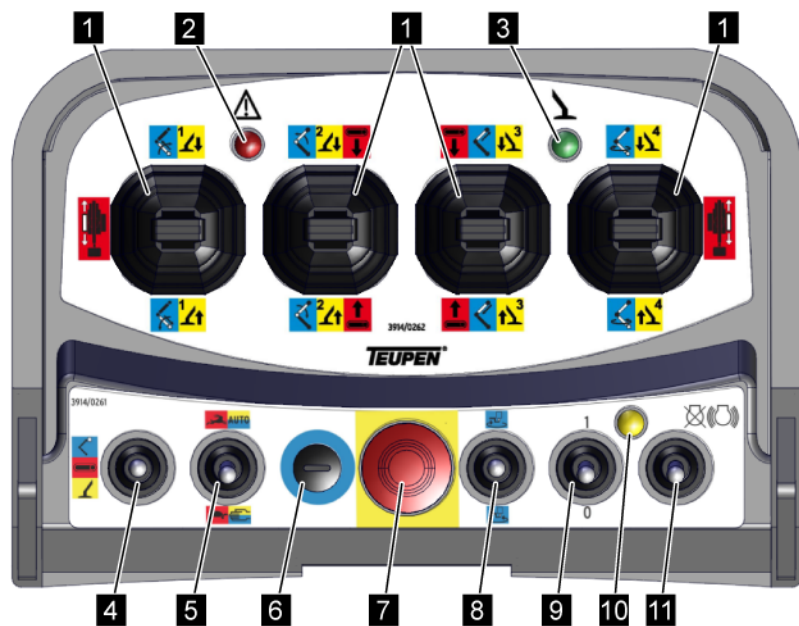


Fig. 23: Cable remote control

The operating elements on the control panel are explained in detail below.

1- Control levers

The control levers can be used to perform the respective colour-coded functions in accordance with the selected operating function and the position of the function selection lever.

Structure and function

<i>2 - Red lamp</i>	The red lamp flashes when the basket weight is exceeded. The red lamp also signals faults.
<i>3 - Green lamp</i>	<p>The green lamp flashes when the outriggers are not in contact with the ground, are not latched or if the bracing angle is not correct.</p> <p>It lights up constantly when the machine is correctly braced.</p>
<i>4 - Toggle switch for function selection</i>	The toggle switch for function selection is used to switch between the chain function, the platform function and the bracing function.
<i>5 - Toggle switch for operating mode selection</i>	<p>Is used to select the operating modes "crawl" or "fast speed" in conjunction with the chain function.</p> <p>Is used to select the operating modes "manual" or "automatic" for the bracing and platform function.</p> <p>The operating mode selector switch can be used to activate and deactivate the ramp function (moving softly into the final positions):</p> <ul style="list-style-type: none">■ AUTO: Ramp function activated■ Manual: Ramp function deactivated
<i>6 - Dummy plug</i>	Has no function.
<i>7 - Emergency Stop button</i>	The Emergency Stop button (🛑 <i>'Emergency Stop Button'</i> on page 31) is situated on the control panel. When it has been actuated, it has to be released by turning it in order to make the machine ready for operation again.
<i>8 - Working basket toggle switch</i>	The toggle switch is used to rotate the working basket.
<i>9 - Toggle switch for cable remote control</i>	The toggle switch is used to switch the cable remote control on and off.
<i>10 - Yellow lamp</i>	The yellow lamp indicates the start-up process and the operating status of the combustion engine.
<i>11 - Toggle switch for engine</i>	The toggle switch is used to start and stop the combustion engine.

4.3.3 Control panel in working basket

Controlling can be performed from the working basket using a control panel.



Fig. 24: Control panel in working basket

- 1 Green lamp
- 2 Red lamp
- 3 Graphic display
- 4 Function keys (4x)
- 5 Home key (optional)
- 6 Illuminated start/stop push-button
- 7 Toggle switch for function selection
- 8 Toggle switch for operating mode selection
- 9 Emergency Stop button
- 10 Toggle switch for rotating the working basket
- 11 Dummy plug
- 12 Control levers

1 - Green lamp

Status	Description
lights up permanently	Machine is braced correctly
flashes slowly	Machine is not braced

Structure and function

2 - Red lamp

Indicates malfunctions.

Status	Description
lights up permanently	Malfunction
blinks	Max. basket weight exceeded

3 - Graphic display

The graphic display shows the movements available with the respective functions as well as machine data, such as operating hours etc. If an illegal movement is selected, warnings and information messages are shown (↩ Chapter 6.5 'Principles of the graphic display' on page 75).

4 - Function keys

The function keys are used to navigate through the menu of the graphic display.

5 -Home key

When you press the home key, the platform automatically assumes its initial position.

6 - Illuminated start/stop push-button

Used to start and stop the combustion engine and indicates the start-up process and operating status.

7 - Toggle switch for function selection

Using the toggle switch, the chain function, platform or bracing function is selected.

8 - Toggle switch operating mode selection

Is used to select the operating modes "crawl" or "fast speed" in conjunction with the chain function.

Is used to select the operating modes "manual" or "automatic" for the bracing and platform function.

The operating mode selector switch can be used to activate and deactivate the ramp function (moving softly into the final positions):

- AUTO: Ramp function activated
- Manual: Ramp function deactivated

9 - Emergency Stop button

On the control panel there is an Emergency Stop button. When it has been actuated, it has to be released by turning it in order to make the machine ready for operation again.

10 - Toggle switch for rotating the working basket

Used to rotate the working basket.

11 - Dummy plug

Has no function.

12 - Control levers

The control levers can be used to perform the respective colour-coded functions in accordance with the selected operating function.

4.3.4 Engine controller



The engine controller is operated directly on the combustion engine.

- 1 Light button (optional)
- 2 Speed adjustment button
- 3 Operation LED/fault LED
- 4 Display
- 5 Arrow key up
- 6 Arrow key down
- 7 Set key
- 8 Key switch

Fig. 25: Engine controller

The operating elements of the engine control are explained in detail below.

1 - Light button (optional)

The button is used to switch on the optional headlights.

2 - Speed adjustment button

The button is used to increase and decrease the basic speed.

3 - Operation LED/fault LED

Indicates the operating status.

A green LED indicates everything is OK.

A red LED indicates that there is a fault.

4 - Display

Shows the operating status as well as fault messages.

Structure and function

5 - Arrow key up

The arrow key can be used to select the next display or increase values.

6 - Arrow key down

The arrow key can be used to select the previous display or reduce values.

7 - Set key

The set key is used to confirm inputs.

8 - Key switch

The key switch is used to start and stop the combustion engine and make settings.



The combustion engine must only be switched on and off using the key switch on the engine controller in service mode.

4.3.5 Display screen on the control box

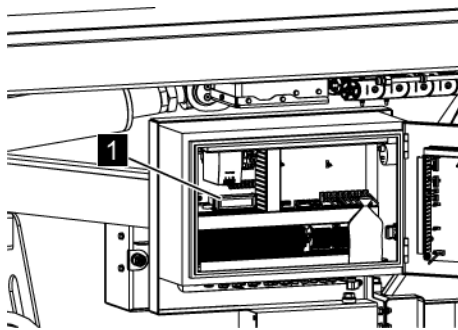


Fig. 26: Display screen

In the control box there is a display screen (Fig. 26/1) which displays fault codes and fault names (↪ Chapter 8.3 'Fault code list' on page 192).

4.3.6 Emergency control

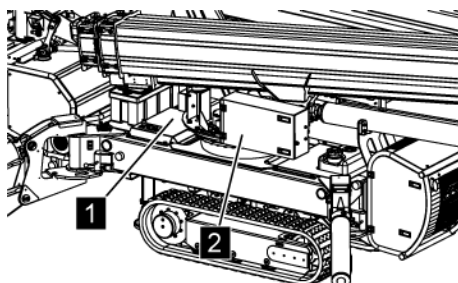
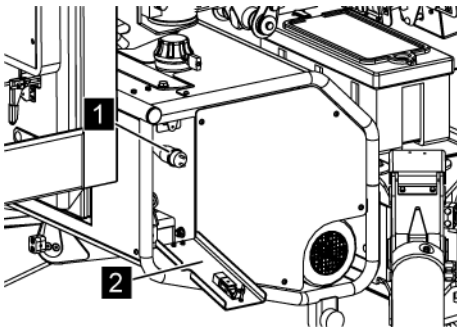


Fig. 27: Emergency control

In case of an energy supply failure the machine can be operated manually for platform and outrigger operation using the valves. The valves for outrigger operation are situated under the cover (Fig. 27/1). The valves for platform operation are situated in the hydraulics control box (Fig. 27/2) on the right-hand side of the machine.

4.4 Connections

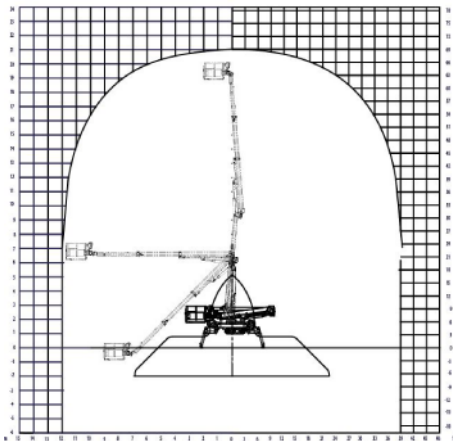


The electric motor is connected by the customer to a 230 V connection (Fig. 28/1).

The plug connector is situated underneath the cover (Fig. 28/2).

Fig. 28: Power connection

4.5 Work areas and danger zones



The work area and danger zones are within and vertically below the swivel range of the machine.

Fig. 29: Work area and danger zone

4.6 Accessories

4.6.1 Keys



The scope of supply includes various keys. They are used, among other things, for opening the control desk, control box, etc.

Fig. 30: Keys

Structure and function

4.6.2 Safety harness (optional)



Wear the safety harness with fall attenuator when performing any work carried out from the working basket. Attach it to the respective fastening points in the working basket. It can be ordered from the manufacturer. Please see page 2 for the contact data.

Fig. 31: Safety harness

Transportation and storage

5 Transportation and storage

5.1 Safety instructions for transportation

Improper transport



WARNING!

Danger to life due to improper transport!

Improper transport can cause severe injuries or even death.

- During transport of the aerial access platform, do not stay in the working basket.
- Heed dimensions of the aerial access platform.
- Never step under or into the swivel range of loads that are up in the air.
- Only move loads under supervision.
- Only use approved lifts and lifting accessories with sufficient carrying capacity.
- Only use the attachment points provided.

5.2 Inspection on receipt of delivery

Check the delivery immediately upon receipt to ensure that it is complete and there is no evidence of transport damage.

In case of transport damage which is visible from the outside, proceed as follows:

- Do not accept the delivery or accept it only with reservations.
- Note scope of the damage on the transport documents or on the transporter's delivery slip.
- Initiate a complaint.



Complain about any defect as soon as it is detected. Damage claims can only be made within 12 months after acquisition of the machine. Special agreements (e.g. maintenance contract) are possible.

5.3 Transportation

Attachment points



Fig. 32: Crane attachment point

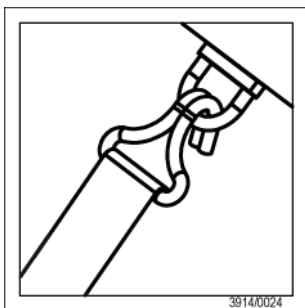


Fig. 33: Trailer attachment point

Transportation by crane

There are several load blocks which are used as the attachment points. They are marked as follows:

Attachment points for transportation by crane

Attachment point for transportation on a trailer

Transport pieces can be transported with a crane under the following conditions:

- The crane and lifts must be designed for the weight of the aerial access platform.
- The user must be authorised to operate the crane.
- The machine must be in the transport position (☞ Chapter 6.10 'Moving the machine into transport position' on page 113).
- Belts and chains must be the same length and sufficiently long.

Transportation and storage

Attaching

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
 ■ Safety shoes
 ■ Safety helmet



WARNING!

Material damage due to improper attachment!

The use of unsuitable attachment points can cause damage to the machine.

- Only use the attachment points specified here.

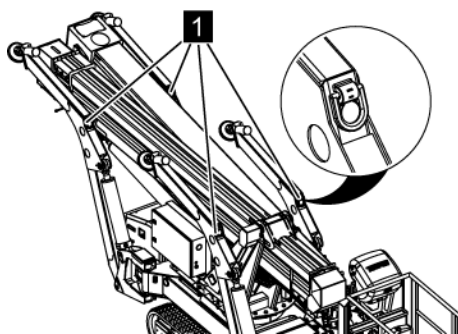


Fig. 34: Crane attachment points



Fig. 35: Crane attachment point symbol

Transportation on a trailer or truck

1. Move the machine into transport position (↪ Chapter 6.10 'Moving the machine into transport position' on page 113).
2. Switch off the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
3. Fasten crane hooks, belts or chain wheels to all four load blocks (Fig. 34/1).



The attachment points are marked with the Fig. 35 symbol.

4. Align the boom of the crane so that the lifting accessories are evenly loaded.
5. If necessary, protect the paint of the aerial access platform with suitable underlay materials.
6. Begin transportation.

The machine can be transported on a trailer or truck under the following conditions:

- The trailer or truck must be engineered for the weight and the dimensions of the machine.
- The machine must be in the transport position (↪ Chapter 6.10 'Moving the machine into transport position' on page 113).
- The machine must be anchored to the means of transport by safety belts connected to the specially provided load blocks (Fig. 38/1 and Fig. 39/1).

Transportation and storage

Loading

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet



WARNING!

Risk of injury due to improper moving of the aerial access platform!

With improper moving, the machine can tip or slide. This can cause severe injuries and significant material damage.

- The incline of the ramps must not exceed 30 %.
- During loading, do not stand downhill behind the aerial access platform.
- Go up the ramps forwards.
- Do not turn the aerial access platform on the ramp or loading area.



NOTICE!

Risk of material damage due to improper lashing!

The use of unsuitable attachment points can cause damage to the machine.

- Only use the lashing eyes specified here.

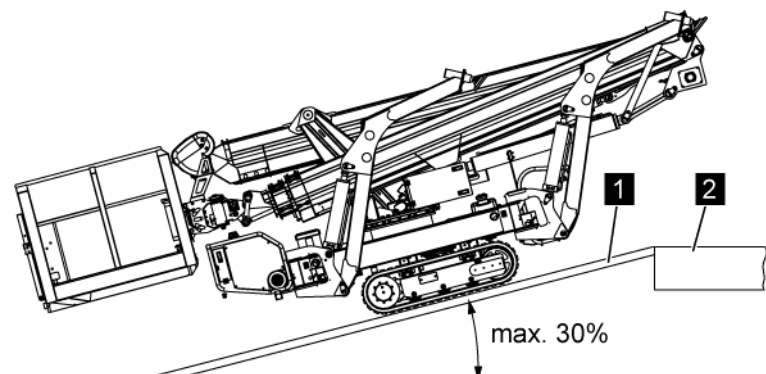


Fig. 36: Transportation on a trailer

1. Drive the aerial access platform forwards onto the ramps (Fig. 36/1).

Transportation and storage

2. → When the machine begins to topple onto the loading area (Fig. 36/2), reduce travel speed.

When the aerial access platform has been set down completely on the loading area (Fig. 36/2) with the chains, the travel speed can be increased again.

On a trailer

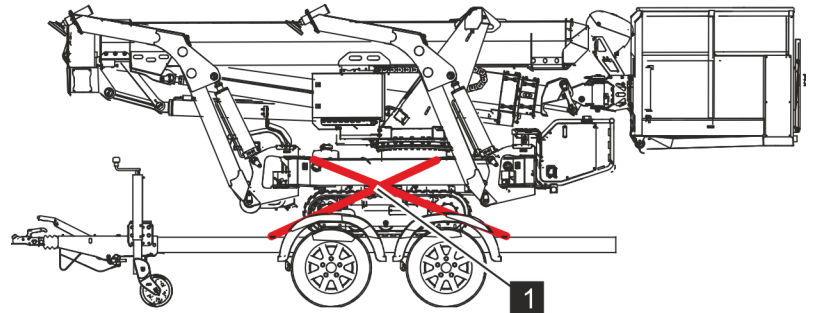


Fig. 37: "Crossed over" anchoring

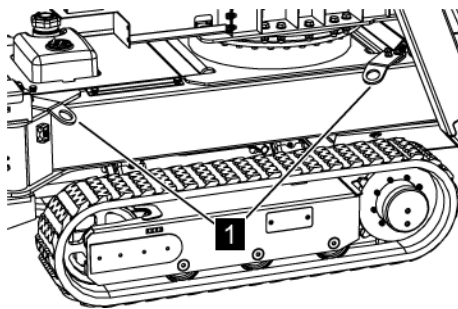


Fig. 38: Trailer attachment points

3. →



WARNING!

Risk of injury if the aerial access platform is anchored to the trailer incorrectly!

If the anchoring is incorrect, the aerial access platform may topple or slip off the trailer. This can cause severe injuries and significant material damage.

- Always anchor the lifting accessories on the aerial access platform to the trailer with a "crossed over" pattern.

Anchor and secure the aerial access platform to the trailer by attaching the lifting accessories (e.g. safety belts) to the mounts (Fig. 38/1) with a crossed over pattern (Fig. 37/1).



There are 2 holders on both the left and right-hand sides of the machine. They are marked with the Fig. 40 symbol.

Transportation and storage

On truck with loading platform

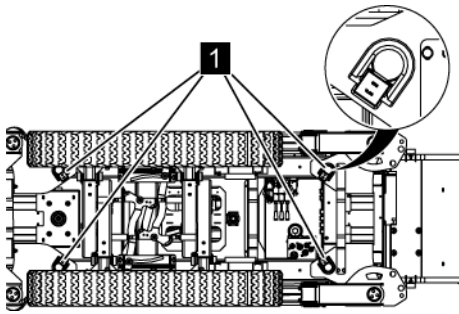


Fig. 39: Truck attachment point

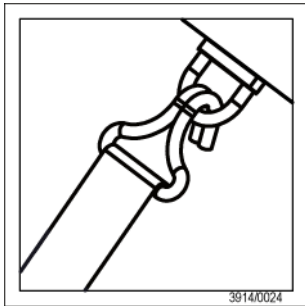


Fig. 40: Trailer attachment point symbol

4. → Anchor and secure the aerial access platform to loading platform, e.g. with safety belts attached to the load blocks (Fig. 39/1).



The loading blocks are situated on the underside of the machine and are marked with the Fig. 40 symbol.

5. → Start transportation.

Unloading

Unloading from a loading area takes place in reverse. To do this, proceed as follows:

1. → Unfasten the anchorings.
2. → Slowly reverse the aerial access platform.
3. → Before tipping, slow down and drive carefully past the tipping point.

After passing the tipping point, the speed can be increased again.

5.4 Storage

Storage of the machine

Store the machine under the following conditions:

- Do not store outdoors.
- Store dry and dust-free.
- Do not subject to any aggressive media.
- Protect against solar radiation.
- Avoid mechanical shocks.
- Storage temperature: 15 to 35 °C.

Transportation and storage

- Relative humidity: max. 60 %
- In case of storage longer than 3 months, check the condition of all parts regularly. If necessary, freshen or replace the rust-proofing.

Transportation and storage

Operation

6 Operation

6.1 Safety instructions for operation

Improper operation



WARNING!

Danger of injury due to improper operation!

Improper operation can cause severe injuries and significant property damage.

- Execute all operating steps according to the details and instructions in these instructions.
- Always perform all work with at least two people.
- Before beginning work, heed the following:
 - Make sure that all covers and safety equipment are installed and functioning properly.
 - Make sure that there are no people in the danger zone.
- Never take safety equipment out of service or bypass it during operation.

6.2 Connecting the cable remote control

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet
- Materials: ■ Cable remote control

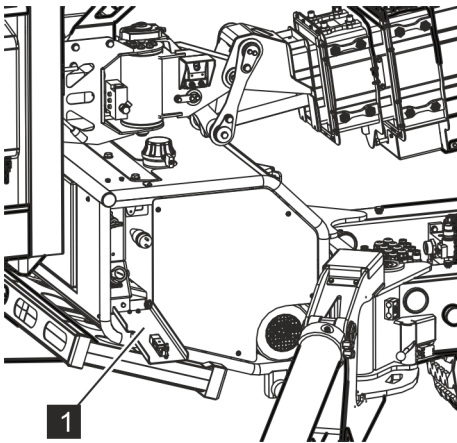


Fig. 41: Cover

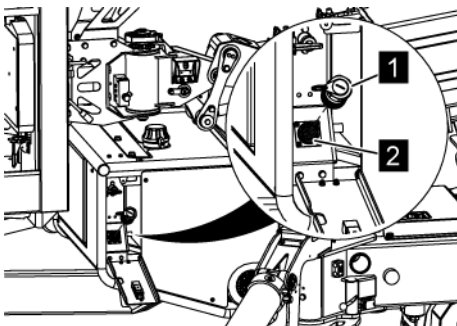


Fig. 42: Bypass plug connector

1. → Open the cover (Fig. 41/1).

2. → Unfasten the bypass plug connector (Fig. 42/1) by turning it anti-clockwise and disconnect it.



During operation, the socket (Fig. 42/2) must be occupied by either the bypass plug connector (Fig. 42/1) or the cable remote control as operation is otherwise not possible for reasons of safety.

3. → Insert the plug connector of the cable remote control into the socket (Fig. 42/2) and tighten it by turning it clockwise.

Operation

6.3 Switching the machine on/off

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet

Power is supplied either by the mains supply (construction site supply point) using an extension cable or by an independent combustion engine.

6.3.1 Switching the machine on/off at the mains supply



DANGER!

Risk of fatal injury from electrical current!

There is a direct risk of fatal injury from electric shock in case of contact with live parts. Damage to the insulation or individual components may represent a risk of fatal injury.

- In case of damage to the insulation, switch off the voltage supply immediately and have the machine repaired.
- Before performing work on live parts, pull the mains plug.
- Never bypass fuses or take them out of operation. When changing fuses, adhere to the correct amperage.
- Keep humidity away from voltage-conducting parts. Humidity can cause a short-circuit.

6.3.1.1 Switching the machine on/off via the cable remote control

**WARNING!****Risk of injury due to improper operation!**

Risk of injury for persons in the working basket, when operating the cable remote control.

- Only use the cable remote control if there is nobody in the working basket.
- Before operating the control panel in the working basket, disconnect the cable remote control from the machine and stow it in a safe place.

Switching on

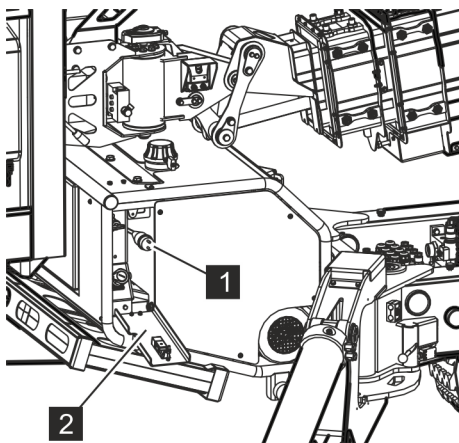


Fig. 43: Power connection

1. → Open the cover (Fig. 43/2).
2. → Connect the plug connector (Fig. 43/1) with an extension cable. In the process, adhere to the maximum cable lengths (↪ 'Cable lengths' on page 42).
3. → Connect the cable remote control (↪ Chapter 6.2 'Connecting the cable remote control' on page 68).

Operation

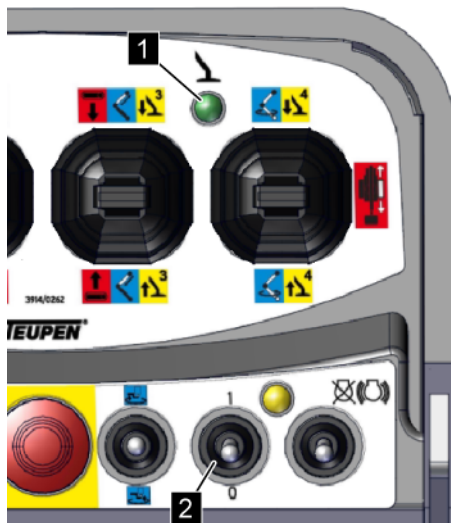


Fig. 44: Switching on the cable remote control

Switching off



Fig. 45: Cable remote control on/off

4. ➔ Set the toggle switch (Fig. 44/2) on the cable remote control to "1".

⇒ The machine is ready for operation if the green lamp (Fig. 44/1) flashes or lights up constantly.



The green lamp flashes when the outriggers are not in contact with the ground, are not latched or if the bracing angle is not correct.

The green lamp lights up constantly if the machine is braced correctly.

1. ➔ Set the toggle switch (Fig. 45) on the cable remote control to "0".
2. ➔ Disconnect the extension cable from the plug connector.

6.3.1.2 Switching the machine on/off via the control panel

Switching on

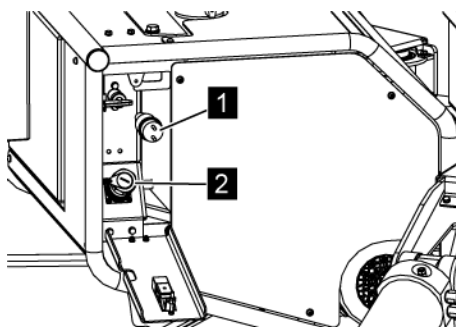


Fig. 46: Switching on the control panel

1. ➔ Make sure that the cable remote control is not connected and the bypass plug connector (Fig. 46/2) is locked in position.



Fig. 47: Green lamp

2. → Connect the plug connector (Fig. 46/1) with an extension cable. In the process, adhere to the maximum cable lengths (↪ 'Cable lengths' on page 42).

⇒ The machine is ready for operation if the green lamp (Fig. 47) on the control panel flashes or lights up constantly.



The green lamp flashes when the outriggers are not in contact with the ground, are not latched or if the bracing angle is not correct.

The green lamp lights up constantly if the machine is braced correctly.

6.3.2 Switching machine on/off using the combustion engine

6.3.2.1 Switching the machine on/off via the cable remote control



NOTICE!

Risk of voltage drop on the starter battery!

Starting up the combustion engine frequently can cause a voltage drop on the starter battery.

- Avoid frequent starting of the combustion engine.

See also the operating instructions for the combustion engine (↪ *Appendix C 'Combustion engines' on page 217*).

Switching on

1. → Check the engine oil level (↪ *Appendix C 'Combustion engines' on page 217*).

2. → Connect the cable remote control (↪ *Chapter 6.2 'Connecting the cable remote control' on page 68*).

Operation



Fig. 48: Cable remote control on/off

3. → Switch on the cable remote control. To do so, set the toggle switch (Fig. 48) on the cable remote control to "1".

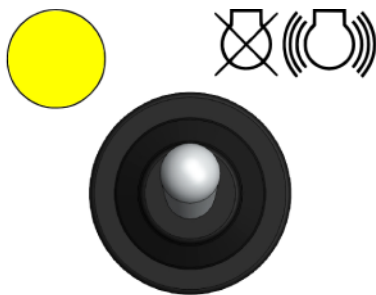


Fig. 49: Toggle switch start/stop

4. → To start up, press and hold the toggle switch (Fig. 49) up for at least 2 seconds.



The starting up process on a diesel engine may take longer as it has an automatic temperature-controlled pre-heating unit.

The yellow lamp (Fig. 49) flashes during the start-up process.

The yellow lamp lights up constantly when the motor is running.

Switching off

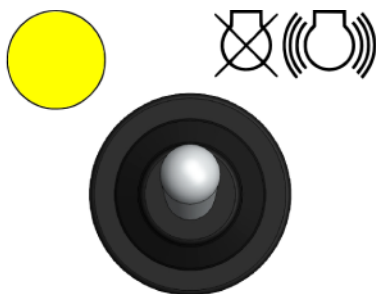


Fig. 50: Toggle switch start/stop

- To switch off the combustion engine (Fig. 50) push the toggle switch up and hold it until the combustion engine stops.

6.3.2.2 Switching the machine on/off via the control panel



NOTICE!

Risk of voltage drop on the starter battery!

Starting up the combustion engine frequently can cause a voltage drop on the starter battery.

- Avoid frequent starting of the combustion engine.

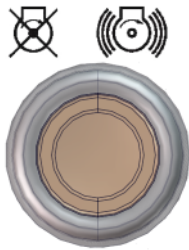
Switching on

Fig. 51: Illuminated start/stop push-button

See also the operating instructions for the combustion engine (↗ Appendix C 'Combustion engines' on page 217).

1. ↗ Check the engine oil level (↗ Appendix C 'Combustion engines' on page 217).
2. ↗ To start up, press and hold the illuminated push-button (Fig. 51) for at least 2 seconds.



The starting up process on a diesel engine may take longer as it has an automatic temperature-controlled pre-heating unit.

The illuminated push-button (Fig. 51) flashes during the start-up process.

The illuminated push-button (Fig. 51) lights up constantly when the motor is running.

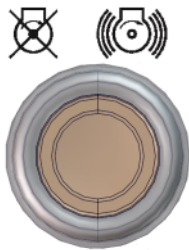
Switching off

Fig. 52: Illuminated start/stop push-button

- To switch off the combustion engine, push and hold the illuminated push-button (Fig. 52) until the combustion engine stops.

6.4 Shutting down in case of emergency

In dangerous situations, component movements must be stopped as quickly as possible and the power supply must be shut off.

In case of emergency, proceed as follows:

1. ↗ Immediately trigger an emergency stop with the emergency stop device.
2. ↗ If there is no risk to your own health, rescue people from the danger zone.
3. ↗ Provide first aid as necessary.
4. ↗ Alert the fire brigade and/or rescue service.
5. ↗ Inform the responsible party at the location of use.

Operation

6. → Switch off the machine and secure it to prevent it from being switched back on again.

6.5 Principles of the graphic display

6.5.1 Overview

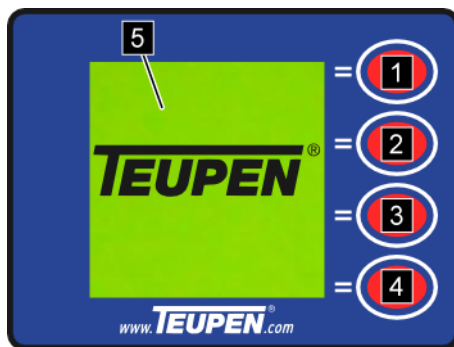


Fig. 53: Overview

- 1–4 Function keys
 5 Display screen

The graphic display comprises the 4 *[function keys]* (Fig. 53/1–4) and the display screen (Fig. 53/5). The graphic display starts up when the machine is switched on. The display is automatically updated in line with current situation of the machine. The *[function keys]* (Fig. 53/1–4) are used to navigate through the menu. The assignment of the *[function keys]* is shown on the display screen.





The display screen also shows operating statuses and information on faults. Refer to:

- ↗ Chapter 6.5.8 'Additional information messages regarding machine status' on page 86
- ↗ Chapter 8.3 'Fault code list' on page 192

6.5.2 Possible assignment of the function keys

The assignment of the *[function keys]* depends on the current menu.

The meaning of the symbols:

Symbol	Meaning
	One level back
	Up/back
	Down/forward
	Decrease value

Symbol	Meaning
	Increase value
	Confirm input
	Information message
	Warning

6.5.3 Examples of the operating modes

6.5.3.1 Chain function

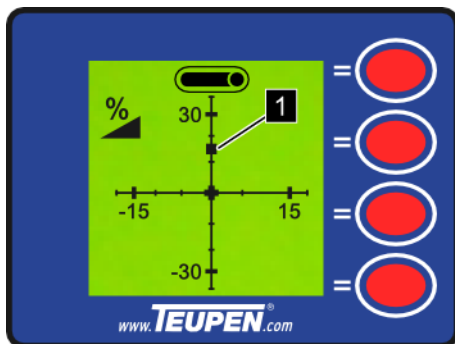


Fig. 54: Example of chain function

In the chain function operating mode the horizontal and vertical tilt of the machine is shown by points (Fig. 54/1) on the coordinate axes.

6.5.3.2 Outrigger function

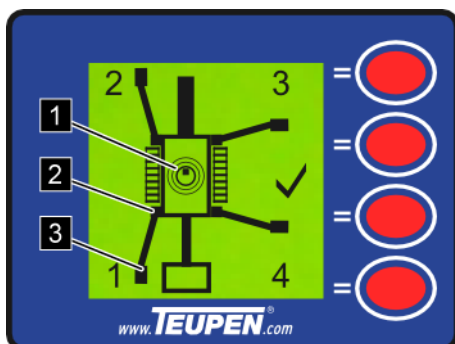


Fig. 55: Example of bracing function

- 1 Circular level
- 2 Outrigger locking
- 3 Ground pressure

In the bracing function operating mode the orientation of the individual outriggers and their correct bracing is shown.

Here: One-sided narrow, correctly levelled (Fig. 55/1), outrigger locked (Fig. 55/2), ground pressure sufficient (Fig. 55/3). The correct bracing is indicated by a check mark.



In addition, a visual inspection of the correct circular level is required.

Operation

6.5.3.3 Platform function

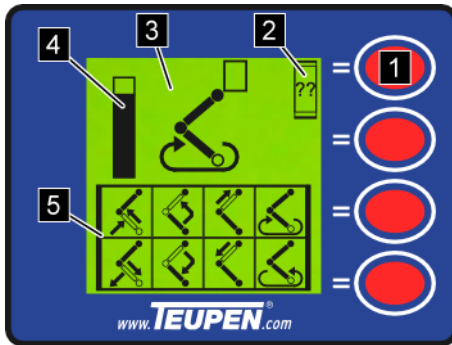


Fig. 56: Example for platform function

In platform function operating mode, the movements currently available to be activated with the operating levers are shown with the lower 8 pictograms (Fig. 56/5). When the limit stop for a platform function is reached, a large pictogram (Fig. 56/3) is shown for the limited movement. A bar graph (Fig. 56/4) also shows the remaining clearance to the limit stop.

An information message (Fig. 56/2) appears when an illegal movement is selected.

1. → Call up the respective information message (Fig. 57) using the [function key] (Fig. 56/1).
2. → Jump back a level with the [function key] (Fig. 57/1).

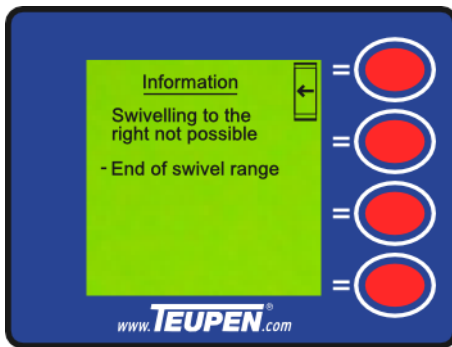


Fig. 57: Example of an information message

Examples

The display screen provides the operator with help, e.g. finding the transport position (x and y), and provides helpful information for operation.

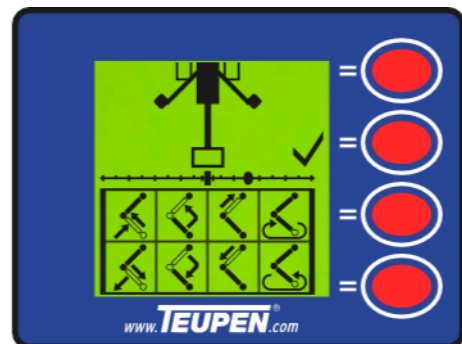
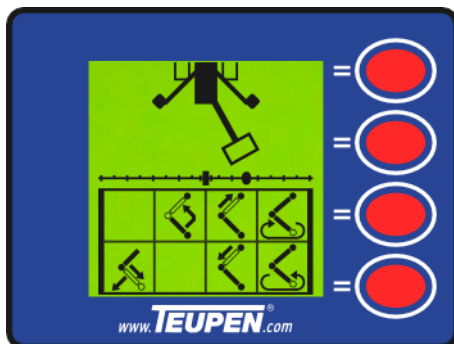


Fig. 58: Platform transport position

As soon as the telescopic arm is in the vertical position above the telescopic arm support, a tick (Fig. 58/right) appears in the display to signal this.

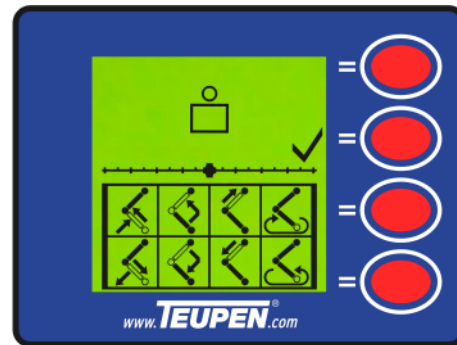
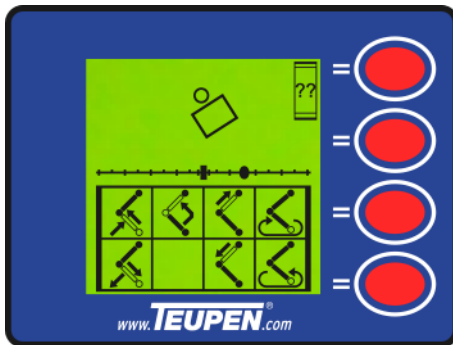


Fig. 59: Working basket transport position

As soon as the working basket is in the transport position, a tick (Fig. 59/right) appears in the display to signal this.

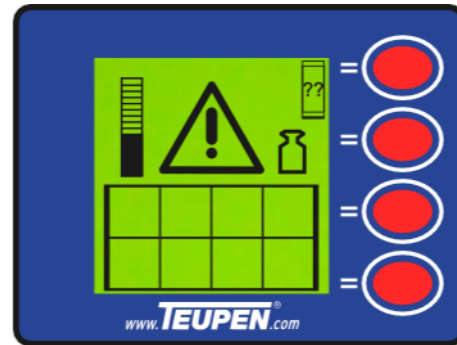
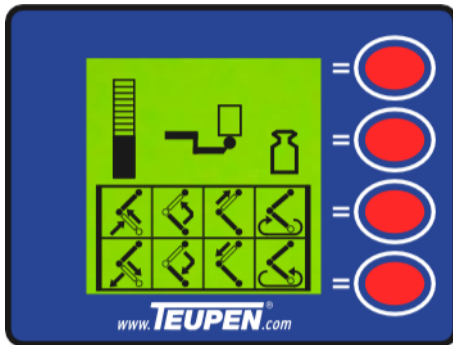


Fig. 60: Permitted basket weight exceeded

As soon as the permitted basket weight has been exceeded, the display screen indicates this (Fig. 60/right). Platform movements are then no longer possible.

Operation

6.5.4 Main menu



Press the [function key] (Fig. 61/4) in normal mode to call up the 'Main menu'.

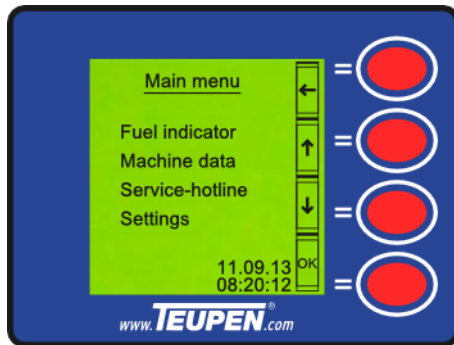


Fig. 61: Main menu overview

The 'Main menu' consists of 4 submenus:

- 'Fuel indicator'
- 'Machine data'
- 'Service hotline'
- 'Settings' (password required)

The selected submenu is shown with a grey background.

1. Select a submenu with the [function keys] (Fig. 61/2 and 3).
2. Use the [function key] (Fig. 61/4) to jump to the selected submenu.
3. Use the [function key] (Fig. 61/1) to jump back to normal mode.

6.5.4.1 Fuel indicator

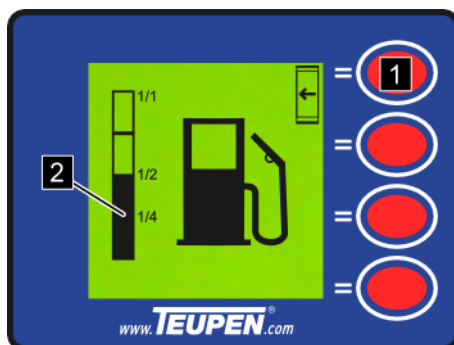


Fig. 62: Fuel indicator

The fuel level is indicated in the column (Fig. 62/2).

- Use the [function key] (Fig. 62/1) to jump back to the 'Main menu'.

6.5.5 Machine data

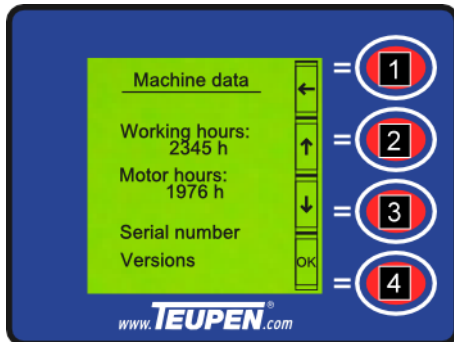


Fig. 63: Machine data

The 'Machine data' menu consists of 2 displays and 2 submenus:

- Display: 'Operating hours'
- Display: 'Motor hours'
- Submenu: 'Serial number'
- Submenu: 'Versions'

The selected submenu is shown with a grey background.

1. → Select a submenu with the [function keys] (Fig. 63/2 and 3).
2. → Use the [function key] (Fig. 63/4) to jump to the selected submenu.
3. → Use the [function key] (Fig. 63/1) to jump back to the [Main menu].

6.5.5.1 Serial number

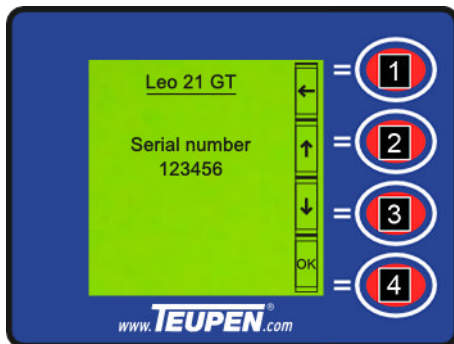


Fig. 64: Serial number

The 'Serial number' menu shows the machine type and the machine number.

- Use the [function key] (Fig. 64/1) to jump back to the 'Machine data' menu.

6.5.5.2 Versions

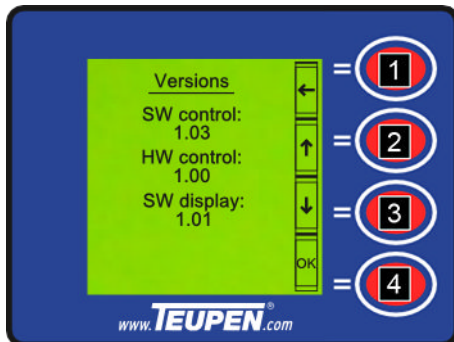


Fig. 65: Versions

The 'Versions' menu displays the following software and hardware versions:

- Controller software version
- Controller hardware version
- Display screen software version

- Use the [function key] (Fig. 65/1) to jump back to the 'Machine data' menu.

Operation

6.5.6 Service hotline

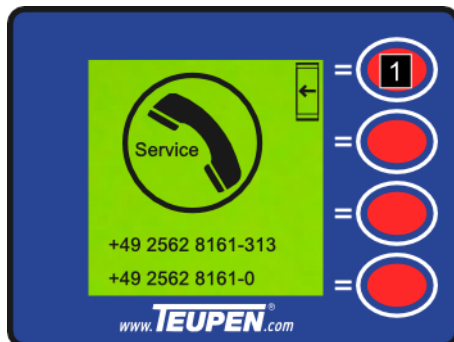


Fig. 66: Service hotline

The 'Service hotline' menu displays the telephone number of the respective service company.

→ Use the [function key] (Fig. 66/1) to jump back to the 'Main menu'.

6.5.7 Settings

Enter password

To access the 'Settings' menu you need to enter a password.



The factory setting for the password on delivery is: 2468

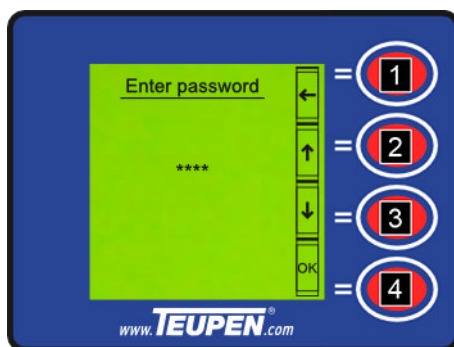


Fig. 67: Enter password

1. → Press the [function key] (Fig. 67/4).
⇒ The cursor flashes on the first digit.
2. → Select the desired digit with the [function keys] (Fig. 67/2 and 3).
3. → Use the [function key] (Fig. 67/4) to confirm the selected digit.
⇒ The cursor moves to the next digit.
4. → Enter the next digits in the same manner.



If the password is correct, the [Settings] menu opens once the last digit has been confirmed.

If the password is entered incorrectly, enter it again as described above.

Alternatively:

→ Use the [function key] (Fig. 67/1) to return to the 'Main menu'.

Settings menu

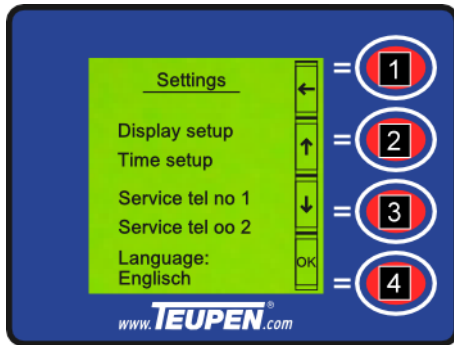


Fig. 68: Settings

The 'Settings' menu consists of 4 submenus:

- 'Display setup'
- 'Time setup'
- 'Service telephone number 1'
- 'Service telephone number 2'
- 'Language'

The selected submenu is shown with a grey background.

1. → Select a submenu with the [function keys] (Fig. 68/2 and 3).
2. → Use the [function key] (Fig. 68/4) to jump to the selected submenu.
3. → Use the [function key] (Fig. 68/1) to jump back to the 'Main menu'.

6.5.7.1 Display setup

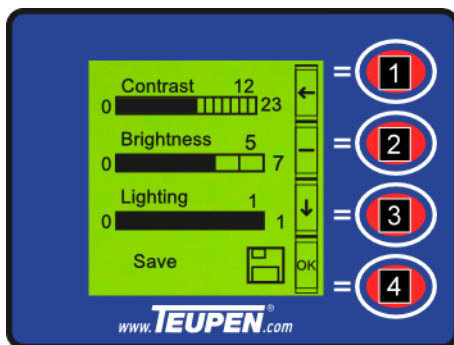


Fig. 69: Display setup

The 'Display setup' menu can be used to make the following settings on the display screen:

- Contrast
- Brightness
- Lighting

The selected setting is shown in with a grey background.

1. → Use the [function key] (Fig. 69/3) to confirm the selected setting.
2. → Use the [Function key] (Fig. 69/2) to decrease the value of the desired setting.
Use the [Function key] (Fig. 69/4) to increase the value of the desired setting.

Operation

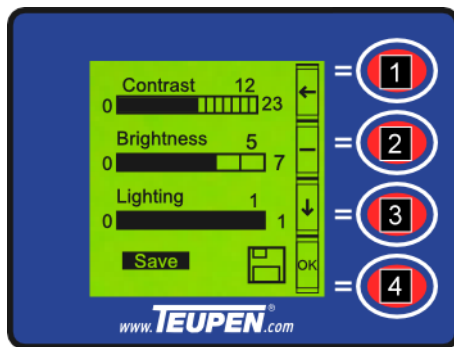


Fig. 70: Saving the display setup

3. → Use the *[function key]* (Fig. 70/3) to set the cursor to "save".
⇒ The assignment of the *[function key]* (Fig. 70/4) jumps to "OK".
4. → Use the *[function key]* (Fig. 70/4) to confirm the setting.
5. → Use the *[function key]* (Fig. 70/1) to return to the *[Setting]* menu.

6.5.7.2 Time setup

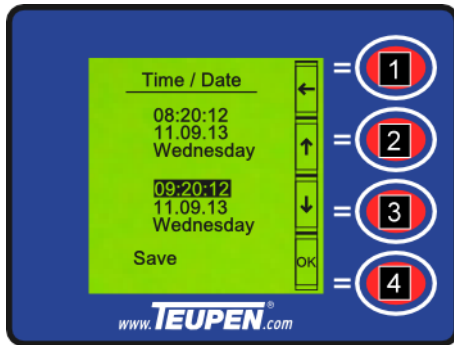


Fig. 71: Time setup

The 'Time setup' menu is used to make the following settings:

- Time
- Date
- Day of the week

The selected setting is shown in with a grey back-ground.

1. Use the [function keys] (Fig. 71/2 and 3) to select the desired setting.
2. Use the [function key] (Fig. 71/4) to confirm the selected setting.
 - ⇒ The cursor flashes on the first setting option (e.g. hours).
3. Use the [Function key] (Fig. 71/2) to increase the value of the desired setting.
Use the [Function key] (Fig. 71/3) to decrease the value of the desired setting.
4. Use the [function key] (Fig. 71/4) to confirm the value.
 - ⇒ The cursor jumps to the next setting option (e.g. minutes).
5. All other settings are made in the same manner.
6. Use the [function keys] (Fig. 72/2 and 3) to set the cursor to "save".
7. Use the [function key] (Fig. 72/4) to confirm the setting.
8. Use the [function key] (Fig. 72/1) to return to the 'Setting' menu.

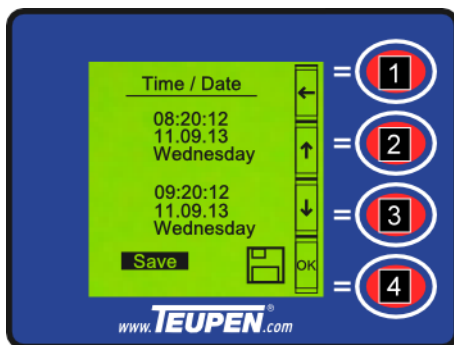


Fig. 72: Saving the time setup

Operation

6.5.7.3 Service telephone number

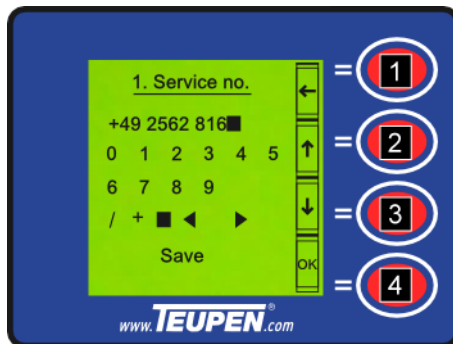


Fig. 73: Service telephone number input

1. Use the [function keys] (Fig. 73/2 and 3) to select the desired digit or special character.
2. Use the [function key] (Fig. 73/4) to confirm the selection.
3. All other inputs are made in the same manner.

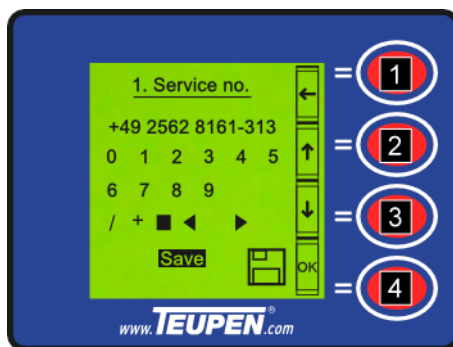


Fig. 74: Saving the service number

4. Use the [function keys] (Fig. 74/2 and 3) to set the cursor to "save".
5. Use the [function key] (Fig. 74/4) to confirm the setting.
6. Use the [function key] (Fig. 74/1) to return to the [Setting] menu.

6.5.7.4 Setting the language



The language is set directly in the 'Settings' menu.

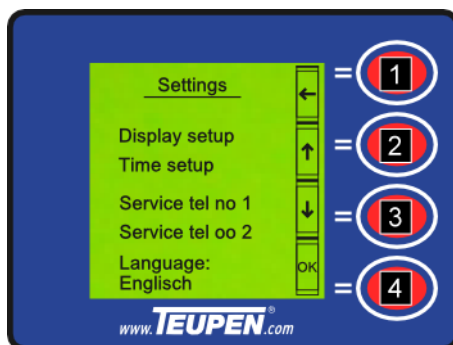


Fig. 75: Setting the language

1. Use the [function keys] (Fig. 75/2 and 3) to select the language.
2. Press the [function key] (Fig. 75/4).
⇒ The language flashes.
3. Use the [function keys] (Fig. 75/2 and 3) to select the desired language.
4. Use the [function key] (Fig. 75/4) to confirm the selected language.

6.5.8 Additional information messages regarding machine status

The following additional information messages may be shown during operation:

Lower control active

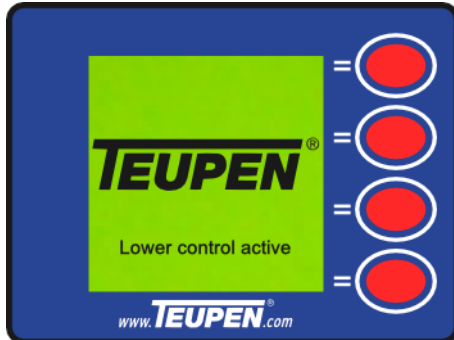


Fig. 76: Lower control active

■ Lower control active.

The control panel is deactivated and the machine can only be operated from the lower controller or using the cable remote control.

Fill up with fuel

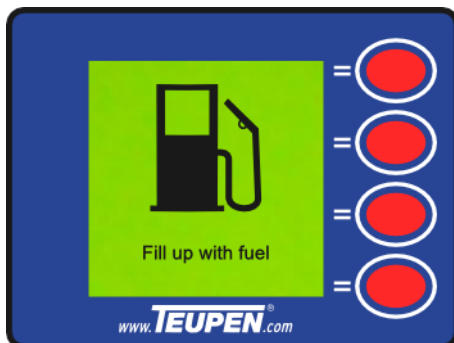


Fig. 77: Fill up with fuel

■ Fuel is getting low.

→ Fill up as soon as possible.

Checking the oil level

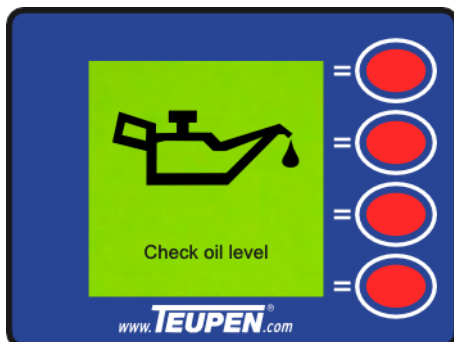


Fig. 78: Checking the oil level

■ Oil pressure is low. Oil level may be too low.

→ Check the oil level (↪ Appendix C 'Combustion engines' on page 217).

Operation

Soiling display for hydraulic filter

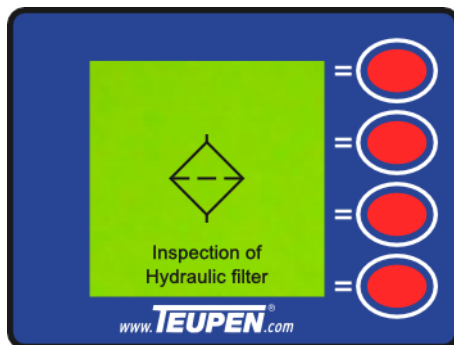


Fig. 79: Inspection of hydraulic filter

- The hydraulic filter is soiled.

→ Replace hydraulic filter (↪ Chapter 7.4.5 'Replacing the hydraulic filter' on page 176).

Engine controller alarm output

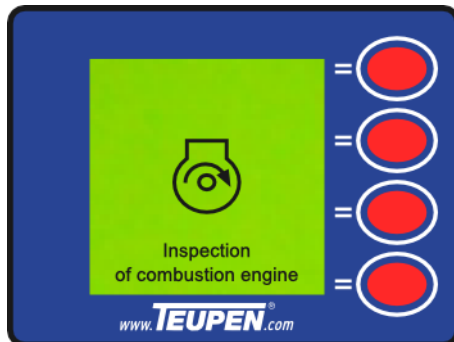


Fig. 80: Inspection of combustion engine

- Fault on the engine controller.

→ Stop operation. Call service.

Water temp high

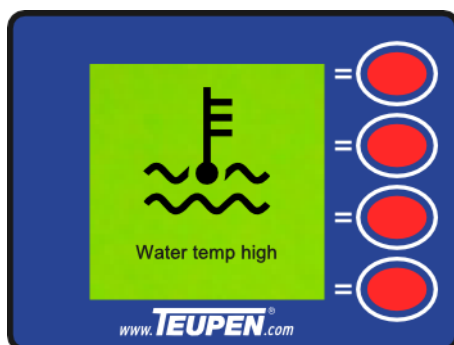
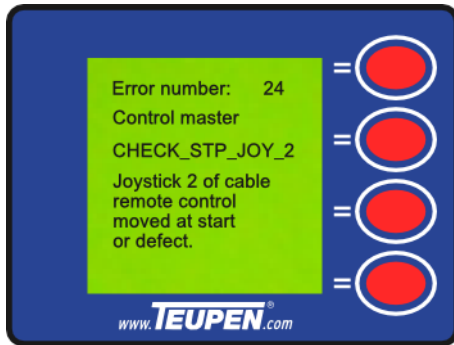


Fig. 81: Water temperature

- The cooling water temperature is too high.

→ Stop operation. Call service.

Fault message



- Various fault messages. They are used primarily to help service staff to detect and clear faults. See also [Chapter 8.3 'Fault code list' on page 192.](#)

Fig. 82: Fault message

Operation

6.6 Moving the machine

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet
■ Safety harness



WARNING!

Risk of injury due to improper moving of the aerial access platform!

There is a danger of severe injuries or even death due to improper moving of the aerial access platform.

- Only move machine in transport position.
- While in the working basket, always put on a safety harness and hook into the attachment points provided.
- Always perform all work with at least two people, whereby one person must remain on the ground in order to activate the emergency control if necessary.
- Do not exceed maximum working basket load of 250 kg.
- Heed openings in the floor when moving.
- Do not drive over materials with sharp edges.
- Do not make any abrupt changes of direction.
- When stopping on an incline, secure the machine against rolling away.
- Make sure that the ladder is folded up and locked.
- When moving across a slope (max. 16.7° or 30 %), do not stay on the down slope side next to the aerial access platform.
- In case of moving on an incline (max. 19.0° or 34 %), do not stay on the down slope behind the aerial access platform.
- Only go up and down slopes forwards.
- Avoid contact of the crawler tracks with oil, gasoline, diesel and salt. Clean them afterwards as necessary.

6.6.1 Moving the machine via the cable remote control

1. ➔ Connect the cable remote control (↗ Chapter 6.2 'Connecting the cable remote control' on page 68).
2. ➔ Switch on the machine (↗ Chapter 6.3 'Switching the machine on/off' on page 69).
3. ➔ Set the function selection switch (Fig. 83) of the cable remote control in centre position to chain function (red).



Fig. 83: Chain function selection switch

Operation

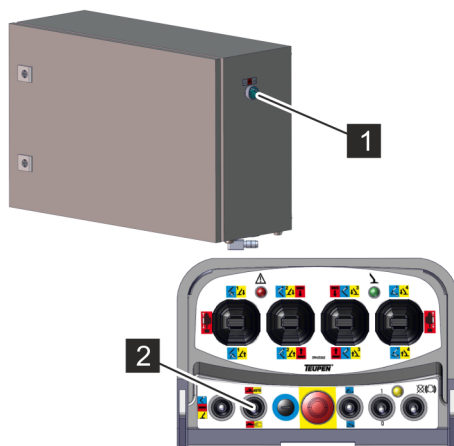


Fig. 84: Operating mode selector switch



Fig. 85: Operating mode selector switch

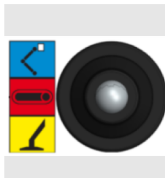
4. Use the operating mode selector switch (Fig. 84/2 and Fig. 85) on the cable remote control and the operating mode selector switch (Fig. 84/1) on the control box to select the speed (see the following table "Switch position/speed").



Temperature-dependent travel speeds

The fast speed setting (S) is enabled from a hydraulic temperature of +15 °C. This is indicated by the operating mode selector switch (Fig. 84/1) on the control box lighting up when the following switch positions are selected.

Cable remote control



Control box operating mode selector switch (Fig. 84/1)



The operating mode selector switch (Fig. 84/1) on the control box and the operating mode selector switch (Fig. 84/2 and Fig. 85) on the cable remote control can be used to set the travel speeds.

Switch position/speed








Cable remote control operating mode selector switch (Fig. 84/2)	Control box operating mode selector switch (Fig. 84/1)	Travel speed
	 	Crawl speed (slow)
		Fast speed (fast)
		Fast speed (S) (faster) Hydraulic oil temperature higher than + 15 °C



Fig. 86: Crawler chassis control levers

5.



By pressing the control levers (Fig. 86/1 and 2) slowly, travel speed can be adapted.

Since the crawl speed has the most force and power, we recommend using it on tight turning radius.



WARNING!

Risk of injury if the speed is not adjusted on drops or ascents!

If the speed is not adjusted when driving the aerial access platform over drops or ascents, the machine may topple or slip. This can cause severe injuries or even death and significant material damage.

- When on slopes or inclines, the machine may only be operated in crawl speed (↩ 'Switch position/speed' Table on page 92).

Use the control levers (Fig. 86/1 and 2) to move the machine as shown in the following table.

Operation

Table "Move machine"

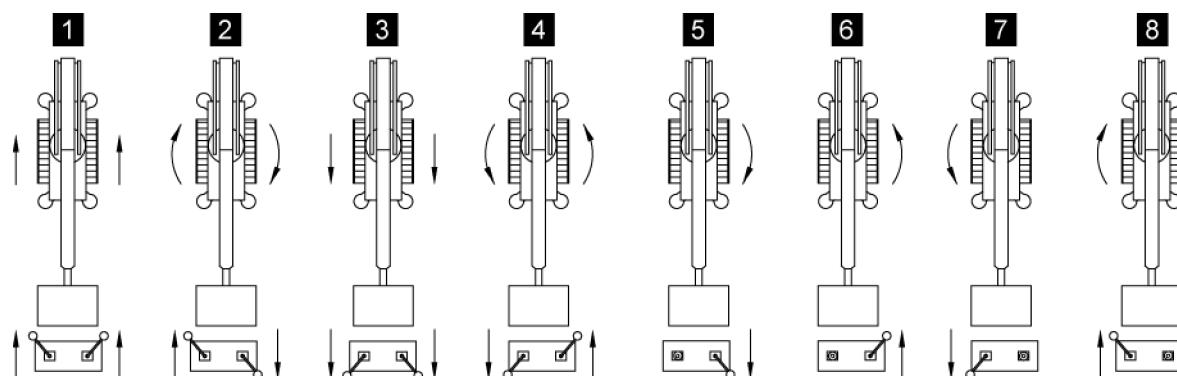


Fig. 87: Movement directions

No.	Operation	Effect
1	Push both control levers towards the front	The machine moves forwards
2	Push the left control lever towards the front and the right control lever towards the rear	Machine rotates clockwise
3	Push both control levers towards the rear	The machine moves backwards
4	Push the left control lever towards the rear and the right control lever towards the front	Machine rotates anti clockwise
5	Push only the right control lever backwards	The machine turns backwards in a clockwise direction
6	Push only the right control lever forwards	The machine turns forwards in a anti-clockwise direction
7	Push only the left control lever backwards	The machine turns backwards in a anti-clockwise direction
8	Push only the left control lever forwards	The machine turns forwards in a clockwise direction



Depending on the nature of the ground below the machine, the possible turning radius can have various sizes. The rubber tracks are loaded more heavily through smaller turning radii and wear out faster.

6.6.2 Moving the machine via the control panel



WARNING!

Risk of injury due to improper moving of the aerial access platform!

There is a danger of severe injuries or even death due to improper moving of the aerial access platform.

- The machine must only be driven on a slope of up to 8° (15 %) when operated from the working basket.

1. → Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
2. → Set the toggle switch (Fig. 88) on control panel to the crawler chassis function.



Fig. 88: Driving operation



Fig. 89: Crawl/fast speed

3. → Use the toggle switch (Fig. 89) to select crawl speed (Fig. 89/Turtle) or fast speed (Fig. 89/Rabbit).

Operation



Fig. 90: Control levers

4. → Move the machine with the control levers (Fig. 90/1 and 2) according to ↗ 'Table "Move machine"' on page 93.



If the control levers (Fig. 86/1 and 2) are shifted as far as they will go in fast speed mode, the gearbox also switches to "fast" in order to reach the highest possible speed.



By pressing the control levers (Fig. 90/1 and 2) slowly, the speed can be adapted.

6.7 Setting the working position of the outriggers

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet



WARNING!

Risk of injury due to improper bracing!

The machine may topple or slip if it is braced improperly. This can cause severe injuries and significant material damage.

- Always perform any work as a pair, with the help of a second person.
- Make sure that the ground has sufficient load bearing capacity (↪ *Chapter 3.4 'Weight and loads' on page 41*).
- Adhere to the stipulations for the maximum gradient of the terrain (↪ *Chapter 3.3 'Productivity' on page 40*).
- If necessary, use base plates.
- Make sure that the floor plates are aligned horizontally (maximum deviation of $\pm 8^\circ$).
- Do not anchor the outriggers using chains, ropes, pegs, etc.
- Always observe the movement of the outriggers when extending them.
- Make sure that there are no persons, supply lines or other objects in the vicinity of the outriggers.
- Extend the outriggers in the transport position carefully and with caution. There is a risk of collision with other parts of the machine!

Operation

The individual outriggers can each be latched in two working positions (narrow and wide). The setting is described in the following using outrigger 3 as an example.

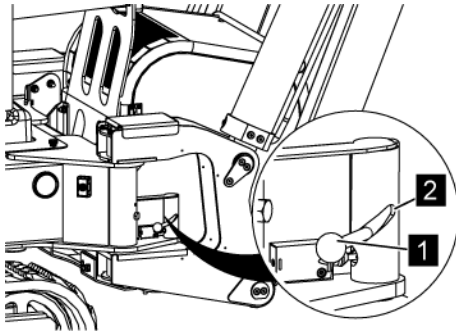


Fig. 91: Unfastening the locking mechanism

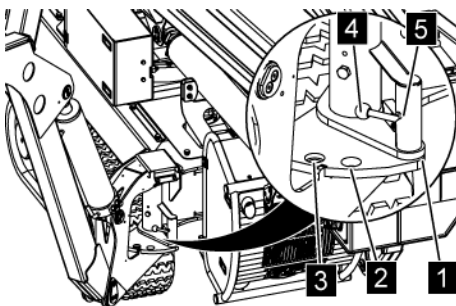


Fig. 92: Selecting the working position

1. →



WARNING!

Risk of crushing!

When unfastening the outrigger, there is a risk of crushing if an outrigger is allowed to pivot in an uncontrolled manner.

Secure the outrigger with one hand.

2. →

Use your free hand to push the latching bolt on the handle bar (Fig. 91/1) up along the link (Fig. 91/2) so that the outrigger can be pivoted freely.

3. →

Pivot the outrigger so that the latching bolt is positioned over the drilled hole for the wide (Fig. 92/1) or narrow (Fig. 92/2) working position.

4. →

Push the latching bolt (Fig. 92/4) down along the link (Fig. 92/5). Make sure that the latching bolt is pushed in all the way.



Drilled hole (Fig. 92/3) = transport position

6.8 Putting machine in work position

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet



WARNING!

Risk of injury due to improper bracing!

The machine may topple or slip if it is braced improperly. This can cause severe injuries and significant material damage.

- Always perform any work as a pair, with the help of a second person.
- Make sure that the ground has sufficient load bearing capacity (↪ *Chapter 3.4 'Weight and loads' on page 41*).
- Adhere to the stipulations for the maximum gradient of the terrain (↪ *Chapter 3.3 'Productivity' on page 40*).
- If necessary, use base plates.
- Make sure that the base plates are aligned horizontally (maximum deviation of $\pm 8^\circ$).
- Do not anchor the outriggers with chains, ropes, pegs, etc.
- Always observe the movement of the outriggers when extending.
- Make sure that no people, supply lines or other objects are in the area around the outriggers.

In order to put the machine in work position, the outriggers can be extended manually or automatically. The bracing of the machine can optionally be done from below with the lower control or from the working basket with the control panel.

Operation

6.8.1 Bracing the machine via the cable remote control

Manual operation



WARNING!

Risk of injury due to improper operation!

Risk of injury for persons in the working basket, when operating the cable remote control.

- Only use the cable remote control if there is nobody in the working basket.
- Before operating the control panel in the working basket, disconnect the cable remote control from the machine and stow it in a safe place.

1. → Connect the cable remote control (↪ Chapter 6.2 'Connecting the cable remote control' on page 68).
2. → Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
3. → Move the outriggers into the desired working position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).
4. → Set the function selection switch (Fig. 93) on the cable remote control to the outrigger function (yellow).



Fig. 93: Function selection switch

5. → Set the operating mode selector switch (Fig. 94) to manual (hand symbol).



Fig. 94: Operating mode selector switch

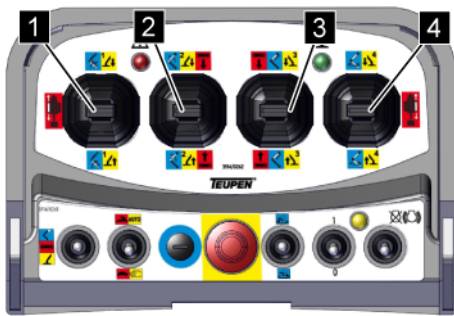


Fig. 95: Outrigger control levers

6. Use the control levers (Fig. 95/1 to 4) to operate the outriggers 1 to 4 as per the following table.

Operation	Symbol	Effect
Push the control lever (Fig. 95/1) forwards.		Outrigger 1 is extended.
Push the control lever (Fig. 95/2) forwards.		Outrigger 2 is extended.
Push the control lever (Fig. 95/3) forwards.		Outrigger 3 is extended.
Push the control lever (Fig. 95/4) forwards.		Outrigger 4 is extended.



The speed of extension can be adjusted by actuating the control levers slowly.



Fig. 96: Circular level

7. Move the chassis into the horizontal position by aligning the outriggers with the circular level (Fig. 96). The bubble (Fig. 96/1) in the circular level must be within the 1° circle (Fig. 96/2).

⇒ If the bracing is correct, the green lamp on the cable remote control lights up constantly.

8. You must also check the bracing visually:

- All the outriggers must be in contact with the ground.
- The chains must not be in contact with the ground.

Operation

Automatic operation



WARNING!

Risk of injury due to improper operation!

Risk of injury for persons in the working basket, when operating the cable remote control.

- Only use the cable remote control if there is nobody in the working basket.
- Before operating the control panel in the working basket, disconnect the cable remote control from the machine and stow it in a safe place.



CAUTION!

Risk of injury from uneven lifting or lowering the machine!

Due to uneven lifting and lowering, the machine can tip or slide. This can cause severe injuries and significant material damage.

- In case of uneven lifting, cancel the process immediately and align the machine manually.
- Have the automatic bracing checked by service staff.

1. → Connect the cable remote control (↪ Chapter 6.2 'Connecting the cable remote control' on page 68).
2. → Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
3. → Move the outriggers into the desired working position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).
4. → Set the function selection switch (Fig. 97) on the cable remote control to the outrigger function (yellow).



Fig. 97: Function selection switch



Fig. 98: Operating mode selector switch

5. → Set the operating mode selector switch (Fig. 98) to automatic (AUTO).

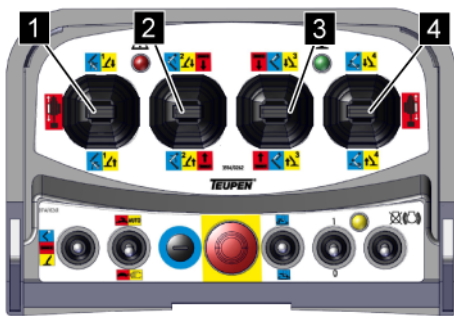


Fig. 99: Outrigger control levers

6. → Use the control levers (Fig. 95/1 to 4) to operate the outriggers 1 to 4 as per the following table.

Operation	Symbol	Effect
Push the control lever (Fig. 99/1, 2, 3 or 4) forwards.	<div>1</div> <div>2</div> <div>3</div> <div>4</div>	All the outriggers are extended simultaneously.



The speed of extension can be adjusted by actuating the control levers slowly.

Operation



Fig. 100: Circular level

7. → Move the chassis into the horizontal position by aligning the outriggers with the circular level (Fig. 100). The bubble (Fig. 100/1) in the circular level must be within the 1° circle (Fig. 100/2).
 ⇒ If the bracing is correct, the green lamp on the cable remote control lights up constantly.
8. → You must also check the bracing visually:
 - All the outriggers must be in contact with the ground.
 - The chains must not be in contact with the ground.

6.8.2 Bracing the machine via the control panel

Manual operation

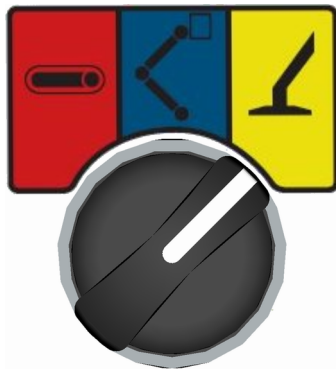


Fig. 101: Outrigger function

1. → Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
2. → Move the outriggers into the desired working position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).
3. → Set toggle switch (Fig. 101) on control panel to the outrigger function (yellow).



Fig. 102: Manual bracing

4. → Set toggle switch (Fig. 102) to manual (hand symbol).



Fig. 103: Outrigger control levers

5. Use the control levers (Fig. 103/1 to 4) to operate the outriggers 1 to 4 as per the following table.

Operation	Symbol	Effect
Push the control lever (Fig. 103/1) forwards.		Outrigger 1 is extended.
Push the control lever (Fig. 103/2) forwards.		Outrigger 2 is extended.
Push the control lever (Fig. 103/3) forwards.		Outrigger 3 is extended.
Push the control lever (Fig. 103/4) forwards.		Outrigger 4 is extended.



The speed of extension can be adjusted by actuating the control levers slowly.



Fig. 104: Circular level

Automatic operation

6. Move the chassis into the horizontal position by aligning the outriggers with the circular level (Fig. 104). The bubble (Fig. 104/1) in the circular level must be within the 1° circle (Fig. 104/2).

⇒ If the bracing is correct, the green lamp on the control panel lights up constantly.

7. You must also check the bracing visually:

- All the outriggers must be in contact with the ground.
- The chains must not be in contact with the ground.

1. Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
2. Move the outriggers into the desired working position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).

Operation

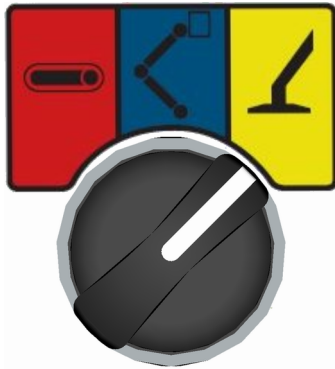


Fig. 105: Outrigger function

3. Set toggle switch (Fig. 105) on control panel to the outrigger function (yellow).



Fig. 106: Automatic bracing

4. Set toggle switch (Fig. 106) to automatic (AUTO).



Fig. 107: Outrigger control levers

5. Use the control levers (Fig. 107/1 to 4) to operate the outriggers 1 to 4 as per the following table.

Operation	Symbol	Effect
Push the control lever (Fig. 107/1, 2, 3 or 4) forwards.	1	All the outriggers are extended simultaneously.
	2	
	3	
	4	



The speed of extension can be adjusted by actuating the control levers slowly.



Fig. 108: Circular level

6. → Move the chassis into the horizontal position by aligning the outriggers with the circular level (Fig. 108). The bubble (Fig. 108/1) in the circular level must be within the 1° circle (Fig. 108/2).

⇒ If the bracing is correct, the green lamp on the control panel lights up constantly.

7. → You must also check the bracing visually:

- All the outriggers must be in contact with the ground.
- The chains must not be in contact with the ground.

6.9 Operating the machine

Personnel:

- Trained people

Protective equipment:

- Occupational safety clothing
- Safety shoes
- Safety helmet
- Safety harness



WARNING!

Risk of injury due to improper operation!

Improper operation can cause severe injuries and significant material damage.

- While in the working basket, always wear a safety harness, do not swing or move jerkily.
- Always perform all work with at least two people, whereby one person must remain on the ground in order to activate the emergency control if necessary.
- Make sure that the ladder is folded up and locked.
- Do not climb onto the safety fence around the basket.
- Do not work on or near high-voltage lines.
- Beware of high obstacles.
- Make sure that when moving the working basket, no body parts are crushed, e.g. against a wall.
- At wind speeds above 12.5 m/s (wind strength 6 Bft), stop work immediately.

Operation

6.9.1 Operating the machine via the cable remote control

1. → Connect the cable remote control (↗ Chapter 6.2 'Connecting the cable remote control' on page 68).
2. → Switch on the machine (↗ Chapter 6.3 'Switching the machine on/off' on page 69).
3. → Move the machine into work position (↗ Chapter 6.8 'Putting machine in work position' on page 98).
4. → Set the function selection switch (Fig. 109) on the cable remote control to the platform function (blue).



Fig. 109: Function selection switch

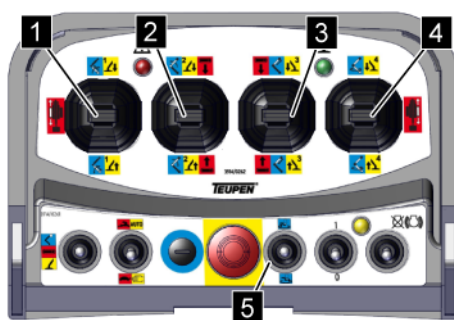


Fig. 110: Platform control levers

5. → Use the control levers (Fig. 110/1 to 4) and the toggle lever (Fig. 110/5) to operate the platform as per the following table.

Operation	Symbol	Effect
Push the control lever (Fig. 110/1) forwards		Raise the lower boom Telescope out the lower boom
Pull the control lever (Fig. 110/1) back		Lower the lower boom Telescope in the lower boom
Push the control lever (Fig. 110/2) forwards		Raise the upper boom
Pull the control lever (Fig. 110/2) back		Lower the upper boom







Operation	Symbol	Effect
Push the control lever (Fig. 110/3) forwards		Telescope out the upper boom
Pull the control lever (Fig. 110/3) back		Telescope in the upper boom
Push the control lever (Fig. 110/4) forwards		Swivel the platform clockwise (viewed from above)
Pull the control lever (Fig. 110/4) back		Swivel the platform anti-clockwise (viewed from above)
Push the toggle lever (Fig. 110/5) forwards		The working basket swivels clockwise (viewed from above)
Pull the toggle lever (Fig. 110/5) back		The working basket swivels anti-clockwise (viewed from above)



Fig. 111: Operating mode selector switch



- The speed of the functions can be adjusted by actuating the control levers slowly.
- The operating mode selector switch (Fig. 111) can be used to activate and deactivate the ramp function (moving softly into the final positions):
 - AUTO: Ramp function activated
 - Manual: Ramp function deactivated

6.9.2 Operating the machine via the control panel

1. → Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
2. → Move the machine into work position (↪ Chapter 6.8 'Putting machine in work position' on page 98).

Operation







Fig. 112: Function selection switch

3. → Set the function selection switch (Fig. 112) on the cable remote control to the platform function (blue).



Fig. 113: Platform control levers

4. → Use the control levers (Fig. 113/1 to 4) and the toggle switch (Fig. 113/5) to operate the platform as per the following table.

Operation	Symbol	Effect
Push the control lever (Fig. 113/1) forwards		Raise the lower boom Telescope out the lower boom
Pull the control lever (Fig. 113/1) back		Lower the lower boom Telescope in the lower boom
Push the control lever (Fig. 113/2) forwards		Raise the upper boom
Pull the control lever (Fig. 113/2) back		Lower the upper boom

Operation





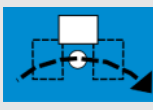
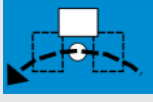
Operation	Symbol	Effect
Push the control lever (Fig. 113/3) forwards		Telescope out the upper boom
Pull the control lever (Fig. 113/3) back		Telescope in the upper boom
Push the control lever (Fig. 113/4) forwards		Swivel the platform clockwise (viewed from above)
Pull the control lever (Fig. 113/4) back		Swivel the platform anti-clockwise (viewed from above)
Turn the toggle switch (Fig. 113/5) to the right		The working basket swivels clockwise (viewed from above)
Turn the toggle switch (Fig. 113/5) to the left		The working basket swivels anti-clockwise (viewed from above)



Fig. 114: Toggle switch for operating mode selection



- The speed of the functions can be adjusted by actuating the control levers slowly.
- The operating mode selector switch (Fig. 114) can be used to activate and deactivate the ramp function (moving softly into the final positions):
 - AUTO: Ramp function activated
 - Manual: Ramp function deactivated

Operation

6.9.3 Negotiating height differences on edges

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet



WARNING!

Risk of fatal injury due to incorrect operation!

The machine may topple if driven over excessively high height differences. This can cause serious or even fatal injuries.

- When driving over terrain with height changes, the crawler chassis must be retracted.
- Vacate the working basket before driving over ascents and drops.
- Never stand in the danger area (toppling range) of the machine.
- Adhere to the maximum height difference when driving over an edge (max. edge height $X = 100 \text{ mm}$ (Fig. 115)).
- Approach the edge at an angle as close to a right angle as possible.

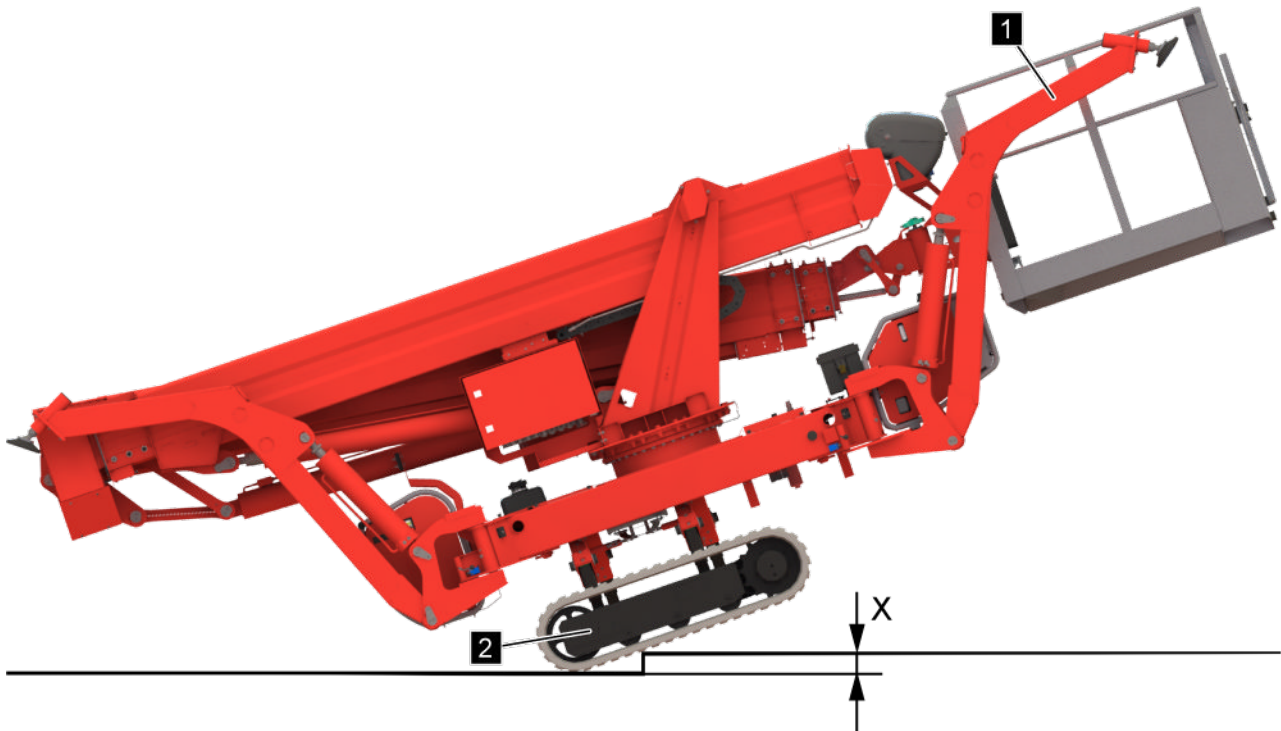


Fig. 115: Driving over edges

1. ➤ Retract the crawler chassis (Fig. 115/2) completely (↪ Chapter 6.11 'Crawler chassis height and width adjustment' on page 125).
2. ➤ Move the machine into transport position (↪ Chapter 6.10 'Moving the machine into transport position' on page 113).
3. ➤ Swivel outriggers 1 and 4 (Fig. 115/1) into the rear transport position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).
4. ➤ Make sure that the heights of the edges (Fig. 115/X) over which you wish to drive do not exceed 100 mm.
5. ➤ Approach the edge at an angle as close to a right angle as possible and drive over it slowly (↪ Chapter 6.6 'Moving the machine' on page 89).

Operation

6.10 Moving the machine into transport position

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet
■ Safety harness

Definition of transport position:

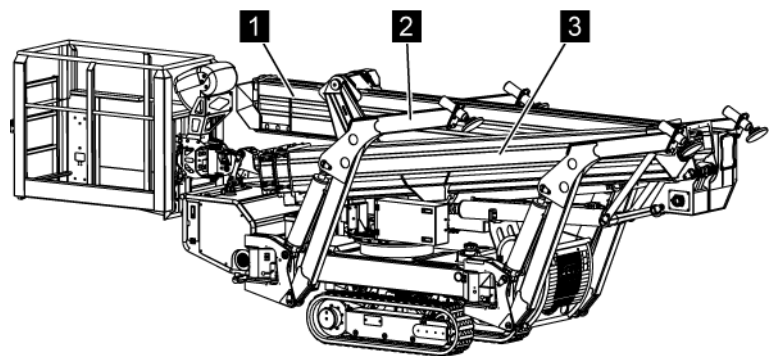


Fig. 116: Transport position

- The upper boom (Fig. 116/1) is on the transport support.
- The lower boom (Fig. 116/3) is on the transport support.
- The outriggers (Fig. 116/2) are retracted and in the transport position.



The rear outriggers (1 and 4) can also be aligned to the rear in the transport position.

Heed the following: The overall width is then > 0.98 m.

**WARNING!****Risk of injury when lowering!**

Due to uneven lowering of the outriggers, the machine can tip or slide. This can cause severe injuries and significant material damage.

- Always put the safety harness on when in the working basket.
- Always perform any work as a pair, with the help of a second person.
- Always observe the movement of the outriggers and of the chassis while retracting.
- Make sure that no limbs or supply lines are underneath the crawler chassis.
- Lower the machine evenly.

In order to move the machine in transport position, the outriggers can be retracted manually or automatically. The machine can be lowered either using the cable remote control or from the working basket, using the control panel.

6.10.1 Moving the machine into the transport position via the cable remote control

Manual lowering

**WARNING!****Risk of injury due to improper operation!**

Risk of injury for persons in the working basket, when operating the cable remote control.

- Only use the cable remote control if there is nobody in the working basket.
- Before operating the control panel in the working basket, disconnect the cable remote control from the machine and stow it in a safe place.

- 1.** ➞ Connect the cable remote control (🔗 *Chapter 6.2 'Connecting the cable remote control' on page 68*).
- 2.** ➞ Switch on the machine (🔗 *Chapter 6.3 'Switching the machine on/off' on page 69*).

Operation

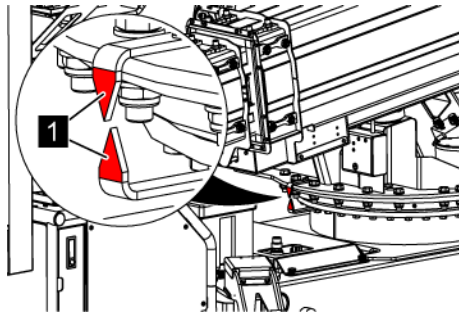


Fig. 117: Rotation indicator



Fig. 118: Function selection switch



Fig. 119: Operating mode selector switch

3. → Telescope in the upper boom and the lower boom (↪ Chapter 6.9 'Operating the machine' on page 106).
4. → Swivel the platform in the direction of the transport position (↪ Chapter 6.9 'Operating the machine' on page 106) so that both arrows (Fig. 117/1) on the rotation indicator are aligned with each other.
5. → Lower the lower boom completely (↪ Chapter 6.9 'Operating the machine' on page 106).
6. → Lower the upper boom completely (↪ Chapter 6.9 'Operating the machine' on page 106).
7. → Set the function selection switch (Fig. 118) on the cable remote control to the outrigger function (yellow).
8. → Set the operating mode selector switch (Fig. 119) to manual (hand symbol).

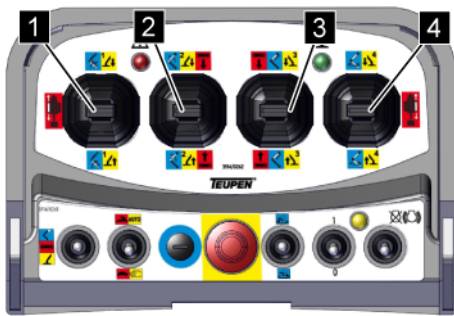






Fig. 120: Outrigger control levers

9. Use the control levers (Fig. 120/1 to 4) to operate the outriggers 1 to 4 as per the following table.

Operation	Symbol	Effect
Pull the control lever (Fig. 120/1) back.		Outrigger 1 is retracted.
Pull the control lever (Fig. 120/2) back.		Outrigger 2 is retracted.
Pull the control lever (Fig. 120/3) back.		Outrigger 3 is retracted.
Pull the control lever (Fig. 120/4) back.		Outrigger 4 is retracted.



The speed of the outriggers can be adjusted by actuating the control levers slowly.

10. Once all outriggers have been retracted, release the outriggers and swivel them into the transport position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).

Automatic lowering



WARNING!

Risk of injury due to improper operation!

Risk of injury for persons in the working basket, when operating the cable remote control.

- Only use the cable remote control if there is nobody in the working basket.
- Before operating the control panel in the working basket, disconnect the cable remote control from the machine and stow it in a safe place.

Operation

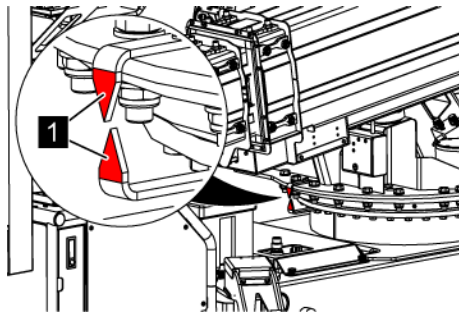


Fig. 121: Rotation indicator



Fig. 122: Function selection switch



Fig. 123: Operating mode selector switch

1. → Connect the cable remote control (↗ Chapter 6.2 'Connecting the cable remote control' on page 68).
2. → Switch on the machine (↗ Chapter 6.3 'Switching the machine on/off' on page 69).
3. → Telescope in the upper boom and the lower boom (↗ Chapter 6.9 'Operating the machine' on page 106).
4. → Swivel the platform in the direction of the transport position (↗ Chapter 6.9 'Operating the machine' on page 106) so that both arrows (Fig. 121/1) on the rotation indicator are aligned with each other.
5. → Rotate the working basket into the centre position (↗ Chapter 6.9 'Operating the machine' on page 106).
6. → Lower the lower boom completely (↗ Chapter 6.9 'Operating the machine' on page 106).
7. → Lower the upper boom completely (↗ Chapter 6.9 'Operating the machine' on page 106).
8. → Set the function selection switch (Fig. 122) on the cable remote control to the outrigger function (yellow).
9. → Set the operating mode selector switch (Fig. 123) to automatic (AUTO).

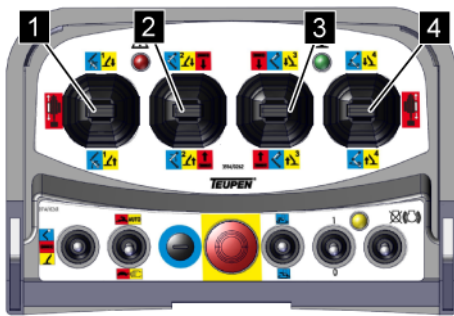






Fig. 124: Outrigger control levers

10. Use the control levers (Fig. 124/1 to 4) to operate the outriggers 1 to 4 as per the following table.

Operation	Symbol	Effect
Pull the control lever (Fig. 120/1, 2, 3 or 4) back.	   	All outriggers are retracted simultaneously.



The speed of the outriggers can be adjusted by actuating the control levers slowly.

11. Once all outriggers have been retracted, release the outriggers and swivel them into the transport position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).

6.10.2 Moving the machine into the transport position via the control panel

Manual lowering



Fig. 125: Home key

1. Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).



Optional "home key"

When you press the home key (Fig. 125), the platform automatically moves into the transport position. Steps 2 to 8 can be omitted in this case. Only the outriggers need to be retracted manually and swivelled into the transport position.

Operation

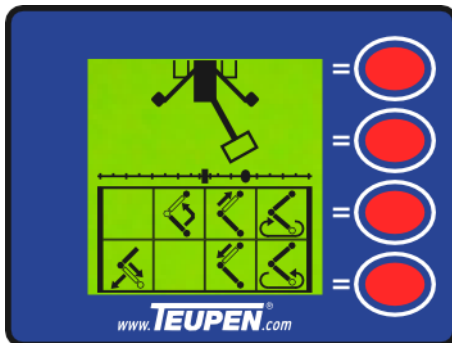


Fig. 126: Before transport position

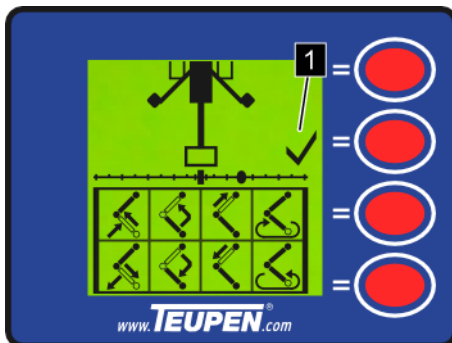


Fig. 127: Transport position

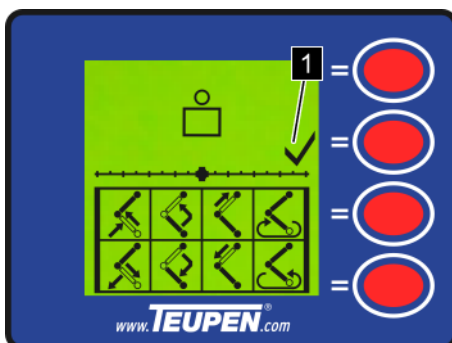


Fig. 128: Working basket transport position

2. ➤ Telescope in the upper and the lower boom (☞ Chapter 6.9 'Operating the machine' on page 106).
3. ➤ Swivel the platform in the direction of the transport position (☞ Chapter 6.9 'Operating the machine' on page 106).
4. ➤ Lower the lower boom completely (☞ Chapter 6.9 'Operating the machine' on page 106).
5. ➤ Lower the upper boom until it stops automatically (☞ Chapter 6.9 'Operating the machine' on page 106).
 ⇒ On the display screen the display (Fig. 126) appears.

6. ➤ Continue to swivel the platform in the direction of the transport position until the transport position is shown on display screen with a tick (Fig. 127/1).

7. ➤ Continue to swivel the working basket in the direction of the transport position until the transport position is shown on display screen with a tick (Fig. 128/1).
8. ➤ Lower the upper boom into the transport position (☞ Chapter 6.9 'Operating the machine' on page 106).

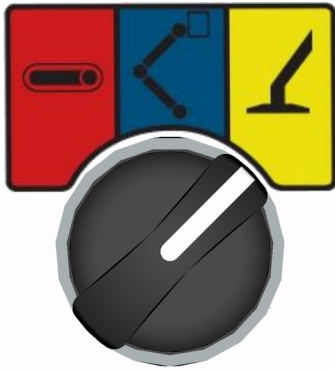


Fig. 129: Outrigger function

- 9.** → Set toggle switch (Fig. 129) on control panel to the outrigger function (yellow).



Fig. 130: Manual bracing

- 10.** → Set toggle switch (Fig. 130) to manual (hand symbol).

Operation



Fig. 131: Outrigger control levers

- 11.** Use the control levers (Fig. 131/1 to 4) to operate the outriggers 1 to 4 as per the following table.



CAUTION!

Risk of injury due to improper bracing!

When lowering and lifting the outriggers in the transport position, there is a risk of the outriggers colliding with components of the machine (profile package, control cabinets, working basket). This can cause severe injuries and material damage.

- Make sure that no people are in the danger zone when moving into transport position.

Operation	Symbol	Effect
Pull the control lever (Fig. 131/1) back.		Outrigger 1 is retracted.
Pull the control lever (Fig. 131/2) back.		Outrigger 2 is retracted.
Pull the control lever (Fig. 131/3) back.		Outrigger 3 is retracted.
Pull the control lever (Fig. 131/4) back.		Outrigger 4 is retracted.



The speed of the outriggers can be adjusted by actuating the control levers slowly.

- 12.** Once all outriggers have been retracted, release the outriggers and swivel them into the transport position (Chapter 6.7 'Setting the working position of the outriggers' on page 96).

Automatic lowering



Fig. 132: Home key

1. → Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).



Optional "home key"

When you press the home key (Fig. 132), the platform automatically moves into the transport position. Steps 2 to 8 can be omitted in this case. Only the outriggers need to be retracted and swivelled into the transport position.

2. → Telescope in the upper and lower booms (↪ Chapter 6.9 'Operating the machine' on page 106).
3. → Swivel the platform in the direction of the transport position (↪ Chapter 6.9 'Operating the machine' on page 106).
4. → Lower the lower boom completely (↪ Chapter 6.9 'Operating the machine' on page 106).
5. → Lower the upper boom until it stops automatically (↪ Chapter 6.9 'Operating the machine' on page 106).
 - ⇒ On the display screen the display (Fig. 133) appears.

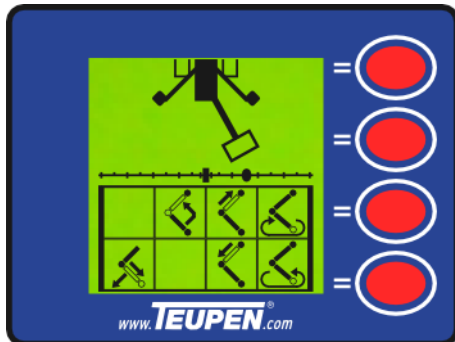


Fig. 133: Before transport position

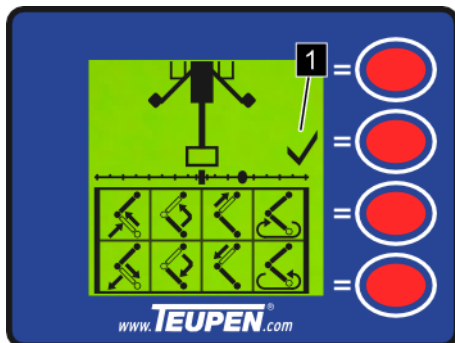


Fig. 134: Transport position

6. → Continue to swivel the platform in the direction of the transport position until the transport position is shown on display screen with a tick (Fig. 134/1).

Operation

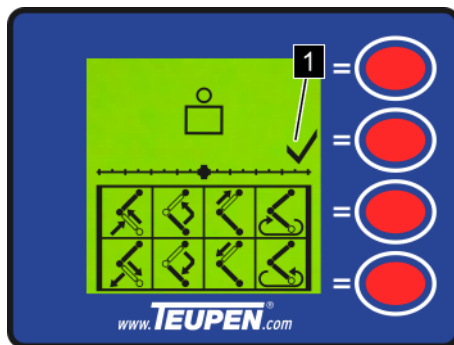


Fig. 135: Working basket transport position

7. → Continue to swivel the working basket in the direction of the transport position until the transport position is shown on display screen with a tick (Fig. 135/1).
8. → Lower the upper boom into the transport position (↪ Chapter 6.9 'Operating the machine' on page 106).

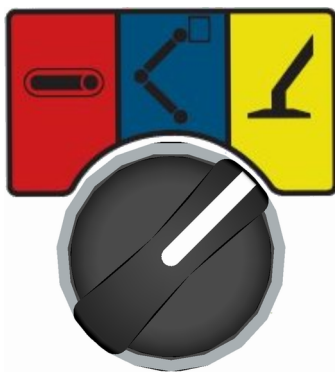


Fig. 136: Outrigger function

9. → Set toggle switch (Fig. 136) on control panel to the outrigger function (yellow).







Fig. 137: Automatic bracing

10. → Set toggle switch (Fig. 137) to automatic (AUTO).



Fig. 138: Outrigger control levers

- 11.** Use the control levers (Fig. 138/1 to 4) to operate the outriggers 1 to 4 as per the following table.

Operation	Symbol	Effect
Pull the control lever (Fig. 138/1, 2, 3 or 4) back.		All outriggers are retracted simultaneously.
		
		
		



The speed of the outriggers can be adjusted by actuating the control levers slowly.

- 12.** Once all outriggers have been retracted, release the outriggers and swivel them into the transport position (↺ Chapter 6.7 'Setting the working position of the outriggers' on page 96).

Operation

6.11 Crawler chassis height and width adjustment

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet



WARNING!

Danger of injury due to improper height/width adjustment!

With improper height/width adjustment, the machine can tip or slide. This can cause severe injuries and significant material damage.

- Only undertake height/width adjustment in the wide working position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).
- Always perform any work as a pair, with the help of a second person.

The height, and thus the width too, of the two crawler chassis can be adjusted independently. This can be performed mechanically or hydraulically (option).

6.11.1 Mechanical height/width adjustment

Extending the crawler chassis mechanically

1. ➤ Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
2. ➤ Put the outriggers in the working position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).

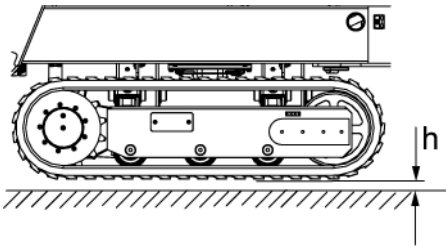


Fig. 139: Removing the load from the crawler chassis

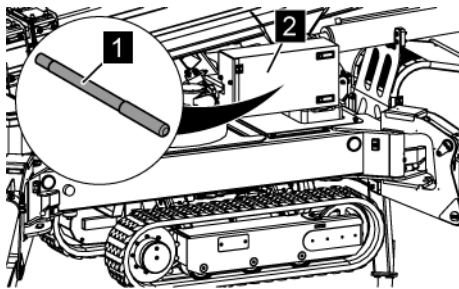


Fig. 140: Removing the hand pump lever

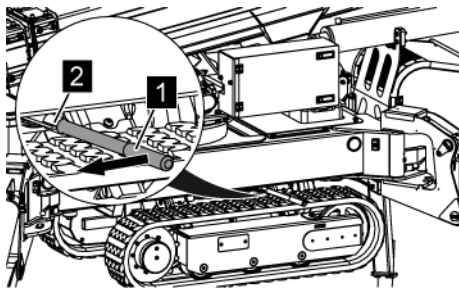


Fig. 141: Inserting the hand pump lever

3. → Raise the machine using the outriggers so that the crawler chassis is relieved of its load (Fig. 139/h = max. 20 mm) (↪ Chapter 6.8 'Putting machine in work position' on page 98).

4. → Remove the hand pump lever (Fig. 140/1) from the hydraulic control box (Fig. 140/2).

5. → Connect the hand pump lever (Fig. 141/1) to the locking mechanism (Fig. 141/2).



WARNING!

Risk of injury from crushing between crawler chassis and ground!

When operating the height adjustment mechanism, there is a risk of severe injuries from crushing between the crawler chassis and the ground.

- Make sure that there are no limbs between the crawler chassis and the floor.

6. → Unfasten the locking mechanism by pushing the hand pump lever (Fig. 141/1) in the direction of the arrow.

⇒ The crawler chassis on the opposite side slips out onto the ground.

7. → Carefully lower both the outriggers on the side of the crawler chassis which is to be extended (thus raising the chassis on this side) so that the crawler chassis is no longer in contact with the ground and pushes out (↪ Chapter 6.8 'Putting machine in work position' on page 98).

8. → Allow the locking mechanism to engage in place at the desired telescopic height.

Operation

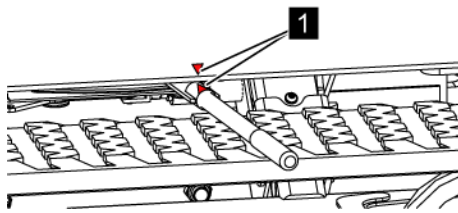


Fig. 142: Red arrows

Retracting the crawler chassis mechanically

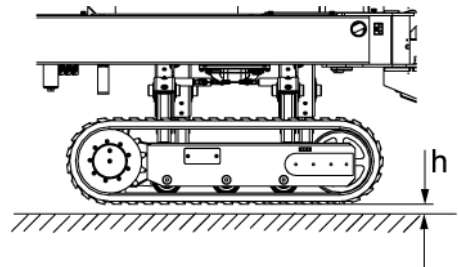


Fig. 143: Removing the load from the crawler chassis

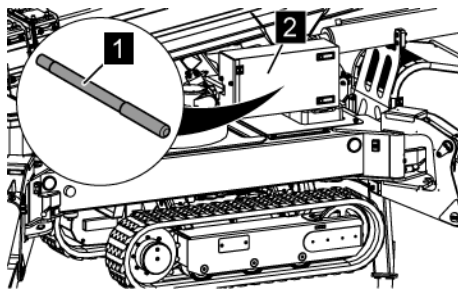


Fig. 144: Removing the hand pump lever

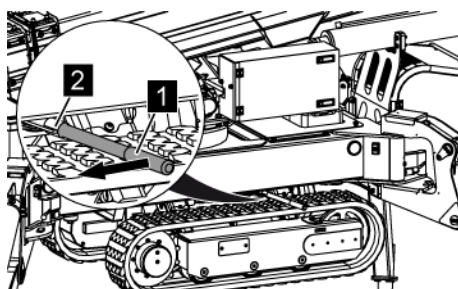


Fig. 145: Inserting the hand pump lever

9. ➔ Make sure that the locking mechanism has engaged properly in place. To do so, the hand pump lever must have been set back enough so that the two arrows (Fig. 142/1) are positioned one above the other.

1. ➔ Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).
2. ➔ Put the outriggers in the working position (↪ Chapter 6.7 'Setting the working position of the outriggers' on page 96).
3. ➔ Raise the machine using the outriggers so that the crawler chassis is relieved of its load (Fig. 143/h = max. 20 mm) (↪ Chapter 6.8 'Putting machine in work position' on page 98).

4. ➔ Remove the hand pump lever (Fig. 144/1) from the hydraulic control box (Fig. 144/2).

5. ➔ Connect the hand pump lever (Fig. 145/1) to the locking mechanism (Fig. 145/2).

**WARNING!****Risk of injury from crushing between crawler chassis and ground!**

When operating the height adjustment mechanism, there is a risk of severe injuries from crushing between the crawler chassis and the ground.

- Make sure that there are no limbs between the crawler chassis and the floor.

6. ➔ Unfasten the locking mechanism by pushing the hand pump lever in the direction of the arrow.
⇒ The crawler chassis on the opposite side slips out onto the ground.
7. ➔ Retract the two outriggers on the side of the crawler chassis which is to be retracted (thus lowering the chassis on this side) (↪ *Chapter 6.8 'Putting machine in work position' on page 98*).
8. ➔ Allow the locking mechanism to engage in place at the desired insertion height.
9. ➔ Make sure that the locking mechanism has engaged properly in place. To do so, the hand pump lever must have been set back enough so that the two arrows (Fig. 146/1) are positioned one above the other.

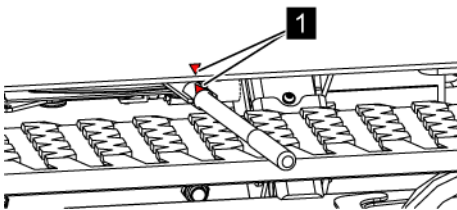


Fig. 146: Red arrows

6.11.2 Hydraulic height adjustment (option)

6.11.2.1 Retracting/extending the crawler chassis hydraulically via the cable remote control

1. ➔ Connect the cable remote control (↪ *Chapter 6.2 'Connecting the cable remote control' on page 68*).
2. ➔ Switch on the machine (↪ *Chapter 6.3 'Switching the machine on/off' on page 69*).

Operation



Fig. 147: Function selection switch

3. → Set the function selection switch (Fig. 147) on the cable remote control to the crawler chassis function (red).

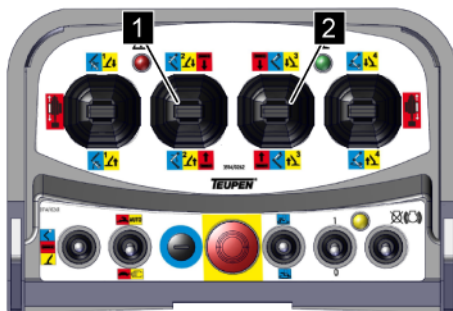


Fig. 148: Control levers for height adjustment

4. → Use the control levers (Fig. 148/1 and 2) to operate the crawler chassis as per the following table.



WARNING!

Risk of injury from crushing between crawler chassis and ground!

When operating the height adjustment mechanism, there is a risk of severe injuries from crushing between the crawler chassis and the ground.

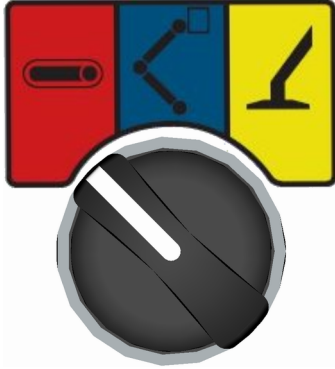
- Make sure that there are no limbs between the crawler chassis and the floor.

Operation	Symbol	Effect
Push the control lever (Fig. 148/1) forwards		The left-hand crawler chassis is extended
Pull the control lever (Fig. 148/1) back		The left-hand crawler chassis is retracted
Push the control lever (Fig. 148/2) forwards		The right-hand crawler chassis is extended
Pull the control lever (Fig. 148/2) back		The right-hand crawler chassis is retracted



The speed of extension for chain adjustment can be adjusted by actuating the control levers slowly.

6.11.2.2 Retracting/extending the crawler chassis hydraulically via the control panel



1. → Switch on the machine (↪ *Chapter 6.3 'Switching the machine on/off' on page 69*).
2. → Set the toggle switch (Fig. 149) on control panel to the crawler chassis function.

Fig. 149: Crawler chassis

Operation



Fig. 150: Control levers for height adjustment

3. Use the control levers (Fig. 150/1 and 2) to operate the crawler chassis as per the following table.



Make sure that there are no obstacles (kerb etc.) to the side of the chassis chains as they may stop adjustment of the chassis.

Operation	Symbol	Effect
Push the control lever (Fig. 150/1) forwards		The left-hand crawler chassis is extended
Pull the control lever (Fig. 150/1) back		The left-hand crawler chassis is retracted
Push the control lever (Fig. 150/2) forwards		The right-hand crawler chassis is extended
Pull the control lever (Fig. 150/2) back		The right-hand crawler chassis is retracted



The speed of extension for chain adjustment can be adjusted by actuating the control levers slowly.

6.11.2.3 Tips and recommendations for adjusting the crawler chassis hydraulically

In the following you will find useful tips for adjusting the crawler chassis:

- The hydraulic adjustment mechanism is designed for adjusting the height and width of the chassis without having to raise the chassis with the outriggers.
- If the chassis cannot be adjusted because of unfavourable ground conditions, the bracing system will have to be used (↗ Chapter 6.8 'Putting machine in work position' on page 98).
- The hydraulic adjustment power is limited in order to protect the machine and the chain chassis. On a solid surface, such as pavement, asphalt, compressed gravel or firm turf, height and lateral adjustments can be made for both one separate chain side and for both sides.
- On a sandy surface or soft grass, it is likely that the chassis chains will dig in one position depending on the extent of the adjustment and especially after being pulled out and pushed in several times.
- If the ground is not particularly hard, we recommend making the desired chassis adjustment beforehand on a solid surface or by using the bracing system (↗ Chapter 6.8 'Putting machine in work position' on page 98) to raise the chassis.

Operation

6.12 Replacing the working basket

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
 ■ Safety shoes
 ■ Safety helmet



We recommend that you carry out the work to replace the working basket as a pair with the help of a second person.

Removing the working basket

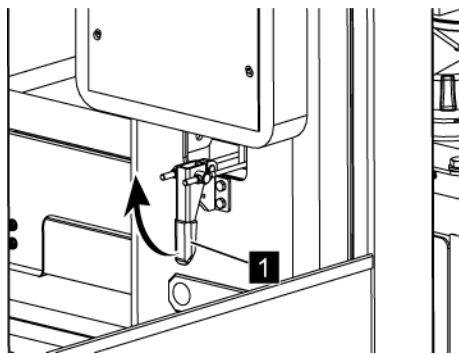


Fig. 151: Unfastening the clamp

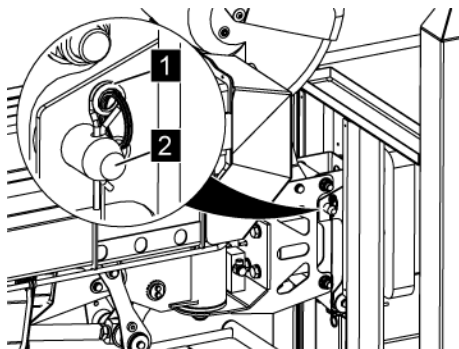


Fig. 152: Split pin

1. → Move the machine into the transport position (↪ Chapter 6.10 'Moving the machine into transport position' on page 113).
2. → Unfasten the clamp (Fig. 151/1).
3. → If the machine has optional "ladder monitoring", unfasten the plug connection underneath the control panel.
4. → 2nd person: Support the working basket at the front.
5. → Pull the split pin (Fig. 152/1) out of the basket bolt (Fig. 152/2).

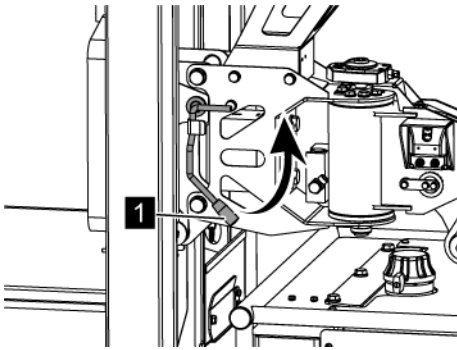


Fig. 153: Basket bolt

6. → Turn the basket bolt (Fig. 153/1) 90° anti-clockwise.

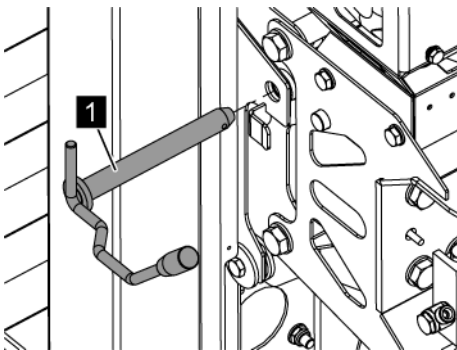


Fig. 154: Removing the basket bolt

7. → Pull out the basket bolt (Fig. 154/1).

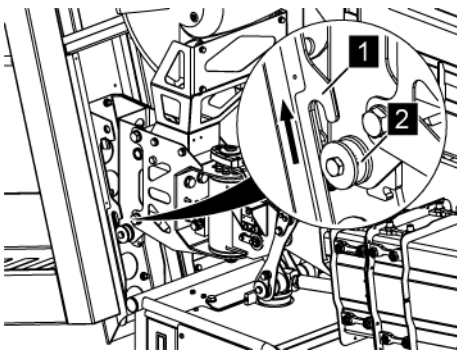


Fig. 155: Removing the working basket

8. → Working as a pair, tilt the working basket (Fig. 155/1) forwards a little and pull it out upwards from the holder (Fig. 155/2).

Operation

Installing the working basket

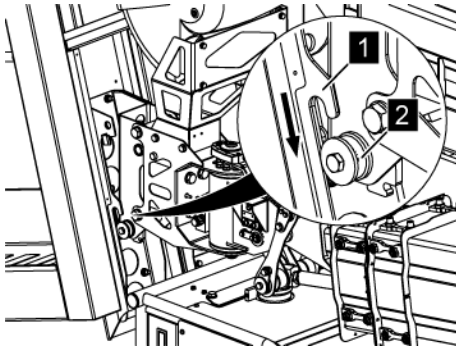


Fig. 156: Inserting the working basket

1. Working as a pair, insert the working basket (Fig. 156/1) into the holder (Fig. 156/2) and push it into the working basket mount.

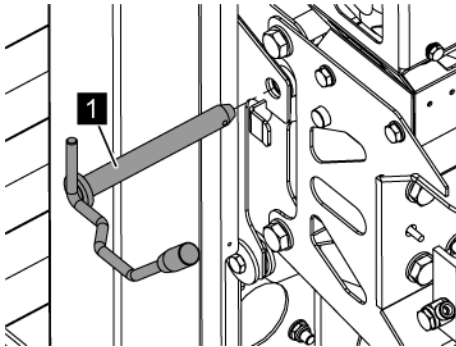


Fig. 157: Inserting the basket bolt

2. Insert the basket bolt (Fig. 157/1).

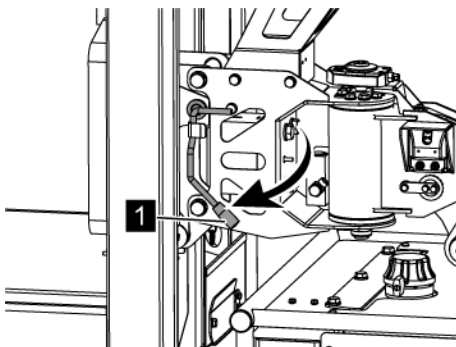


Fig. 158: Fastening the basket bolt

3. Turn the basket bolt (Fig. 158/1) 90° clockwise so that it engages in place.

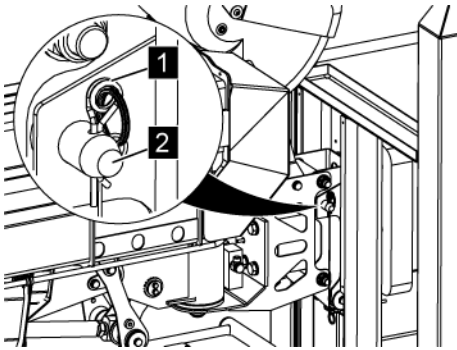


Fig. 159: Split pin

4. → Insert the split pin (Fig. 159/1) into the basket bolt (Fig. 159/2).
5. → If the machine has optional "ladder monitoring", connect the plug connection underneath the control panel.

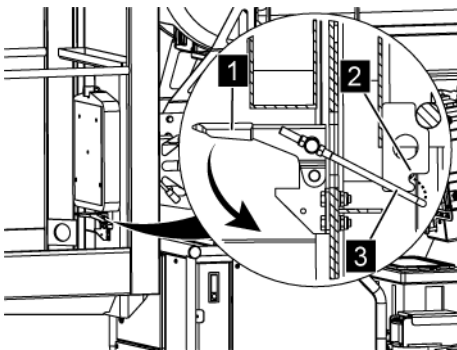


Fig. 160: Tensioning the working basket

6. → Tension the working basket. To do so, insert the shackle (Fig. 160/3) into the bracket (Fig. 160/2) and close the clamp (Fig. 160/1) by pushing it down.

Operation

6.13 Filling the fuel tank

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes



WARNING!

Risk of fire from improper refuelling!

There is a risk of fire from expelled vapours and spilled fuel.

- Shut the engine off before refuelling.
- Wear suitable gloves.
- Do not smoke when refuelling and make that fire and naked flames are kept away.
- Only refuel in well-ventilated areas or outdoors as expelled vapours may be inhaled.
- Never fill the fuel tank higher than the mark.
- Wipe up any spilled fuel or absorb it with suitable binding agent and dispose of it before starting up the combustion engine.

- 1.** → Make sure that the combustion engine is switched off (↪ *Chapter 6.3 'Switching the machine on/off' on page 69*).
- 2.** → Make sure that the aerial access platform is in a horizontal position.
- 3.** → Wear suitable gloves (diesel gloves, disposable gloves etc.).
- 4.** → Remove the fuel tank cap (Fig. 161/1) from the fuel tank by turning it anti-clockwise and keep it in a clean place.

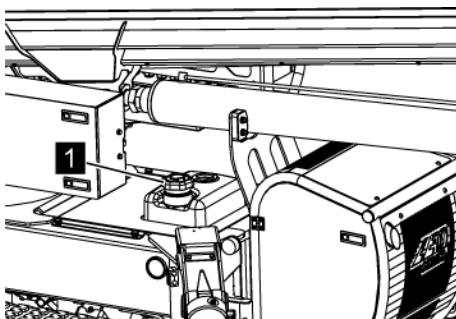


Fig. 161: Fuel tank cap

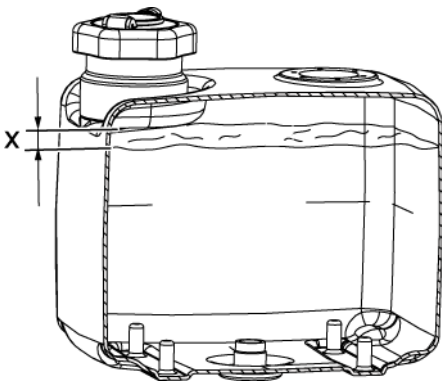


Fig. 162: Fuel filling level

5. → Top up the fuel tank to around $X = 2$ cm below the tank nozzle.
6. → Screw the fuel tank cap (Fig. 161/1) back on.
7. → Wipe up any spilled fuel as necessary before starting up the combustion engine.

6.14 Emergency mode

- | | |
|-----------------------|--------------------------------|
| Personnel: | ■ Trained people |
| Protective equipment: | ■ Occupational safety clothing |
| | ■ Safety shoes |
| | ■ Safety helmet |



WARNING!

Risk of injury due to missing safety devices!

In emergency mode, all the safety devices (e.g. limit switches) are disabled.

- Perform emergency operation as per the following instructions.

The aerial access platform has an emergency mode which enables you to operate the aerial access platform without the control panel or the lower control and without an energy supply.

Operation

6.14.1 Platform operation in emergency mode

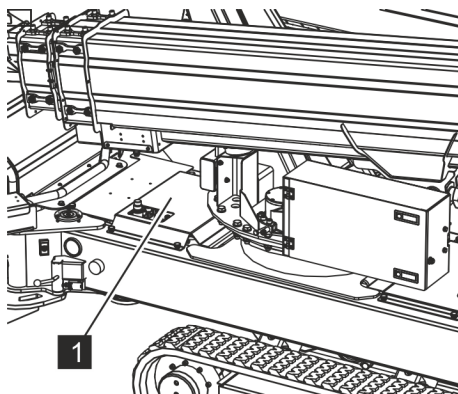


Fig. 163: Cover

1. ➔ Unscrew the cover (Fig. 163/1).

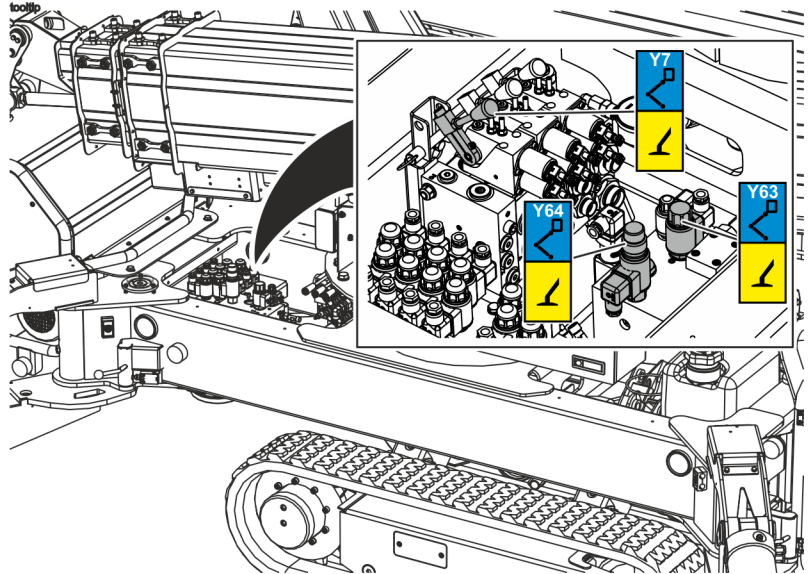


Fig. 164: Platform valves

2. ➔ Screw in the pressure relief valve (Fig. 164/Y64) completely.
3. ➔ Unscrew and remove the black cap (Fig. 164/Y63) from the release valve and completely screw out the valve actuator.
4. ➔ Pull the valve (Fig. 165/Y7) up.

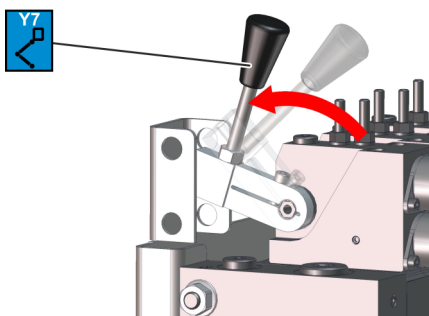


Fig. 165: Valve Y7

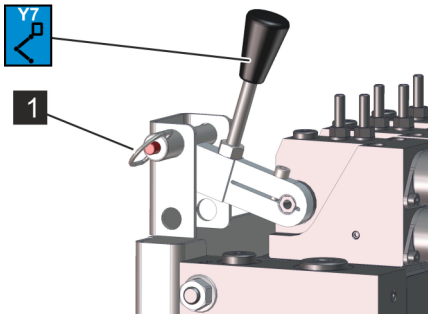


Fig. 166: Locking pin

5. → Lock the valve (Fig. 166/Y7) with the locking pin (Fig. 166/1).

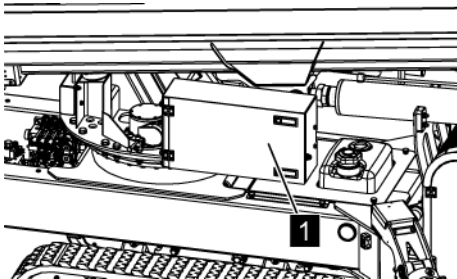


Fig. 167: Hydraulic control box

6. → Open the hydraulic control box (Fig. 167/1).

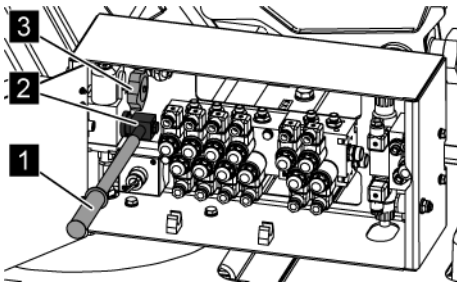


Fig. 168: Hand pump

7. → Connect the hand pump lever (Fig. 168/1) to the hand pump (Fig. 168/2).



The hand pump lever (Fig. 168/1) is situated in the hydraulic control box.

8. → Make sure that the hand wheel (Fig. 168/3) on the hand pump (Fig. 168/2) is closed.

Operation

9. ➔




WARNING!

Risk of injury due to improper operation!

The machine may topple or slip if platform mode is operated improperly. This can cause severe injuries and material damage.

- If there are people or objects in the working basket, keep it in a position as close to horizontal as possible.
- Always fully telescope in the booms all the way first.
- Swivel the platform into transport position.
- First lower the upper boom, then the lower boom into the transport position.

Actuate the desired valve as per  Chapter 6.16.1 'Valve assignment for platform' on page 155 by pushing it in and simultaneously pump up and down with the hand pump (Fig. 168/1) until the selected actuator has reached the desired position.



More than one valve can also be actuated simultaneously.

Information on the transport position

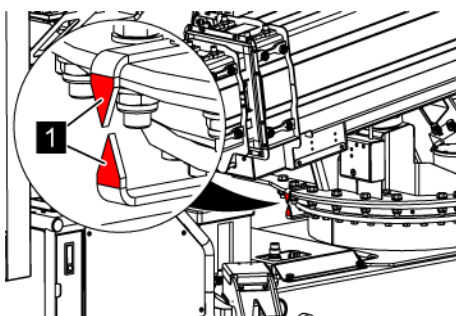


Fig. 169: Rotation indicator

10. ➔ Swivel the platform in the direction of the transport position so that both arrows (Fig. 169/1) on the rotation indicator are aligned with each other.

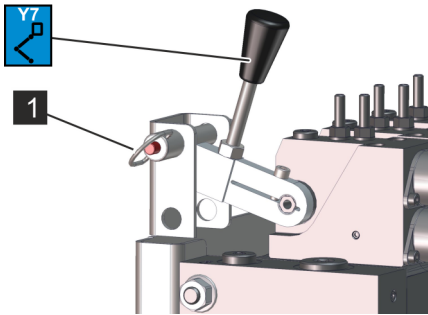


Fig. 170: Locking pin

- 11.** After emergency operation, remove the locking pin (Fig. 170/1) and move the valve (Fig. 170/Y7) into the centre position.

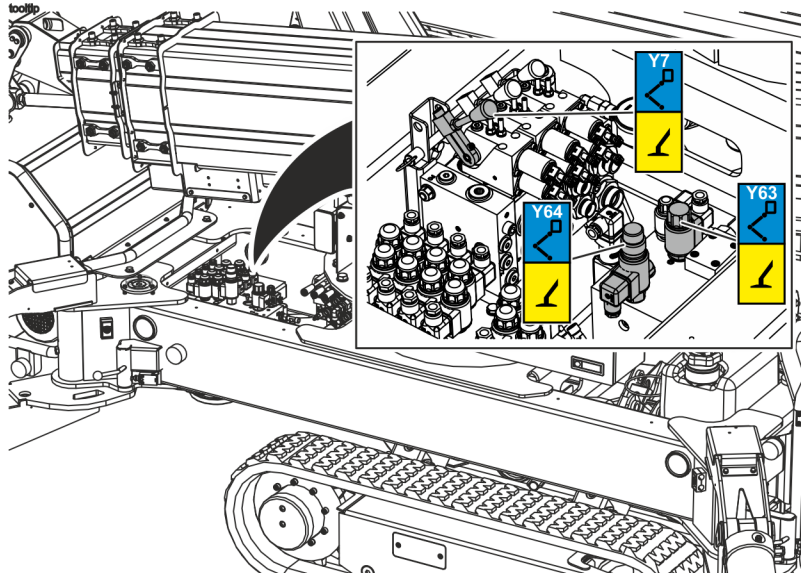


Fig. 171: Valves

- 12.** Completely screw in the release valve (Fig. 171/Y63).
- 13.** Completely screw out the pressure relief valve (Fig. 171/Y64).



WARNING!

Risk of injury due to uncontrolled movements!

If the valves are set incorrectly in normal mode, there is a risk of uncontrolled movements. This can cause severe injuries.

- Make sure that for normal mode the valves (Fig. 171/Y63, Y64 and Y7) are in the initial position.

Operation

6.14.2 Operate the outriggers in emergency mode



Work as a pair!

For outrigger operation in emergency mode, a second trained person is required.

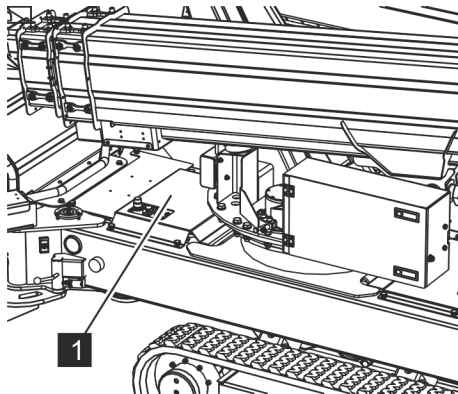


Fig. 172: Cover

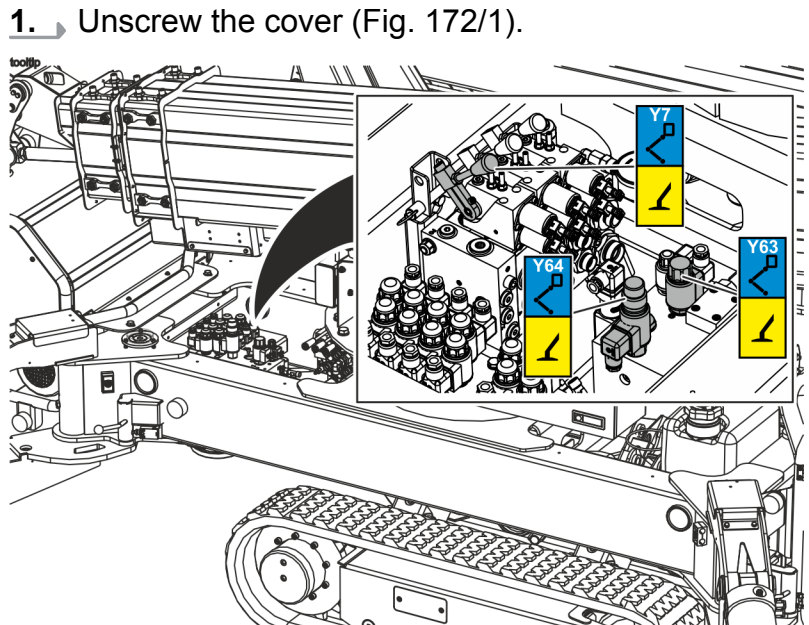


Fig. 173: Valves for outriggers

2. Trained person 1:

Completely screw in the pressure relief valve (Fig. 173/Y64).

3. Unscrew and remove the black cap (Fig. 173/Y63) from the release valve and completely screw out the valve actuator.

4. Push the valve (Fig. 173/Y7) down and hold it.

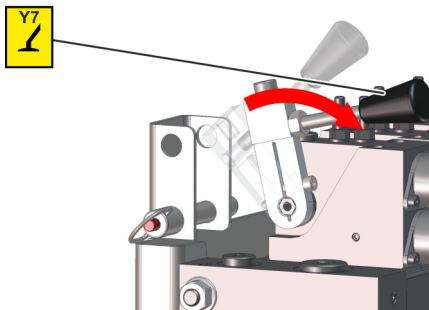


Fig. 174: Valve Y7 outrigger operation

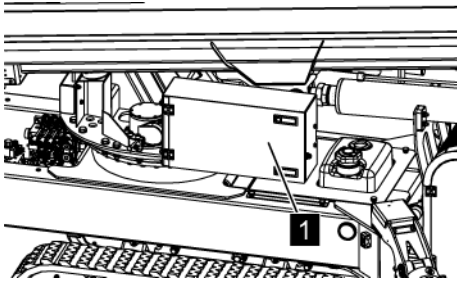


Fig. 175: Hydraulic control box

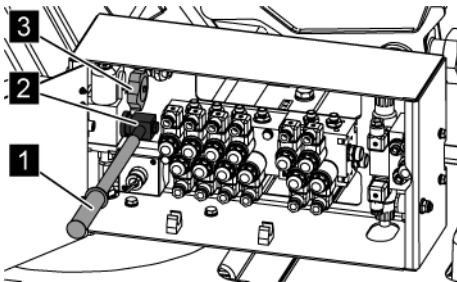


Fig. 176: Hand pump

5. → Trained person 2:

Open the hydraulic control box (Fig. 175/1).

6. → Connect the hand pump lever (Fig. 176/1) to the hand pump (Fig. 176/2).



The hand pump lever (Fig. 176/1) is situated in the hydraulic control box.

7. → Make sure that the hand wheel (Fig. 176/3) on the hand pump (Fig. 176/2) is closed.

8. →




WARNING!

Risk of injury due to improper operation!

The machine may topple or slip if outrigger mode is operated improperly. This can cause severe injuries and material damage.

- Keep the machine in a position as close to horizontal as possible when lowering.

Trained person 1:

Actuate the desired valve by pushing it in as per  Chapter 6.16.2 'Valve assignment for outriggers' on page 158.



More than one valve can also be actuated simultaneously.

9. → Trained person 2:

Pump up and down with the hand pump (Fig. 176/2) until the selected component has reached the desired position.

Operation

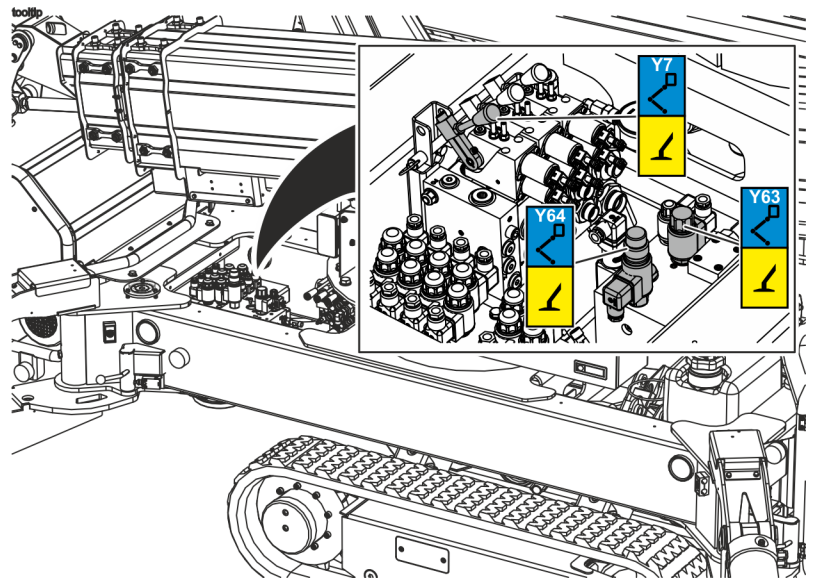


Fig. 177: Valves for outriggers

10. Trained person 1:

Release the valve (Fig. 177/Y7) after emergency mode.

11. Screw the release valve (Fig. 177/Y63) all the way in and completely unscrew and remove the pressure relief valve (Fig. 177/Y64).



WARNING!

Risk of injury due to uncontrolled movements!

If the valves are set incorrectly in normal mode, there is a risk of uncontrolled movements. This can cause severe injuries.

- Make sure that for normal mode the valves (Fig. 177/Y63, Y64 and Y7) are in the initial position.

6.15 Service mode

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety helmet

Definition of service operation

Operation of aerial access platform without safety functions, using only the hydraulic control without support of the control. Fully hydraulic operation with power supply from electric motor or combustion engine. In this case, use of the control is not intended since this can create problems.

Service operation is only permitted when the aerial access platform is in perfect technical condition. Service operation can be required or useful, for instance, during maintenance work.

The service operation is divided into platform, outrigger and chain function.



Service operation is not emergency operation!

6.15.1 Switching the machine on/off using the engine controller



The combustion engine must only be switched on and off using the key switch on the engine controller in service mode.

If the machine has the optional diesel engine:

The engine controller has an automatic preheating unit. When cold the combustion engine is preheated before it is started up. When at (warm) operating temperature, preheating is not required.

Operation

Starting the combustion engine



Fig. 178: Preheating

1. → For the optional diesel engine only:

Turn the key (Fig. 178/1) clockwise into the horizontal position as shown.

⇒ The engine is preheated. Wait for the preheating time to elapse and for the display Fig. 178/2 to switch to Fig. 179.



Fig. 179: Starting the combustion engine

2. → Turn the key (Fig. 179/1) clockwise and hold it in the diagonal position as shown until the engine starts up.

⇒ When the key is released, it jumps back into the horizontal position (Fig. 178).



The engine is secured mechanically to prevent it from starting up again immediately. It cannot be restarted again until the ignition key is turned back to the initial position (Fig. 180).

Stopping the combustion engine



Fig. 180: Stopping the combustion engine

- Turn the key (Fig. 180/1) anti-clockwise into the initial position as shown.

6.15.2 Platform operation in service mode



WARNING!

Risk of injury due to missing safety devices!

In service mode all the safety devices (e.g. limit switches) are disabled.

- Perform service mode as per the following instructions.

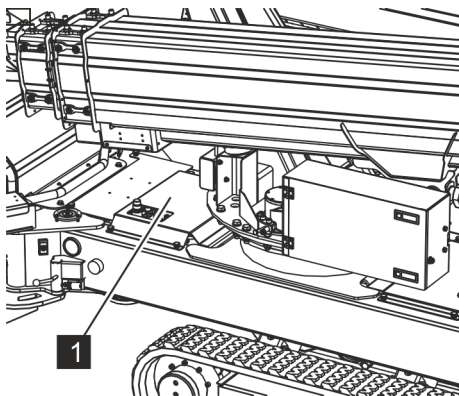


Fig. 181: Cover

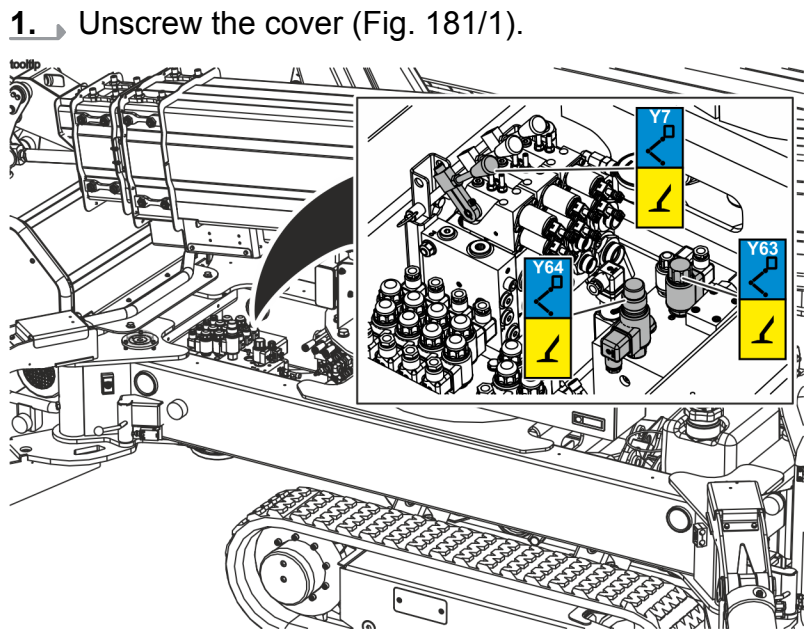


Fig. 182: Platform valves

1. ➔ Unscrew the cover (Fig. 181/1).
2. ➔ Completely screw in the pressure relief valve (Fig. 182/Y64).
3. ➔ Unscrew and remove the black cap (Fig. 182/Y63) from the release valve and completely screw out the valve actuator.
4. ➔ Pull the valve (Fig. 183/Y7) up.

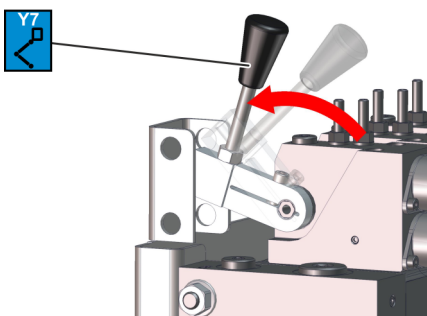


Fig. 183: Valve Y7

Operation

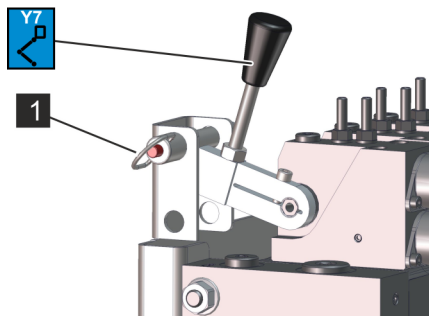


Fig. 184: Locking pin

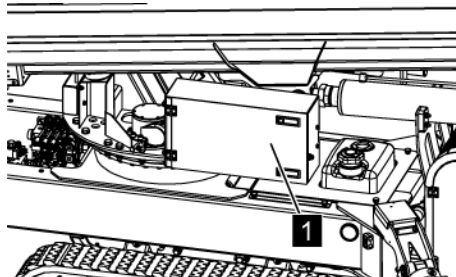


Fig. 185: Hydraulic control box

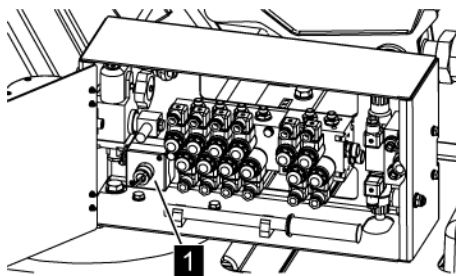


Fig. 186: Key switch

Information on the transport position

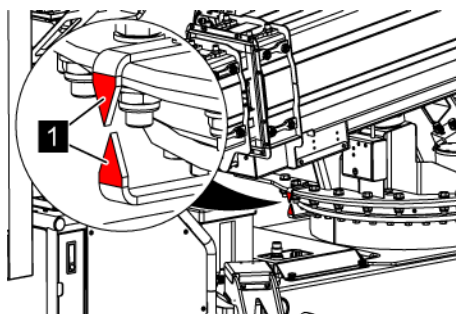


Fig. 187: Rotation indicator

5. → Lock the valve (Fig. 184/Y7) with the locking pin (Fig. 184/1).
6. → Switch on the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).

7. → Open the hydraulic control box (Fig. 185/1).

8. → Set the key switch (Fig. 186/1) to the "I" position.
9. → Actuate the desired valve (↪ Chapter 6.16.1 'Valve assignment for platform' on page 155) by pushing it in.



More than one valve can also be actuated simultaneously.

10. → Swivel the platform in the direction of the transport position so that both arrows (Fig. 187/1) on the rotation indicator are aligned with each other.

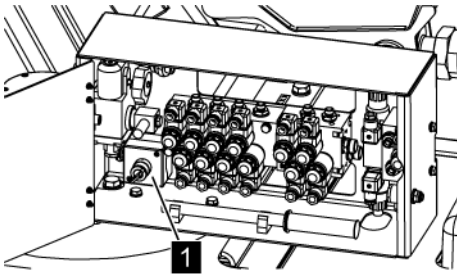


Fig. 188: Key switch

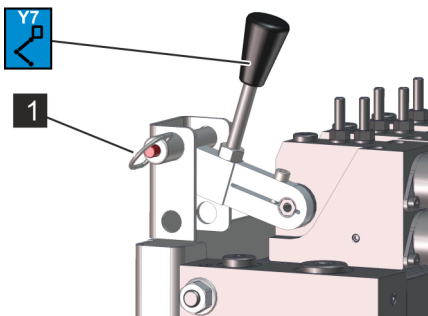


Fig. 189: Locking pin

11. After service mode, set the key switch (Fig. 188/1) to the "0" position.

12. Remove the locking pin (Fig. 189/1) and move the valve (Fig. 189/Y7) into the centre position.

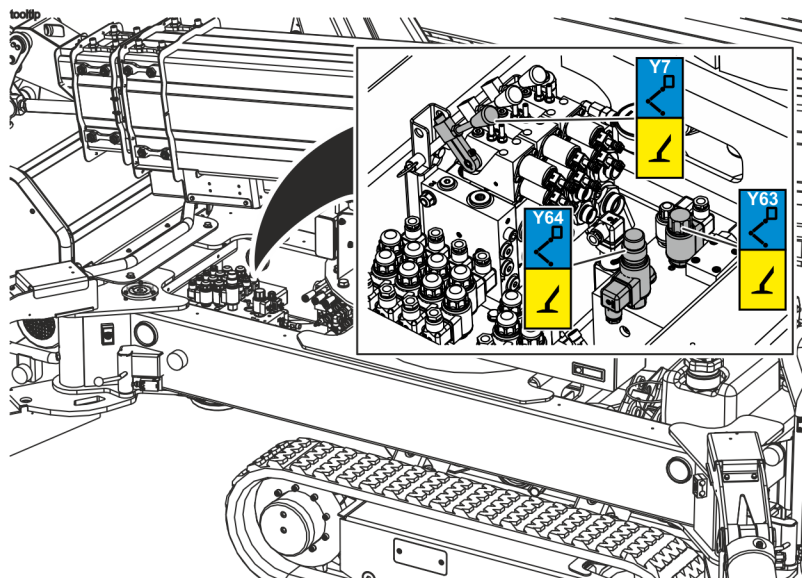


Fig. 190: Valves

13. Completely screw in the release valve (Fig. 190/Y63).
14. Completely screw out the pressure relief valve (Fig. 190/Y64).



WARNING!

Risk of injury due to uncontrolled movements!

If the valves are set incorrectly in normal mode, there is a risk of uncontrolled movements. This can cause severe injuries.

- Make sure that for normal mode the valves (Fig. 190/Y63, Y64 and Y7) are in the initial position.

Operation

6.15.3 Outrigger operation in service mode



Work as a pair!

For outrigger operation in service mode, a second trained person is required.

1. ➔ Switch on the machine (⚡ Chapter 6.3 'Switching the machine on/off' on page 69).
2. ➔ Unscrew the cover (Fig. 191/1).

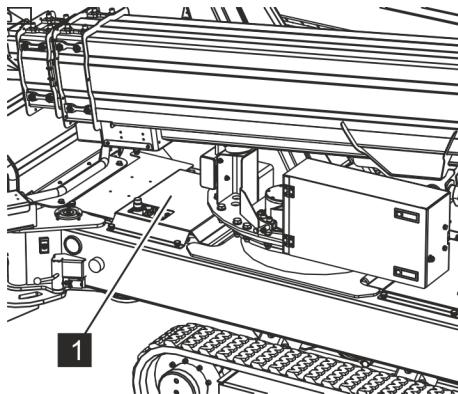


Fig. 191: Cover

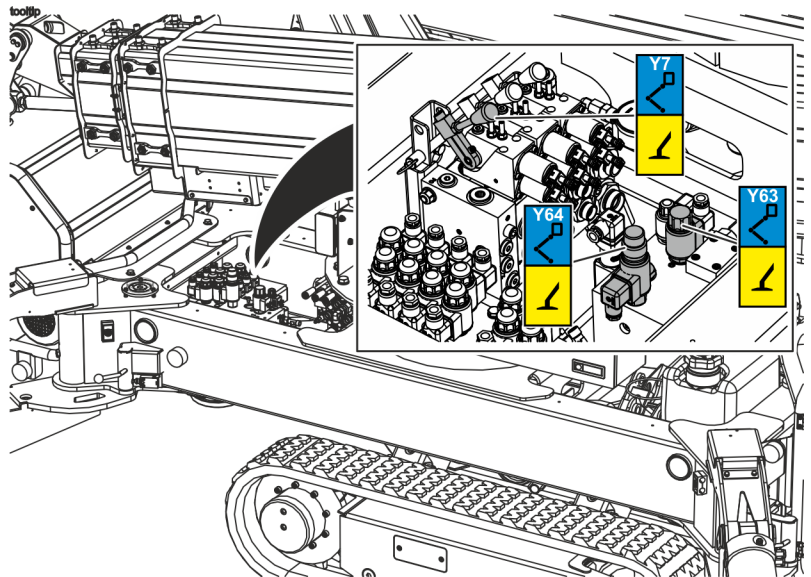


Fig. 192: Valves for outriggers

3. ➔ Trained person 1:

Completely screw in the pressure relief valve (Fig. 192/Y64).

4. ➔ Unscrew and remove the black cap (Fig. 192/Y63) from the release valve and completely screw out the valve actuator.
5. ➔ Push the valve (Fig. 193/Y7) down and hold it.

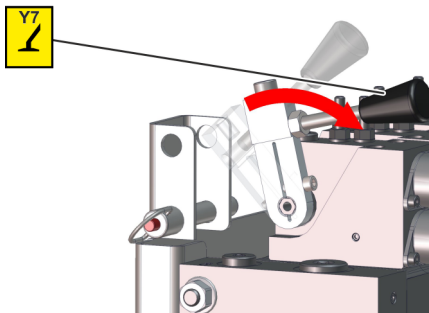


Fig. 193: Valve Y7 outrigger operation

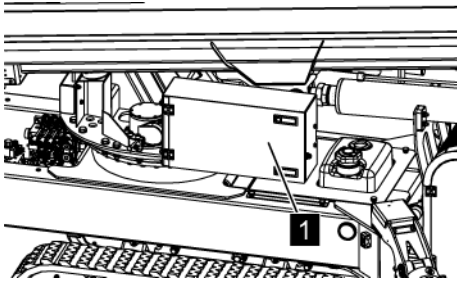


Fig. 194: Hydraulic control box

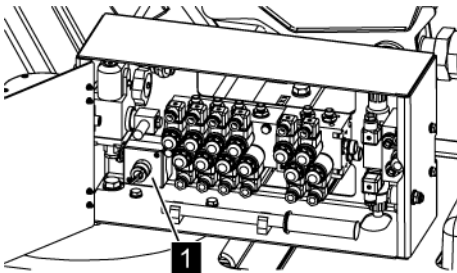


Fig. 195: Key switch

6. ➤ Trained person 2:

Open the hydraulic control box (Fig. 194/1).

7. ➤ Set the key switch (Fig. 195/1) to the "I" position.

8. ➤ Trained person 1:

Actuate the desired valve by pushing it in as per
👉 Chapter 6.16.2 'Valve assignment for outriggers' on page 158.



More than one valve can also be actuated simultaneously.

9. ➤ Trained person 2:

After service mode, set the key switch (Fig. 195/1) to the "0" position.

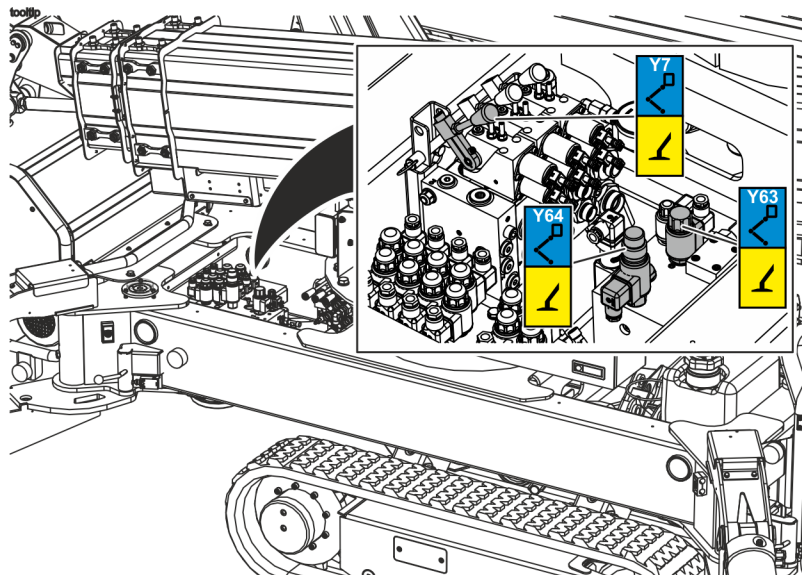


Fig. 196: Valves for outriggers

10. ➤ Trained person 1:

Release the control lever (Fig. 196/Y7).

Operation

11. ➤ Screw the release valve (Fig. 196/Y63) all the way in and completely unscrew and remove the pressure relief valve (Fig. 196/Y64).



WARNING!

Risk of injury due to uncontrolled movements!

If the valves are set incorrectly in normal mode, there is a risk of uncontrolled movements. This can cause severe injuries.

- Make sure that for normal mode the valves (Fig. 196/Y63, Y64 and Y7) are in the initial position.

6.15.4 Chain drive in service mode

1. ➤ Switch on the machine (⚡ Chapter 6.3 'Switching the machine on/off' on page 69).
2. ➤ Unscrew the cover (Fig. 197/1).

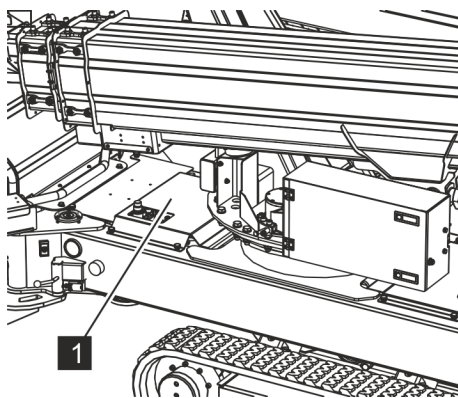


Fig. 197: Cover

3. ➤ Open the hydraulic control box (Fig. 198/1).

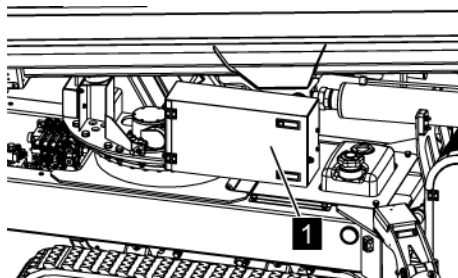


Fig. 198: Hydraulic control box

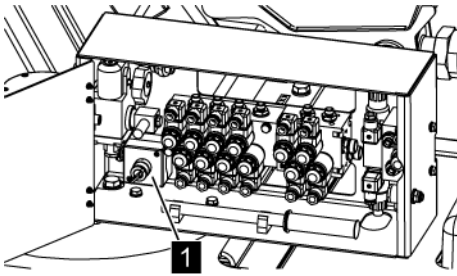


Fig. 199: Key switch

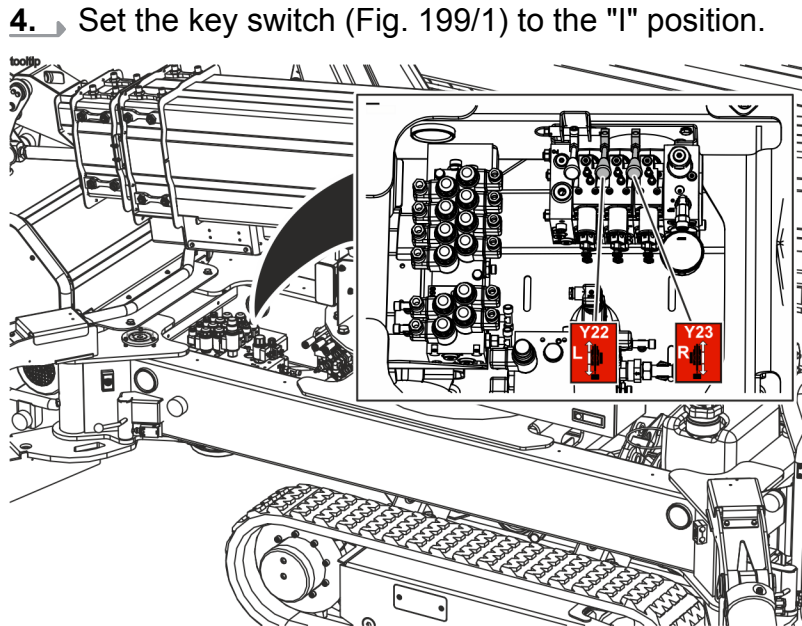




Fig. 200: Chain drive

5. Use the valves (Fig. 200/Y22 and Y23) to operate the crawler chassis:

Symbol	Description	
	Pull Y22 up	The left-hand crawler chassis runs in reverse
	Pull Y22 down	The left-hand crawler chassis runs forwards
	Pull Y23 up	The right-hand crawler chassis runs in reverse
	Pull Y23 down	The right-hand crawler chassis runs forwards

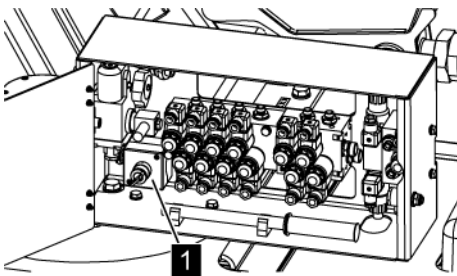


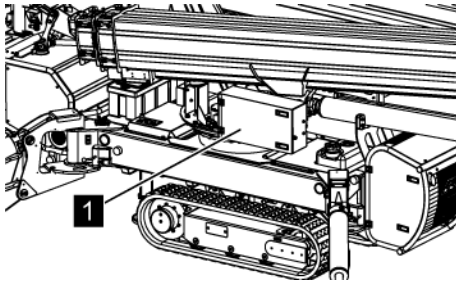
Fig. 201: Key switch

6. After service mode, set the key switch (Fig. 201/1) to the "0" position.

Operation

6.16 Valve assignments

6.16.1 Valve assignment for platform



The valves for platform operation are situated in the hydraulics control box (Fig. 202/1) on the right-hand side of the machine.

Fig. 202: Platform valves

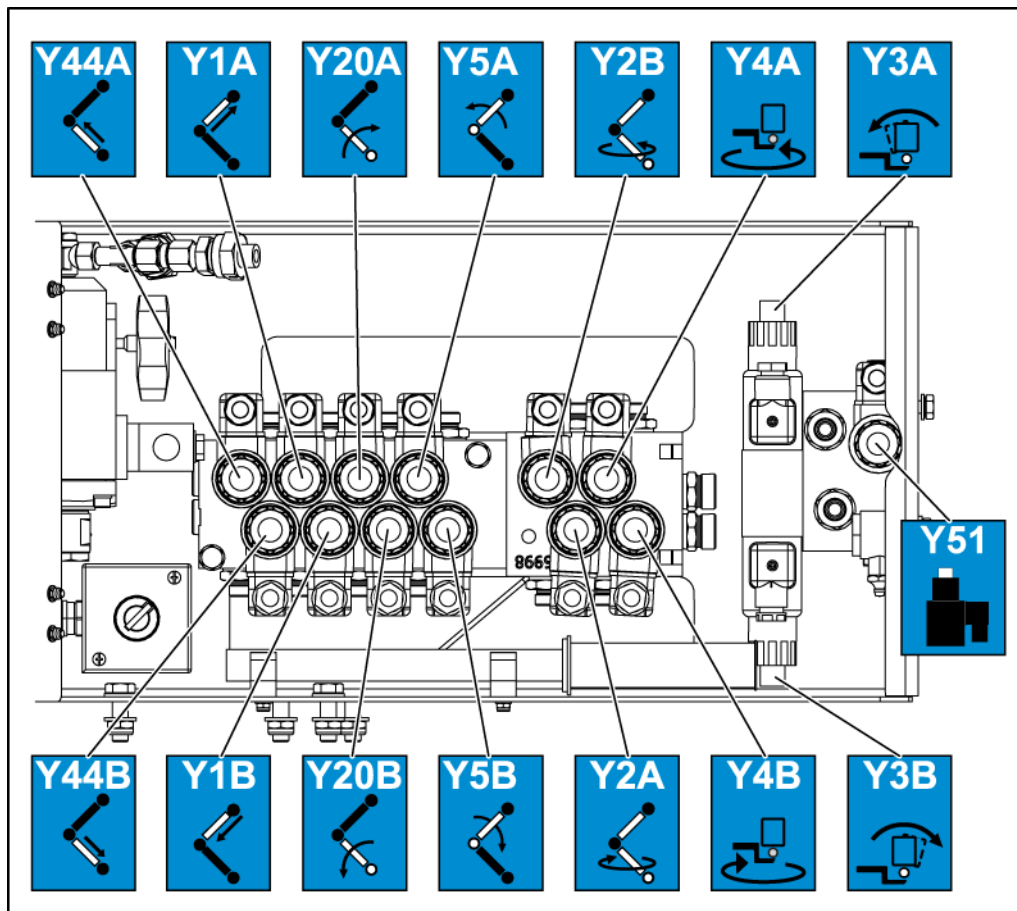











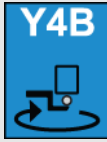





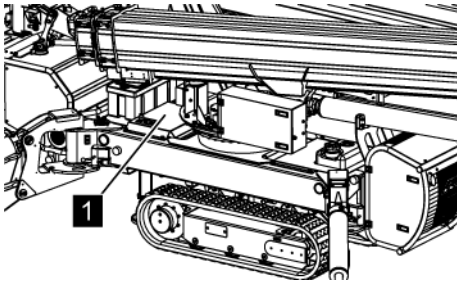
Fig. 203: Valve assignment for platform

Symbol	Description	Symbol	Description
	Telescope out the lower boom		Telescope in the lower boom
	Telescope out the upper boom		Telescope in the upper boom
	Raise the lower boom		Lower the lower boom
	Raise the upper boom		Lower the upper boom

Operation

Symbol	Description	Symbol	Description
	Pivot the platform anti-clockwise (viewed from above)		Pivot the platform clockwise (viewed from above)
	Pivot the working basket anti-clockwise (viewed from above)		Pivot the working basket clockwise (viewed from above)
	Tilt the working basket to the rear		Tilt working basket to the front
	The basket level release valve (only not required with hand pump; in service mode with electric motor, e.g. the release valve has to be pressed as well when adjusting the basket level)		

6.16.2 Valve assignment for outriggers



The valves for operating the outriggers are situated in the rear area of the chassis underneath the cover (Fig. 204/1).

Fig. 204: Valves for outriggers

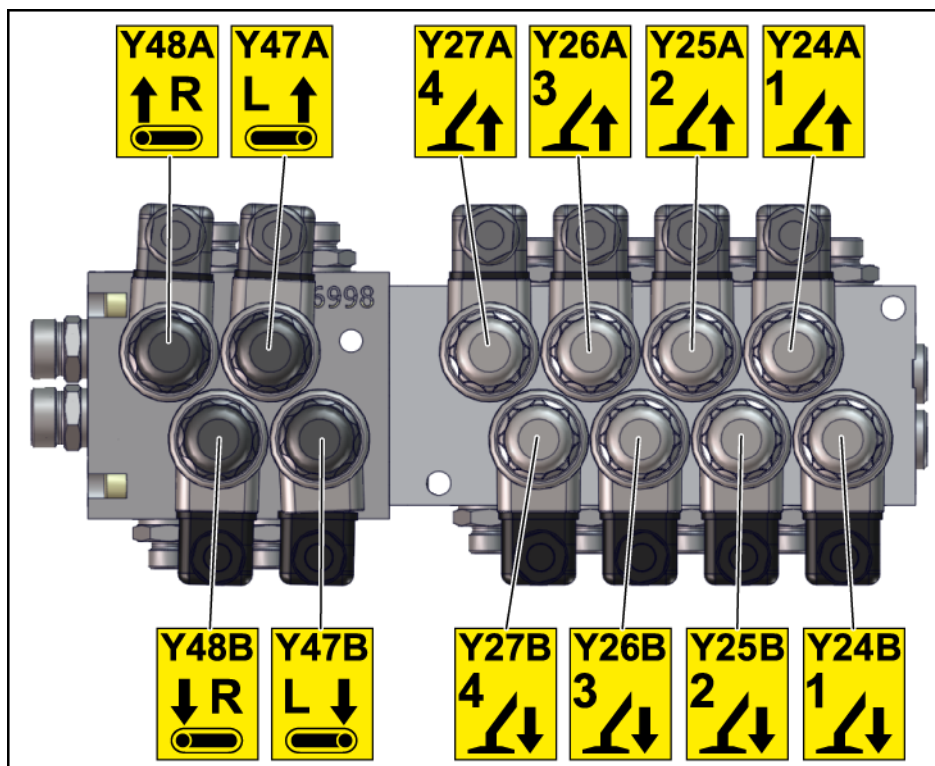



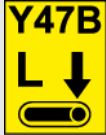




Fig. 205: Valve assignment for outriggers

Explanation of symbols for upper row of valves

Y48A	Y47A	Y27A	Y26A	Y25A	Y24A
The right-hand chassis is retracted	The left-hand chassis is retracted	Outrigger 4 is retracted	Outrigger 3 is retracted	Outrigger 2 is retracted	Outrigger 1 is retracted

Operation

Explanation of symbols for lower row of valves

					
The right-hand chassis is extended	The left-hand chassis is extended	Outrigger 4 is extended	Outrigger 3 is extended	Outrigger 2 is extended	Outrigger 1 is extended

6.17 Resetting the combination for the locks

The combination for the combination locks is set in the factory to match the last 3 digits of the serial number. In the following examples the serial number of the aerial access platform is 141123.

6.17.1 Resetting the combination on the shackle lock

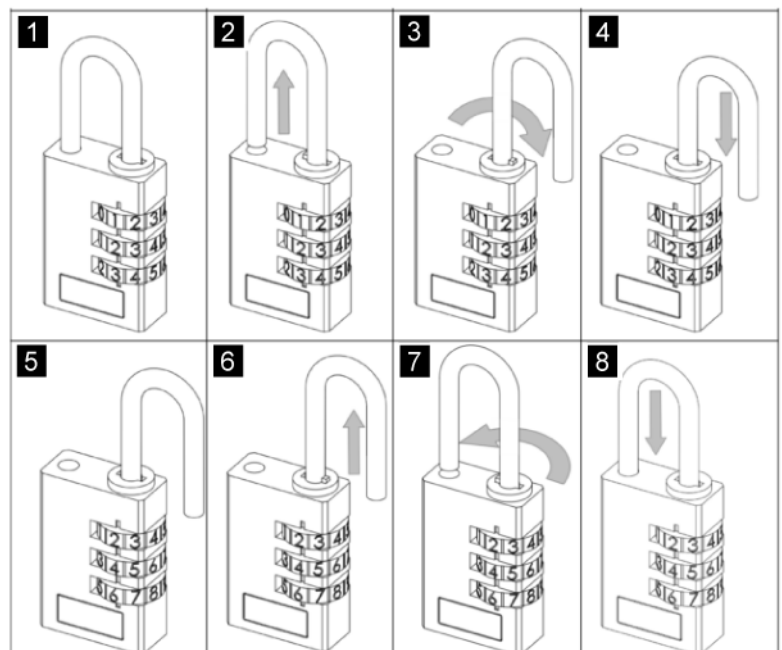


Fig. 206: Shackle lock

1. Set the last 3 digits of the serial number (in the example 123).
2. Pull up the shackle.

3. ➞ Turn the shackle 180°.
4. ➞ Push the shackle down.
5. ➞ Enter the desired new number (in the example 246).
6. ➞ Pull up the shackle.
7. ➞ Turn the shackle 180°.
8. ➞ Push the shackle down.

6.17.2 Resetting the combination for the combination lock on the control panel

Resetting the combination on the combination lock

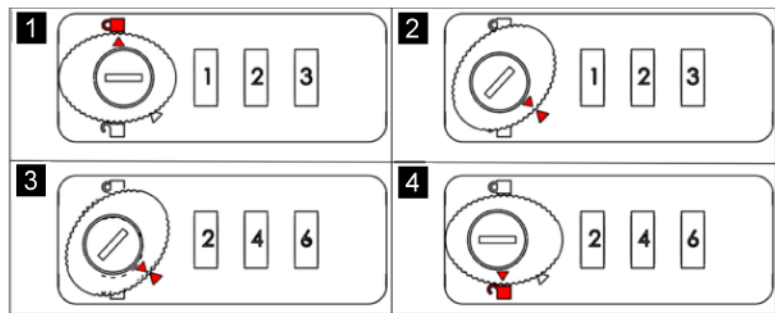


Fig. 207: Resetting the combination on the combination lock

1. ➞ Set the last 3 digits of the serial number (in the example 123).
2. ➞ Turn the operating knob anti-clockwise to the [arrow] symbol.
3. ➞ Enter the desired new number (in the example 246).
4. ➞ Turn the operating knob clockwise to the [open lock] symbol.

Operation

Finding a combination with a key

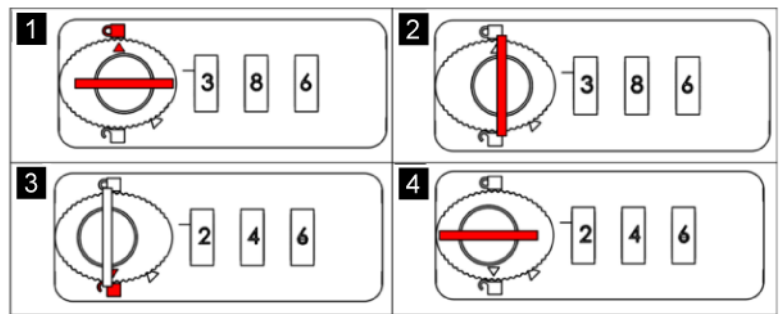


Fig. 208: Finding the combination for the combination lock

- 1.** ➤ Insert the key.
- 2.** ➤ Turn key by 90° clockwise.
- 3.** ➤ Leave the key in this position and turn the operating knob 180° anti-clockwise.
 ⇒ The combination lock sets the correct number combination automatically.
- 4.** ➤ Turn the key 90° and remove it.

Maintenance

7 Maintenance

7.1 Safety instructions for maintenance

Electrical system



DANGER!

Danger to life from electric power!

Contact with live parts may prove fatal. When switched on, electric components may be subject to uncontrolled movements and may cause grave injury.

- Switch off the power supply before starting work and make sure that it cannot be switched on again.

Securing to prevent restart



WARNING!

Danger to life from an unauthorised restart!

In the event of an unauthorised restart of the power supply during maintenance, there is a danger of serious injuries or death for persons in the danger zone.

- Switch off all power supplies before starting work and make sure they cannot be switched on again.

Improperly-executed maintenance work**WARNING!****Danger of injury due to improperly-executed maintenance work!**

Improper maintenance can cause severe injuries and significant property damage.

- Before starting work, ensure that there is sufficient assembly space.
- Make sure the assembly space is orderly and clean! Loosely-stacked components and tools or those left lying around are a source of accidents.
- Do not loosen connections sealed with yellow signal paint.
- If components have been removed, make sure they are assembled correctly, re-fit all fastening elements and adhere to screw tightening torques.
- Before recommissioning, heed the following points:
 - Make sure that all maintenance work is performed and completed according to the details and instructions in these instructions.
 - Make sure that there are no people in the danger zone.
 - Make sure that all covers and safety equipment are installed and functioning properly.

Exhaust gases**WARNING!****Danger to life from poisoning or suffocation due to exhaust gases!**

When inhaled, exhaust gases can lead to suffocation and cause severe poisoning as well as an illness of the respiratory system.

- Always ensure fresh air supply when working on the machine in combustion engine mode.
- Any person inhaling exhaust gases must be provided with fresh air immediately. Consult a physician.

Maintenance

Batteries



WARNING!

Danger of injury due to incorrect handling of batteries!

In case of batteries are improperly handled, there is the danger that the batteries can explode or that liquids that are hazardous to health can egress from the batteries. The liquid egressing can cause severe burns upon skin contact, severe poisoning upon swallowing and blindness in case it comes in contact with eyes.

- Never short circuit the contacts (positive and negative poles) of the batteries!
- Never use or store batteries in places where the atmosphere is explosive or where temperatures can rise excessively.
- Never attempt to solder batteries, to repair them, to change their form, to remodel them or to dismantle them.
- Always protect batteries from access by unauthorised persons.
- In order to avoid fires, overheating, explosions or escape of fluids, do not subject batteries to heavy vibrations or shocks, place heavy weights on them or subject them to other damaging exposures. Liquids which emanate from batteries can get inflamed.
- Avoid contact with escaping liquids.

Measures to be undertaken upon contact with battery liquids:

- Wash skin with plenty of water and soap after contact.
- Rinse out with clear water under the eyelids for at least 15 minutes after contact. While doing so, do not direct the stream of water directly on the eyes and do not rub. Immediately summon medical assistance.

Hot surfaces**WARNING!****Danger of injury due to hot surfaces!**

Surfaces of engine components can get heated up considerably during operation. Skin contact with hot surfaces causes severe burns to the skin.

- Avoid contact with engine components such as exhaust components, silencers, coolers, radiators, pipes and engine blocks.
- Check before all work on engine components, as to whether these are hot. If necessary, allow them to cool.

Hot operating materials**WARNING!****Danger of injury due to hot materials!**

Operating materials (coolant liquids or motor oils) can attain high temperatures in use. Skin contact with hot materials causes severe burns to the skin.

- Avoid contact with hot operating materials.
- Check before all work with operating materials, as to whether these are hot. If necessary, allow them to cool.

Anti freeze agents**WARNING!****Health danger of anti freeze agents**

The coolant of the diesel engine consists of a mixture of water and anti freeze agent. In case of body contact, swallowing or inhalation of aerosols, anti freeze agents can lead to severe health hazards.

- Avoid contact with anti freeze materials.
- Do not eat, drink or smoke while handling anti freeze materials. Wash hands before breaks and at the end of work.
- Always wear protective gloves while working with anti freeze agents.

Maintenance

Measures to be undertaken upon contact with anti freeze agents:

- Wash skin with plenty of water after contact.
- Rinse eyes thoroughly with water for at least 15 minutes and call a doctor.
- Rinse out mouth after swallowing and drink plenty of water afterwards. Summon a doctor.
- In case aerosols are inhaled, go out into fresh air.

Engine oil



WARNING!

Danger of injury through engine oil!

Engine oil contains poisonous substances which can cause inflammations and / or are carcinogenic.

- Avoid all skin contact with engine oil.
- In case of accidental skin contact, wash the hands or affected area immediately with soap. Do not ever use petrol, gasoline, solvents or other chemical cleaning agents.

Environmental protection

Observe the following environmental protection instructions during maintenance work:

- In respect of all lubrication points supplied manually with lubricant, remove any escaping, used or surplus grease and dispose of in accordance with applicable local regulations.
- Catch replaced oils in suitable containers and dispose of in accordance with applicable local regulations.

The following sections describe the maintenance work which is required to ensure the machine can be operated in the optimum manner and fault-free.

If increased wear is discovered during regular checks, the requisite maintenance intervals will need to be shortened to match the actual signs of wear. Contact the manufacturer if you have any questions regarding maintenance work or intervals, see the contact data on page 2.



Refer to the instructions in the appendix for information on maintenance work for the combustion engine (↪ Appendix C 'Combustion engines' on page 217).

7.2 Maintenance schedule



Refer to the operating instructions provided by the manufacturer when performing maintenance work on the combustion engine (↪ Appendix C 'Combustion engines' on page 217).

Maintenance

7.3 General maintenance schedule

Interval	Maintenance work	Personnel
As necessary	Tension the chain (↗ Chapter 7.4.2 'Tensioning the chain' on page 171)	Specialist staff
	Clean the machine (↗ Chapter 7.4.1 'Cleaning the machine' on page 170)	Trained people
After the first 50 operating hours	Re-tighten the fastening screws on the rotating assembly (↗ Chapter 7.4.9 'Rotating assembly tightening torques' on page 182)	Specialist staff
Every 50 operating hours	Grease the grease nipples on the rotating assembly, rotary drive and on the working basket levelling device (↗ Chapter 7.4.7 'Lubricating the rotary drive' on page 181 and ↗ Chapter 7.4.8 'Lubrication schedule' on page 181)	Specialist staff
	Lubricate the bolts (↗ Chapter 7.4.8 'Lubrication schedule' on page 181)	Specialist staff
	Check the hydraulic oil level (↗ Chapter 7.4.3 'Checking the hydraulic oil level' on page 173)	Specialist staff
Every 150 operating hours	Lubricate the boom section slide bearing (↗ Chapter 7.4.6 'Lubricating the boom section and ropes' on page 178)	Specialist staff
	Check the hydraulic hoses for damage and leaks	Specialist staff
	Check the energy supply chains for wear and damage	Specialist staff
Every 800 operating hours or annually	Re-tighten the fastening screws on the rotating assembly (↗ Chapter 7.4.9 'Rotating assembly tightening torques' on page 182)	Specialist staff
	Carry out annual maintenance as per the "-LEO maintenance- check list" (see the appendix of the machine file)	Expert
	Replace the hydraulic filter (↗ Chapter 7.4.5 'Replacing the hydraulic filter' on page 176)	Specialist staff
	Check the gear oil level (↗ Chapter 7.4.4 'Checking the gear oil for the chain chassis' on page 174)	Specialist staff
	Replace the filter insert (↗ Chapter 7.4.5 'Replacing the hydraulic filter' on page 176)	Specialist staff
	Check the rope break switches on the retraction and extension ropes to make sure they are working.	Specialist staff

Interval	Maintenance work	Personnel
	Check the retraction and extension ropes for damage.	Specialist staff
Every 6 years	Replace all hydraulic hoses	Hydraulics Specialist
Every 10 years	Replace the retraction and extension ropes.	Specialist staff

7.4 Maintenance work

7.4.1 Cleaning the machine

- Personnel: ■ Trained people
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes
■ Safety goggles



NOTICE!

Risk of material damage due to improper cleaning!

Improper cleaning can cause damage to the machine.


- Do not use any acid-based or aggressive cleaning agents.
- Remove all cleaning agents thoroughly with clear water.

- 1.** ➞ Pull the mains plug.
- 2.** ➞ Make sure that all covers are fitted properly.

Maintenance



Fig. 209: Do not use high-pressure cleaners

3. ➔ Remove coarse dirt with the high-pressure cleaner. Components (Fig. 209) with the respective marking must not be cleaned with the high-pressure cleaner.
4. ➔ Clean the machine with a sponge, acid-free household cleaner and a water hose.
5. ➔ After cleaning the machine, lubricate it as per  Chapter 7.4.8 'Lubrication schedule' on page 181.

7.4.2 Tensioning the chain

Personnel:	■ Specialist staff
Protective equipment:	■ Occupational safety clothing
	■ Safety shoes
Special tool:	■ Grease gun
Materials:	■ Multi-purpose lubricant (Item no. 3917/0095)

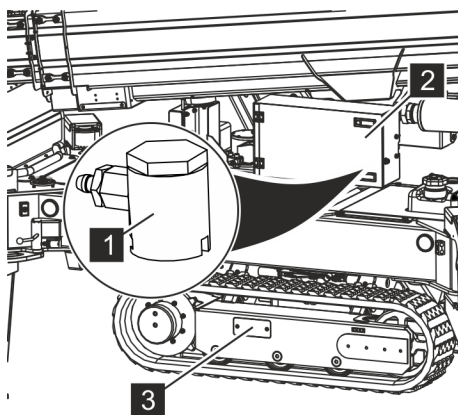



Fig. 210: Slide coupling

1. ➔ Move the machine into work position ( Chapter 6.8 'Putting machine in work position' on page 98). The machine must be braced completely and the chains may no longer touch the floor.
2. ➔ Remove the slide coupling (Fig. 210/1) from the hydraulic control box (Fig. 210/2).
3. ➔ Unscrew and remove the maintenance cover (Fig. 210/3).

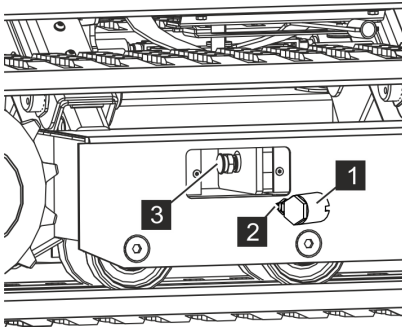


Fig. 211: Tensioning the chain

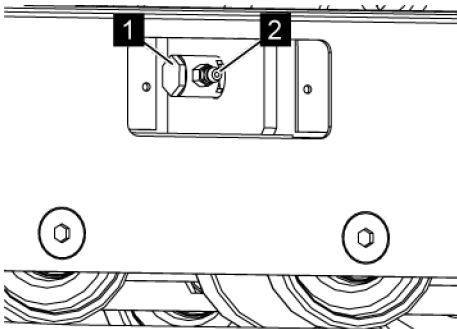


Fig. 212: Turning the slide coupling

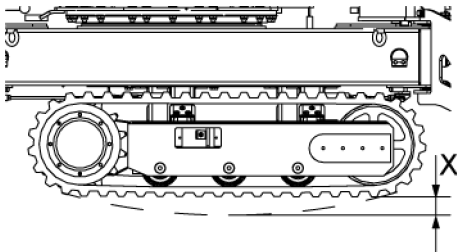


Fig. 213: Slack X

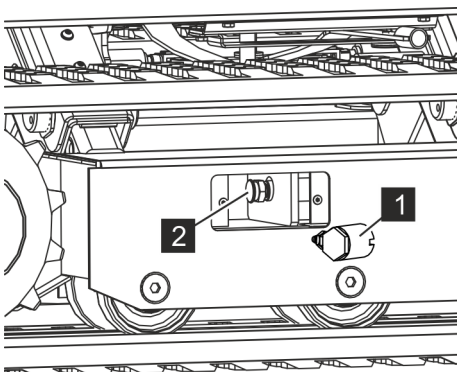


Fig. 214: Pulling out the slide coupling

4. → Push the slide coupling (Fig. 211/1) with the grease nipple (Fig. 211/2) in front onto the grease tension cylinder (Fig. 211/3).

5. → Turn the slide coupling (Fig. 212/1) by 180° clockwise until the grease nipple (Fig. 212/2) points outward.

6. → Apply a grease gun to the grease nipple (Fig. 212/2) and inject a sufficient quantity of multi-purpose grease (article no. 3917/0095) so that the chain slacks (Fig. 213/X) by 10–15 mm.

7. → Make sure that no lubricant escapes from the grease nipple (Fig. 212/2).

8. → Turn the slide coupling (Fig. 214/1) back by 180° anti-clockwise and pull it out of the grease tension cylinder (Fig. 214/2).

Maintenance

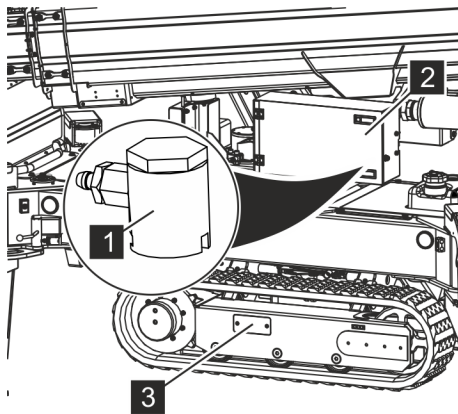


Fig. 215: Slide coupling

9. ➔ Stow the slide coupling (Fig. 215/1) back in the hydraulic control box (Fig. 215/2).
10. ➔ Screw the maintenance cover (Fig. 215/3) in place.

7.4.3 Checking the hydraulic oil level

Personnel:	■ Specialist staff
Protective equipment:	■ Occupational safety clothing
	■ Safety shoes
Materials:	■ Hydraulic oil (Item no. 3917/0066)



NOTICE!

Risk of material damage due to improper filling!

If the oil level is incorrect or if the incorrect hydraulic oil is used, the hydraulic system may fail or become damaged.

- Check the oil level regularly.
- Only use the specified oils (↪ Chapter 3.9 'Consumables' on page 43).
- Do not mix types of oil.

1. ➔ Move the machine into the transport position (↪ Chapter 6.10 'Moving the machine into transport position' on page 113).
2. ➔ Make sure that the machine is aligned horizontally.
3. ➔ Switch off the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).

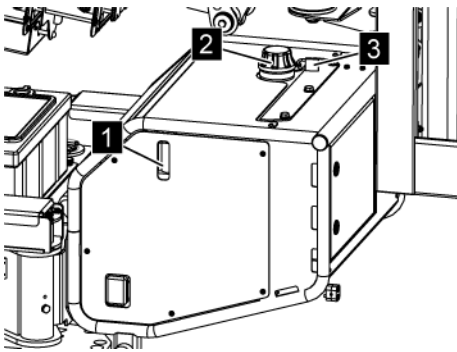


Fig. 216: Hydraulic oil

4. → Check the oil level at the inspection glass (Fig. 216/1).
5. → If necessary, top up the hydraulic oil (article no. 3917/0066) (↗ Chapter 3.9 'Consumables' on page 43). To do so, open the padlock (Fig. 216/3) with the corresponding key (↗ Chapter 4.6.1 'Keys' on page 56) and remove it.
6. → Unscrew and remove the lid (Fig. 216/2) from the hydraulic oil tank.
7. → Fill the hydraulic oil up to the maximum mark on the inspection glass (Fig. 216/1).
8. → Screw on the lid (Fig. 216/2) and secure it with the padlock (Fig. 216/3).

7.4.4 Checking the gear oil for the chain chassis

Personnel:	■ Specialist staff
Protective equipment:	■ Occupational safety clothing
	■ Safety shoes
Materials:	■ Gearbox oil (Item no. 3917/0130)



NOTICE!

Risk of material damage due to improper filling!

If the oil level is incorrect or the gear oil is incorrect, the gear unit may fail or become damaged.

- Check the oil level regularly.
- Only use the specified oils (↗ Chapter 3.9 'Consumables' on page 43).

Maintenance

The chain drives each have a separate gearbox. The following instructions apply for one gearbox.

1. → Move the machine into the transport position (☞ Chapter 6.10 'Moving the machine into transport position' on page 113).
2. → Align the machine so that the lower edge of the screw connection (Fig. 217/1) rests on the middle axis (Fig. 217/2) of the gearbox unit (Fig. 217/3).
3. → Make sure that the machine is aligned horizontally.
4. → Pull the mains plug.

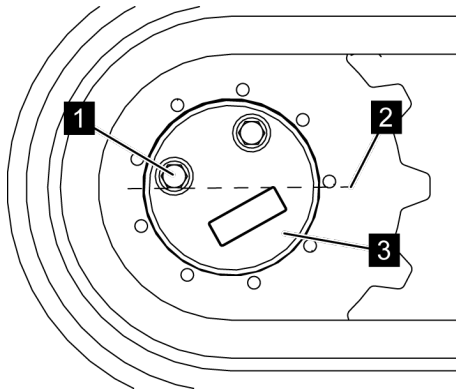


Fig. 217: Aligning the aerial access platform

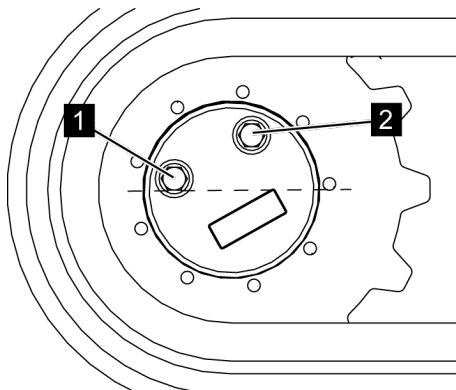


Fig. 218: Unscrewing the screw connections

5. → Unscrew the screw connections (Fig. 218/1 and 2).



If necessary, collect leaked gear oil and dispose of it properly.

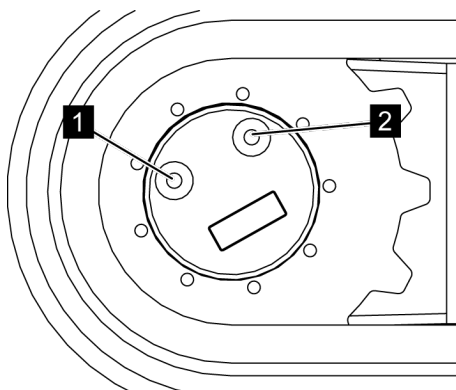
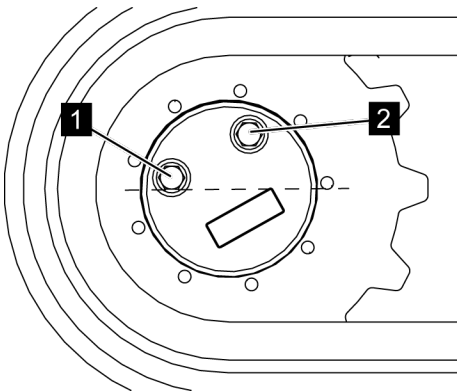


Fig. 219: Checking the oil level

6. → Check the oil level by sight. The gearbox must be filled with oil up to the bottom edge of the threaded hole (Fig. 219/1).
7. → If necessary, top up the gear oil (article no. 3917/0122) (☞ Chapter 3.9 'Consumables' on page 43). To do so, slowly top up the oil through the drilled hole (Fig. 219/2) until it reaches the bottom edge of the threaded hole (Fig. 219/1).
8. → Make sure that the seals and copper washers on the screw connections are in place and free of damage.



9. → Re-tighten the screw connections (Fig. 220/1 and 2) with the seals or copper washers.

Fig. 220: Tightening the screw connections

7.4.5 Replacing the hydraulic filter

- | | |
|-----------------------|---|
| Personnel: | ■ Specialist staff |
| Protective equipment: | ■ Occupational safety clothing |
| | ■ Safety shoes |
| Materials: | ■ Filter insert (article no. 3162/0053) |
| | ■ Filter insert (article no. 3162/0054) |

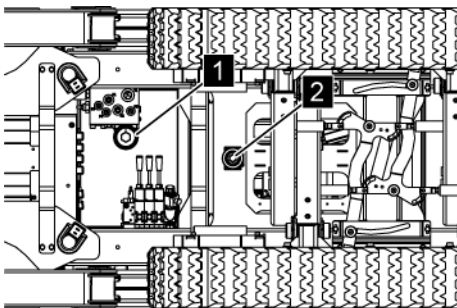


Fig. 221: Hydraulic filters

The hydraulic filters (Fig. 221/1 and 2) are situated at the rear of the machine and can be accessed from below the machine.

- 1 - Control block filter (3161/0031) with filter insert (3162/0053)
- 2 - Basket level filter (3161/0030) with filter insert (3162/0054)

The following describes how to replace the filter inserts using a hydraulic filter as an example.



The filter inserts can be ordered from the manufacturer. See page 2 for contact details.

Replacing the filter insert

1. → Move the aerial access platform into the transport position (↪ Chapter 6.10 'Moving the machine into transport position' on page 113).
2. → Switch off the machine (↪ Chapter 6.3 'Switching the machine on/off' on page 69).

Maintenance

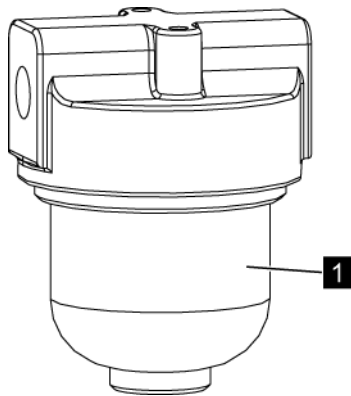


Fig. 222: Filter bowl

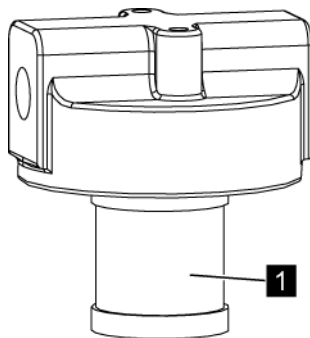


Fig. 223: Filter insert

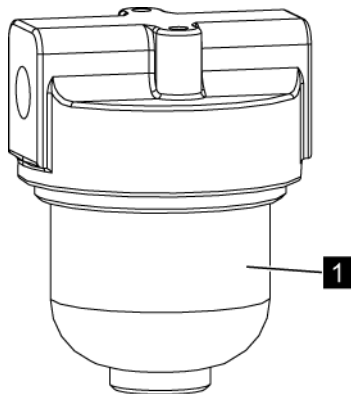


Fig. 224: Filter bowl

3. ➔ Place a suitable container for hydraulic oil underneath the filter bowl (Fig. 222/1).
4. ➔ Carefully unscrew the filter bowl (Fig. 222/1).
5. ➔ Collect leaked hydraulic oil and dispose of it properly.
6. ➔ Check the filter bowl (Fig. 222/1) for damage and clean it.

7. ➔ Remove the filter insert (Fig. 223/1) and insert a new filter insert.

8. ➔ Screw the filter bowl (Fig. 224/1) back in.
9. ➔ Check the hydraulic oil level (🔧 Chapter 7.4.3 'Checking the hydraulic oil level' on page 173).

7.4.6 Lubricating the boom section and ropes

Personnel:	■ Qualified personnel
Protective equipment:	■ Occupational safety clothing ■ Safety shoes
Materials:	■ Spray grease KL300 (article no. 3917/0036) ■ Grease MP 2/3 (article no. 3917/0103)

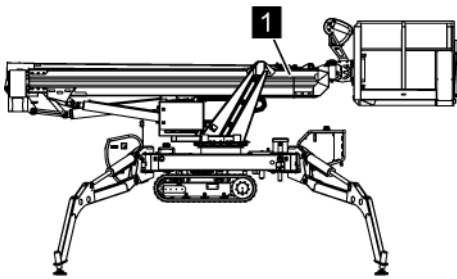


Fig. 225: Raising the upper boom

1. → Move the machine into the wide working position (↪ Chapter 6.8 'Putting machine in work position' on page 98).
2. → Raise the upper boom (Fig. 225/1) until it is positioned roughly horizontal (↪ Chapter 6.9 'Operating the machine' on page 106).
3. → Brace the upper boom section with a belt slip or with a cart.



WARNING!

Risk of injury if safety devices are deactivated!

Subsequent operation of the platform can only be performed in service mode (↪ Chapter 6.15 'Service mode' on page 146). In service mode all the safety devices are disabled.

- Adhere to the operating sequence below and follow the instructions precisely.

4. → Change to service mode (↪ Chapter 6.15 'Service mode' on page 146).

Maintenance

Lubricating the upper boom section and the retraction/extension ropes

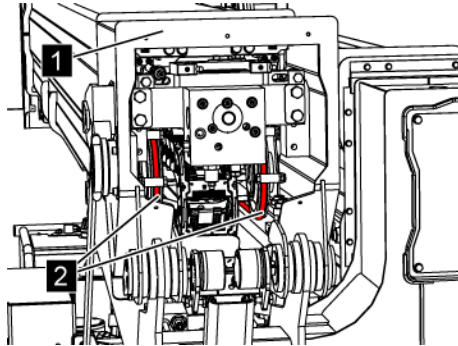


Fig. 226: Upper boom profile

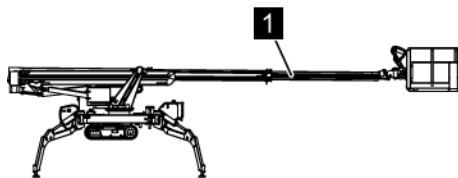


Fig. 227: Telescoping out the upper boom section

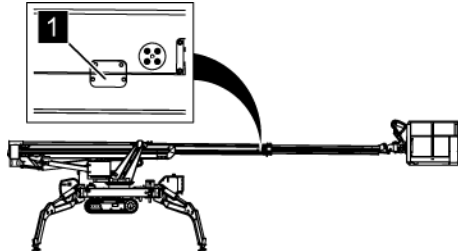


Fig. 228: Upper boom maintenance covers

5. ➤ Remove the maintenance flap from the upper boom profile (Fig. 226/1).



CAUTION!

Risk of crushing!

Do not reach into moving parts.

6. ➤ Whilst the upper boom is extending, spray KL300 spray grease (article no. 3917/0036) onto the ropes (Fig. 226/2).
7. ➤ Telescope out the upper boom section (Fig. 227/1) completely (⚠ Chapter 6.15 'Service mode' on page 146).
8. ➤ Clean the sliding surfaces of the upper boom section on all sides and then grease them on all sides with MP 2/3 grease (article no. 3917/0103).
9. ➤ Remove the maintenance covers (Fig. 228/1) from the maintenance opening on both sides of the upper boom.
10. ➤ Whilst the upper boom is retracting, spray KL300 spray grease (article no. 3917/0036) through the maintenance opening and onto the ropes.
11. ➤ Only telescope in the upper boom section enough so that the maintenance covers (Fig. 228/1) can remain fitted.
12. ➤ Fit the maintenance covers (Fig. 228/1) on both sides of the upper boom.
13. ➤ Telescope in the upper boom section (Fig. 227/1) completely (⚠ Chapter 6.15 'Service mode' on page 146).
14. ➤ Fit the maintenance flap on the upper boom profile.

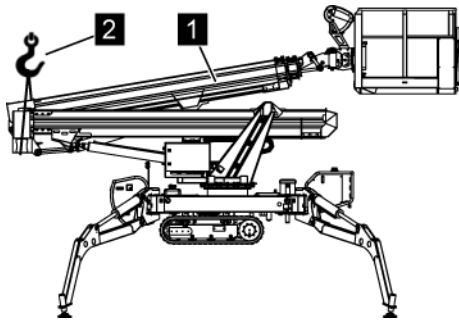
Lubricating the lower boom section

Fig. 229: Upper boom

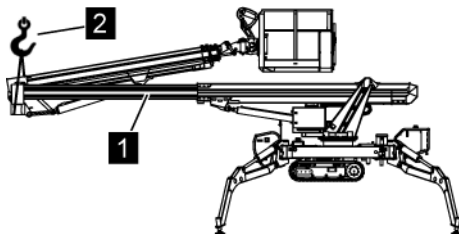


Fig. 230: Telescoping out the lower boom section

15. Raise the upper boom (Fig. 229/1) so that the working basket cannot collide with the lift boom holder when the lower boom section is being retracted (↪ Chapter 6.15 'Service mode' on page 146).
16. Secure the lower boom section with a crane (belt slip) (Fig. 229/2).
17. Telescope out the lower boom section (Fig. 230/1) completely (↪ Chapter 6.15 'Service mode' on page 146).
18. Clean the sliding surfaces of the lower boom section on all sides and then grease them on all sides with MP 2/3 grease (article no. 3917/0103).
19. Telescope in the lower boom section (Fig. 230/1) completely (↪ Chapter 6.15 'Service mode' on page 146).
20. Remove the crane (belt slip) (Fig. 230/2).
21. Exit service mode (↪ Chapter 6.15 'Service mode' on page 146).

Maintenance

7.4.7 Lubricating the rotary drive

Personnel:	■ Specialist staff
Protective equipment:	■ Occupational safety clothing
	■ Safety shoes
Special tool:	■ Grease gun
Materials:	■ Multi-purpose lubricant (Item no. 3917/0095)

1. → Move the machine into the working position (↪ Chapter 6.8 'Putting machine in work position' on page 98).
2. → Apply a grease gun to the grease nipples (4 x) on the rotating assembly (Fig. 231/1) and inject multi-purpose grease.
3. → Remove the excess grease and dispose of it properly.

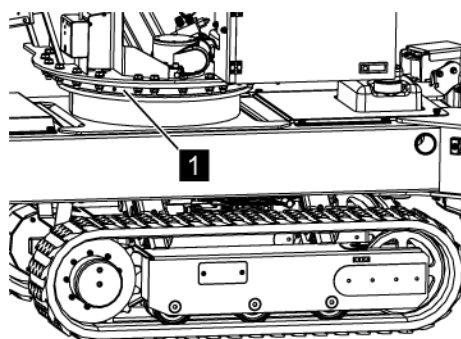


Fig. 231: Lubricating the rotating assembly

7.4.8 Lubrication schedule



When handling lubricants, always adhere to the manufacturer's safety data sheet. You can order the lubricants from the manufacturer by stating the article number. See page 2 for contact details.

No.	Designation	Lubricant	TEUPEN article number	Interval
1	Bolts	Grease spray	3917/0005	Every 50 Bh
2	Boom section slide bearings (↪ Chapter 7.4.6 'Lubricating the boom section and ropes' on page 178)	MP 2/3 grease	3917/0103	Every 150 Bh

No.	Designation	Lubricant	TEUPEN article number	Interval
3	Rotary drive (☞ Chapter 7.4.7 'Lubricating the rotary drive' on page 181)	Grease	3917/0130	Every 50 Bh
4	Working basket levelling cylinders (grease nipples)	Multi-purpose grease	3917/0095	Every 50 Bh
5	Retraction/extension ropes (☞ Chapter 7.4.6 'Lubricating the boom section and ropes' on page 178)	KL 300 spray grease	3917/0036	At the same time as item 2

Bh = operating hours

7.4.9 Rotating assembly tightening torques



WARNING!

Danger due to incorrect tightening torques!

If screws are tightened with the incorrect tightening torque, components can come loose and cause personal injury and property damage.

- Never exceed the maximum allowable tightening torque.
- Check the tightening torques regularly.
- Always heed the relevant guidelines and design criteria for screw connections.

The table shows the required tightening torques for achieving the most reliable initial tension for the screws of the rotating assembly.

Screw size	Screw quality	Tightening torque
M12	10.9	110 Nm
M16	10.9	270 Nm

Faults

8 Faults

The following section describes possible causes of faults and the work to remedy them.

In case of faults that occur more than once, abbreviate the maintenance intervals according to the actual utilisation.

In case of faults that cannot be remedied using the following instructions, contact the manufacturer, see contact data on page 2.

8.1 Safety instructions for fault clearance

Electrical system



DANGER!

Danger to life from electric power!

Contact with live parts may prove fatal. When switched on, electric components may be subject to uncontrolled movements and may cause grave injury.

- Switch off the power supply before starting work and make sure that it cannot be switched on again.

Securing to prevent restart



WARNING!

Danger to life from an unauthorised restart!

In the event of an unauthorised restart of the power supply while tracking down and rectifying a fault, there is a danger of serious injuries or death for persons in the danger zone.

- Switch off all power supplies before starting work and make sure they cannot be switched on again.

*Improperly-performed work for
fault repair***WARNING!****Danger of injury due to improper fault repair!**

Improperly-performed work for fault repair can cause severe injuries and significant property damage.

- Before starting work, ensure that there is sufficient assembly space.
- Make sure the assembly space is orderly and clean! Loosely-stacked components and tools or those left lying around are a source of accidents.
- Do not loosen connections sealed with yellow signal paint.
- If components have been removed, make sure they are assembled correctly, re-fit all fastening elements and adhere to screw tightening torques.
- Before recommissioning, heed the following points:
 - Make sure that all fault repair work is performed and completed according to the details and instructions in these instructions.
 - Make sure that there are no people in the danger zone.
 - Make sure that all covers and safety equipment are installed and functioning properly.

Moving parts**WARNING!****Danger of injury from moving parts!**

Rotating parts and/or parts moving in linear fashion may cause serious injuries.

- Before carrying out any troubleshooting work on moving parts, shut down the machine and take precautions to prevent restarting. Wait until all parts have stopped moving.
- When in the danger zone, wear close-fitting protective work clothing with low tear strength.

Faults

Exhaust gases



WARNING!

Danger to life from poisoning or suffocation due to exhaust gases!

When inhaled, exhaust gases can lead to suffocation and cause severe poisoning as well as an illness of the respiratory system.

- Always ensure fresh air supply when working on the machine in combustion engine mode.
- Any person inhaling exhaust gases must be provided with fresh air immediately. Consult a physician.

Batteries



WARNING!

Danger of injury due to incorrect handling of batteries!

In case of batteries are improperly handled, there is the danger that the batteries can explode or that liquids that are hazardous to health can egress from the batteries. The liquid egressing can cause severe burns upon skin contact, severe poisoning upon swallowing and blindness in case it comes in contact with eyes.

- Never short circuit the contacts (positive and negative poles) of the batteries!
- Never use or store batteries in places where the atmosphere is explosive or where temperatures can rise excessively.
- Never attempt to solder batteries, to repair them, to change their form, to remodel them or to dismantle them.
- Always protect batteries from access by unauthorised persons.
- In order to avoid fires, overheating, explosions or escape of fluids, do not subject batteries to heavy vibrations or shocks, place heavy weights on them or subject them to other damaging exposures. Liquids which emanate from batteries can get inflamed.
- Avoid contact with escaping liquids.

Measures to be undertaken upon contact with battery liquids:

- Wash skin with plenty of water and soap after contact.
- Rinse out with clear water under the eyelids for at least 15 minutes after contact. While doing so, do not direct the stream of water directly on the eyes and do not rub. Immediately summon medical assistance.

Hot surfaces



WARNING!

Danger of injury due to hot surfaces!

Surfaces of engine components can get heated up considerably during operation. Skin contact with hot surfaces causes severe burns to the skin.

- Avoid contact with engine components such as exhaust components, silencers, coolers, radiators, pipes and engine blocks.
- Check before all work on engine components, as to whether these are hot. If necessary, allow them to cool.

Hot operating materials



WARNING!

Danger of injury due to hot materials!

Operating materials (coolant liquids or motor oils) can attain high temperatures in use. Skin contact with hot materials causes severe burns to the skin.

- Avoid contact with hot operating materials.
- Check before all work with operating materials, as to whether these are hot. If necessary, allow them to cool.

Faults

Anti freeze agents



WARNING!

Health danger of anti freeze agents

The coolant of the diesel engine consists of a mixture of water and anti freeze agent. In case of body contact, swallowing or inhalation of aerosols, anti freeze agents can lead to severe health hazards.

- Avoid contact with anti freeze materials.
- Do not eat, drink or smoke while handling anti freeze materials. Wash hands before breaks and at the end of work.
- Always wear protective gloves while working with anti freeze agents.

Measures to be undertaken upon contact with anti freeze agents:

- Wash skin with plenty of water after contact.
- Rinse eyes thoroughly with water for at least 15 minutes and call a doctor.
- Rinse out mouth after swallowing and drink plenty of water afterwards. Summon a doctor.
- In case aerosols are inhaled, go out into fresh air.

Engine oil



WARNING!

Danger of injury through engine oil!

Engine oil contains poisonous substances which can cause inflammations and / or are carcinogenic.

- Avoid all skin contact with engine oil.
- In case of accidental skin contact, wash the hands or affected area immediately with soap. Do not ever use petrol, gasoline, solvents or other chemical cleaning agents.

How to act in case of faults

The following basic rules apply:

- 1.** In case of faults which represent an immediate risk to personnel or objects of material value, immediately trigger an emergency stop.
- 2.** Determine the cause of the fault.

3. → When carrying out fault clearance which requires tasks to be performed in the danger area, switch off the machine and secure it to prevent it from being switched back on.
Inform the responsible party at the location of use of the fault immediately.
4. → Depending on the type of fault, have it remedied by qualified staff or remedy it yourself.



The following fault table provides information on who is authorised to clear the fault.

8.2 Fault table



In addition to the following table, you must also adhere to the operating instructions for the Kubota diesel engine (↗ Appendix C.1 'Kubota diesel engine' on page 219).



If the fault is not included in the table below or if it cannot be remedied using the measures described, contact the manufacturer (see page 2 for the contact details).

Fault description	Cause	Remedy	Personnel
The diesel engine does not work	Fuel tank empty	Fill the fuel tank (↗ Appendix C.1 'Kubota diesel engine' on page 219)	Trained people

Faults

Fault description	Cause	Remedy	Personnel
	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (☞ <i>Chapter 8.5 'Fuses' on page 201</i>)	Trained people
	Starter battery flat	Charge the starter battery (☞ <i>Appendix C.1 'Kubota diesel engine' on page 219</i>)	Trained people
	Emergency Stop Button actuated	Release the Emergency Stop Button (☞ <i>'Emergency Stop Button' on page 31</i>)	Trained people
The machine does not work with voltage supply from construction site supply point	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (☞ <i>Chapter 8.5 'Fuses' on page 201</i>)	Trained people
	Extension cable faulty	Replace the extension cable (☞ <i>'Cable lengths' on page 42</i>)	Trained people
	Incorrect cable cross-section or incorrect cable length	Adhere to permissible cable length(s) and cable cross-section (☞ <i>'Cable lengths' on page 42</i>)	Trained people
	Emergency Stop Button actuated	Release the Emergency Stop Button (☞ <i>'Emergency Stop Button' on page 31</i>)	Trained people
Operation cannot be performed from the lower controller	Emergency Stop Button actuated	Release the Emergency Stop Button (☞ <i>'Emergency Stop Button' on page 31</i>)	Trained people
The platform function cannot be operated from the working basket	Emergency Stop Button actuated	Release the Emergency Stop Button (☞ <i>'Emergency Stop Button' on page 31</i>)	Trained people
	Bracing not correct	Brace the machine correctly (☞ <i>Chapter 6.8 'Putting machine in work position' on page 98</i>)	Trained people
The chains cannot be driven	The switch position on the lower controller or the control panel is incorrect	Set the toggle switch to the "drive" position (☞ <i>Chapter 6.6 'Moving the machine' on page 89</i>)	Trained people

Faults

Fault description	Cause	Remedy	Personnel
	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (↗ Chapter 8.5 'Fuses' on page 201)	Trained people
Bracing not possible	The switch position on the lower controller or the control panel is incorrect	Set the toggle switch to "outriggers" (↗ Chapter 6.8 'Putting machine in work position' on page 98)	Trained people
	Machine not in the transport position	Move the machine into the transport position (↗ Chapter 6.10 'Moving the machine into transport position' on page 113)	Trained people
	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (↗ Chapter 8.5 'Fuses' on page 201)	Trained people
The platform function does not work	The switch position on the lower controller or the control panel is incorrect	Set the toggle switch to "platform" (↗ Chapter 6.9 'Operating the machine' on page 106)	Trained people
	Emergency Stop Button actuated	Release the Emergency Stop Button (↗ 'Emergency Stop Button' on page 31)	Trained people
	Bracing not correct	Check the bracing (↗ Chapter 6.8 'Putting machine in work position' on page 98)	Trained people
	There is no supply voltage or it is too low	Check the voltage supply	Qualified Electrician
	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (↗ Chapter 8.5 'Fuses' on page 201)	Trained people

Faults

Fault description	Cause	Remedy	Personnel
The upper boom cannot be telescoped out	The upper boom is in the transport support	Lift upper boom out of the transport support (↗ Chapter 6.9 'Operating the machine' on page 106)	Trained people
	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (↗ Chapter 8.5 'Fuses' on page 201)	Trained people
Pivoting is not possible	The upper boom is still in the transport support	Lift upper boom out of the transport support (↗ Chapter 6.9 'Operating the machine' on page 106)	Trained people
	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (↗ Chapter 8.5 'Fuses' on page 201)	Trained people
The green light on the control panel flashes	Bracing not correct	Check the bracing (↗ Chapter 6.8 'Putting machine in work position' on page 98)	Trained people
The red lamp on the control panel lights up constantly	The operating lever has been shifted during the start-up process	Trigger and emergency stop and restart the controller (release the Emergency Stop Button)	Trained people
	System fault	Call the service department	Trained people
The red lamp on the control panel flashes	Maximum basket weight exceeded	Reduce the basket weight	Trained people
The red and green lamps do not light up at all	Safety devices have been triggered (fuse protection, residual-current circuit breaker)	Check the safety devices and switch them on or replace them as necessary (↗ Chapter 8.5 'Fuses' on page 201)	Trained people
Motor pump runs and stalls	The hydraulic hose is bent	Check the hydraulic hoses	Qualified personnel
	Pressure filter soiled	Replace the filter insert (↗ Chapter 7.4.5 'Replacing the hydraulic filter' on page 176)	Qualified personnel

Faults

Fault description	Cause	Remedy	Personnel
Motor pump is running but there is no pressure in the system	The hand wheel on the hand pump has come loose	Close hand wheel clockwise	Trained people
Cylinder lowers by itself	Hydraulic system faulty	Take machine out of service immediately and call service	Trained people
Loud motor pump noise and movements get slower and then stop	Too little hydraulic oil in the tank	Check hydraulic oil level and top up if necessary (↪ <i>Chapter 7.4.3 'Checking the hydraulic oil level' on page 173</i>)	Trained people
	Hydraulic system is leaking	Call the service department	Trained people
Outlet in the working basket has no voltage	Voltage supply interrupted	Check voltage supply	Qualified Electrician
	Plug not in the outlet	Plug in plug (↪ <i>Chapter 6.3 'Switching the machine on/off' on page 69</i>)	Trained people
	Safety equipment has triggered	Check the fuses (↪ <i>Chapter 8.5 'Fuses' on page 201</i>)	Trained people
Great wear on the crawler track	Drive ring severely worn	Call the service department	Trained people
Steel wires of the crawler tracks broken	Excessive tension on the chains due to trapped stones, abrupt swerving on a rough surface, a faulty spring assembly, frozen material between the rollers	Call the service department	Trained people

8.3 Fault code list

Table of possible fault messages

Number	Description
1	Software error / hardware fault.
2	Software error / hardware fault.

Faults

Number	Description
3	Software error / hardware fault.
4	Microprocessor hardware fault.
5	Check the inputs for ground pressure for outrigger 1.
6	Check the inputs for ground pressure for outrigger 2.
7	Check the inputs for ground pressure for outrigger 3.
8	Check the inputs for ground pressure for outrigger 4.
9	Check inputs for the "wide braced" position switch for outrigger 1.
10	Check inputs for the "wide braced" position switch for outrigger 2.
11	Check inputs for the "wide braced" position switch for outrigger 3.
12	Check inputs for the "wide braced" position switch for outrigger 4.
13	Check safety relay 1, monitoring contact.
14	Check safety relay 2, monitoring contact.
15	Check safety relay 3, monitoring contact.
16	Check safety relay 4, monitoring contact.
17	Check the inputs for the position switch 'telescopic arm applied'.
18	If the controller is switched on and the outriggers are detected to not be locked, none of the position switches for the height of the outriggers must be actuated.
19	Joystick 1 on the cable remote control was moved during start-up or is faulty.
20	Joystick 2 on the cable remote control was moved during start-up or is faulty.
21	The joysticks on control panel were moved during start-up or are faulty (release contact).
22	The joysticks on the cable remote control were moved during start-up or are faulty (release contact).
23	Joystick 1 on the control panel was moved during start-up or is faulty.
24	Joystick 2 on the control panel was moved during start-up or is faulty.
25	Joystick 3 on the control panel was moved during start-up or is faulty.
26	Joystick 4 on the control panel was moved during start-up or is faulty.
27	Button 1 on the lower controller has been actuated or is faulty.
28	Button 2 on the lower controller has been actuated or is faulty.
29	Button 3 on the lower controller has been actuated or is faulty.
30	Button 4 on the lower controller has been actuated or is faulty.

Number	Description
31	The toggle switch for activating the basket pivoting movement on the lower controller has been actuated or is faulty.
32	The toggle switch for activating the movements on the lower controller has been actuated or is faulty.
33	The toggle switch for activating automatic bracing on the lower controller has been actuated or is faulty.
34	One of the toggle switches for setting the basket level has been actuated or is faulty.
35	Voltage was applied on the output side when switching on the machine or an output driver is faulty.
36	The voltage of the back-up battery is more than 4 V. Replace the battery or there is a hardware fault on the controller.
37	The supply voltage has dropped below 17 V.
38	The supply voltage has exceeded 32 V.
39	The measured angle must not exceed a certain value whilst the telescopic boom is applied. The position switch in the support may be stuck.
40	The chassis enabling relay needs to be checked.
41	The machine has been pivoted too far with narrow bracing or the resolver transducer is faulty.
42	The machine has been pivoted too far with single-sided wide bracing or the resolver transducer is faulty.
43	The machine has been pivoted too far with wide bracing or the resolver transducer is faulty.
44	The maximum swivel range has been exceeded or the resolver transducer is faulty.
45	Pivot angle verification error. Check the resolver transducer or calibrate the angle sensors.
46	Check the position of the angle sensors. It may be necessary to reset to zero or reset.
47	The telescopic boom is set too wide or the resolver transducer is faulty.
48	Check the pressure sensors.
49	Check the pressure sensor to make sure the values are reliable.
50	The pressure measured is too low for this situation. The telescopic boom is braced or the pressure sensor is faulty.
51	The position switch for the telescoped in position of the telescopic arm is faulty.
52	Software error / hardware fault.

Faults

Number	Description
53	Software error / hardware fault.
54	Hardware fault SPI real time clock.
55	The machine has not been switched off for several days and needs to be restarted.
56	The input information for the safety functions between the master and slave is different.
57	The input information for the safety functions between the master and slave is different.
58	The input information for the safety functions between the master and slave is different.
59	The input information for the safety functions between the master and slave is different.
60	Check safety relay 1 monitoring contact.
61	Check safety relay 2 monitoring contact.
62	Check safety relay 3 monitoring contact.
63	Check safety relay 4 monitoring contact.
64	The telescopic boom is set too wide or the resolver transducer is faulty.
65	The load curve has been saved incorrectly. Check the load curves and save them again.
66	The load curve deviates too far from the base curve. Check the load curves and save them again.
67	The values of the load curve are faulty. Check the load curves and save them again.
68	The angle values in the load curve do not match the specifications. Check the load curves and save them again.
69	The number of outrigger positions does not match the specifications. Check the load curves and save them again.
70	Error when checking the load curve. Check the load curves and save them again.
71	Error when calculating the load limit. Check the load curves and angle sensors on the telescopic boom.
72	The max. current for the basket scale has been exceeded. Check the basket scale.
73	The current for the basket scale has dropped below the min. level. Check the basket scale.
74	The valid measuring range for the basket scale has been exceeded. Check the basket scale.

Number	Description
75	The basket scale supplies different values. Check the basket scale.
76	Software error
77	Calibration values from the outputs faulty. Check the values or load the factory settings.
78	Software error / hardware fault.
79	Software error / hardware fault.
80	Joystick values faulty. Check the joysticks and their parametrisation.
81	Joystick values of radio remote control faulty. Check the radio remote control.
82	Calibration values of the joysticks faulty. Check the values or load the factory settings.
83	Second controller not accessible via the internal CAN bus. Check the CAN connection and the second controller.
84	The second controller had already been started whilst this controller was being started up. Check voltage supply and CAN bus.
85	Check the internal CAN bus.
86	Check the internal CAN bus.
87	Check the internal CAN bus.
88	Software error
89	Check the internal CAN bus.
90	Check the external CANopen bus.
91	Check the external CANopen bus.
92	Check the external CANopen bus.
93	Check the external CANopen bus.
94	Check the radio transmitter and radio receiver/external CANopen bus.
95	Check the radio transmitter and radio receiver/external CANopen bus.
96	The offset value has exceeded the permitted range. Check and re-calibrate the resolver transducer.
97	Error when reading in angle sensors on telescopic arm. Check the resolver transducers and supply line.
98	Error reading in resolver transducers. Check the resolver transducers and supply line.
99	Error reading in pivot angle sensors. Check the resolver transducers and supply line.

Faults

Number	Description
100	Compare the calibration values from the resolver transducers faulty, check values and calibrate resolver transducers again.
101	Software error / hardware fault.
102	EEPROM memory content faulty. Carry out calibration functions.
103	Software error / hardware fault.
104	Software error / hardware fault.
105	Software error / hardware fault.
106	RAM content faulty. Re-start the machine or delete the RAM lists.
107	Software error / hardware fault.
108	Software error / hardware fault.
109	Software error / hardware fault.
110	Software error / hardware fault.
111	Software error / hardware fault.
112	Software error / hardware fault.
113	Software error / hardware fault.
114	Software error / hardware fault.
115	Software error / hardware fault.
116	Software error / hardware fault.
117	Software error / hardware fault.
118	The bracing angle is within an illegal range or the tilt sensor is faulty.
119	A fault has been detected by another controller. Read out the fault memory on the second controller.
120	Software error / hardware fault.
121	The software version has been changed. Change to the correct software version with TODAC.
122	Check the inputs for the position switch 'basket pivoting middle position'.
123	Check the inputs for the position switch 'basket pos. lowering OK'.
124	Check the inputs for the position switch 'low working height'.
125	The USA enabling button has been actuated whilst starting up the machine or is faulty.
126	Check the inputs of the 'lower boom' position switch.
127	Check the inputs for outrigger locking function for outrigger 1.
128	Check the inputs for outrigger locking function for outrigger 2.

Number	Description
129	Check the inputs for outrigger locking function for outrigger 3.
130	Check the inputs for outrigger locking function for outrigger 4.
131	Lower boom angle verification error. Check the resolver transducer or calibrate the angle sensors.
132	The maximum lower boom angle has been exceeded or the resolver transducer is faulty.
133	Differential angle verification error. Check the resolver transducer or calibrate the angle sensors.
134	The maximum upper boom angle has been exceeded or the resolver transducer is faulty.
135	The offset value has exceeded the permitted range. Check and re-calibrate the resolver transducer for the lower boom.
136	Joystick 3 on the cable remote control was moved during start-up or is faulty.
137	Joystick 4 on the cable remote control was moved during start-up or is faulty.
138	Check the tilt sensor for the working basket level/external CANopen bus.
139	Check the tilt sensor for the working basket level/external CANopen bus.
140	The tilt sensor for the basket level supplies different values. Check the sensor.
141	The maximum tilt angle for the basket level has been exceeded. Check the sensor or the working basket level controller
142	The tilt sensor for the basket level is faulty. Check the sensor.
143	Invalid parameters for activation of the basket level. Perform parametrisation.
144	Software error / hardware fault.
145	The rotary angle sensor on the working basket is faulty. Check the sensor and supply line.
146	The minimum upper boom angle has been exceeded or the resolver transducer is faulty.
147	The minimum differential angle has been exceeded or the resolver transducer is faulty.
148	The maximum differential angle has been exceeded or the resolver transducer is faulty.
149	The minimum lower boom angle has been exceeded or the resolver transducer is faulty.
150	The lower boom must only be lowered if the limit switches "lower boom telescoped in" are actuated.

Faults

Number	Description
151	The offset value has exceeded the permitted range. Check and re-calibrate the resolver transducer.
152	Check the inputs for the position switch 'upper boom applied'.
153	The measured angle must not exceed a certain value whilst the upper boom is applied. The position switch in the support may be stuck.
154	The position switch for the upper boom telescoped in position is faulty.
155	The switch for activating the home function on the control panel has been actuated or is faulty.
156	The switch for activating the basket pivoting movement on the ground-level controller had been actuated or is faulty.
157	Tilt sensor for the basket level has transmitted an invalid measured value. The measured value is outside the measuring range.
158	The differential angle has been exceeded whilst the lower boom was raised or the resolver transducer is faulty.
159	The differential angle has been exceeded whilst the lower boom was raised or the resolver transducer is faulty.
160	Last fault entry (number does not appear)

8.4 Notes about the rubber track

Damage

During operation, the rubber track is subject to normal wear. Some kinds of damage are explained in the table below.

Damage	Possible cause	Note
Cracks in the profile foot	<ul style="list-style-type: none"> ■ Hard use in the field. ■ Crossing sharp-edged or high hurdles. ■ With old, little-used tracks, possible material fatigue as a result of bending load. 	No compromise of operation.
Cracks on the outside flanks	<ul style="list-style-type: none"> ■ Hard use in the field. ■ Crossing sharp-edged or high hurdles. 	No compromise of operation.
Cracks on the inside by the metal core	<ul style="list-style-type: none"> ■ Various causes. 	No compromise of operation.

Faults

Damage	Possible cause	Note
Wear of the metal core	<ul style="list-style-type: none"> ■ Normal wear due to cams of the drive wheel. ■ Increased wear with use on very sandy ground. 	Heed chain tension. The metal core can become bent by great wear. This can cause breaks with progressive wear. Change rubber tracks early.
Wear of the profile	<ul style="list-style-type: none"> ■ Normal occurrence. ■ Depending on the area of application earlier or later. 	Depending on the area of application, the rubber tracks must be replaced appropriately early. Essentially, however, can be moved until there is no more profile.

Remedies

- Brief daily visual inspection.
- Careful moving in swampy ground, especially when slowing down.
- In case of palpable resistance, first determine the cause. Do not move forward with force.
- Use care when driving on impassable and hilly land, especially when slowing down.
- Execute control manoeuvres with appropriate caution.
- Clean chain drive after completing work.
- If there is a danger of frost, clean the drive and track inside by driving on clean ground. Then park the machine on wooden boards.

Faults

8.5 Fuses

8.5.1 Changing fuses

- Personnel: ■ Specialist staff
- Protective equipment: ■ Occupational safety clothing
■ Safety shoes



DANGER!

Risk of fatal injury from electrical current!

Contact with live components can cause fatal injuries. Activated electrical components can perform uncontrolled movements and cause serious injuries.

- Before starting work, switch off the voltage supply and secure it to prevent it from being switched back on.
- When changing fuses or circuit breakers, make sure that the ampere rating is correct.

1. ➤ Switch off the machine (⚡ *Chapter 6.3 'Switching the machine on/off' on page 69*).
2. ➤ Replace the faulty fuse with a new fuse of equal amperage (⚡ *Chapter 8.5.2 'Fuse assignment' on page 201*).

8.5.2 Fuse assignment

Overview of fuses

The fuses are situated in the following positions on the machine:

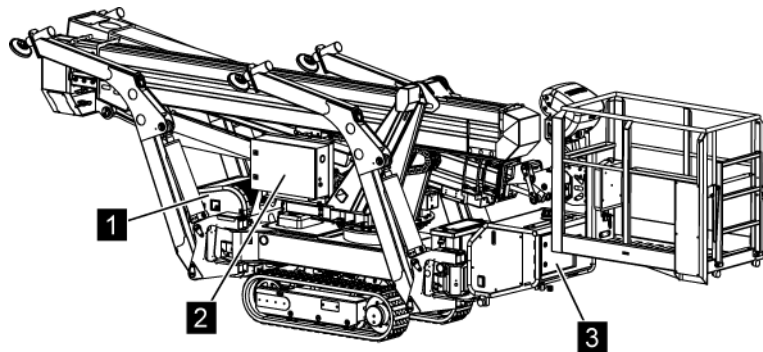


Fig. 232: Overview of fuses

- 1 ↗ on page 202
- 2 ↗ Chapter 8.5.2.2 'Control box on lift boom holder' on page 202
- 3 ↗ Chapter 8.5.2.3 'Control box on the chassis' on page 203

8.5.2.1 Control box for the drive unit

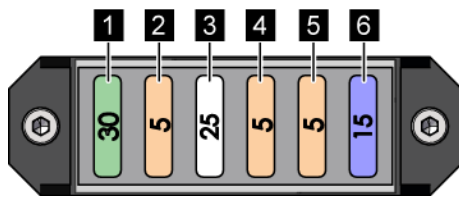


Fig. 233: Drive unit fuses

No.	Description	Assign-ment
1	Main fuse 12 V	30 A
2	Engine components	5 A
3	Control fuse 12 V	25 A
4	Constant voltage 12 V	5 A
5	Speed adjustment	5 A
6	Headlights (optional)	15 A

8.5.2.2 Control box on lift boom holder

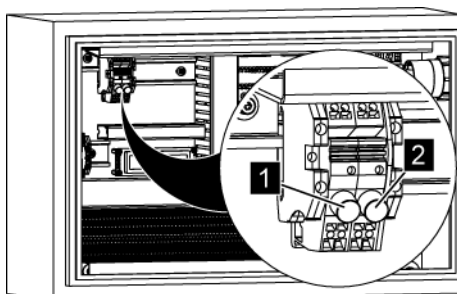
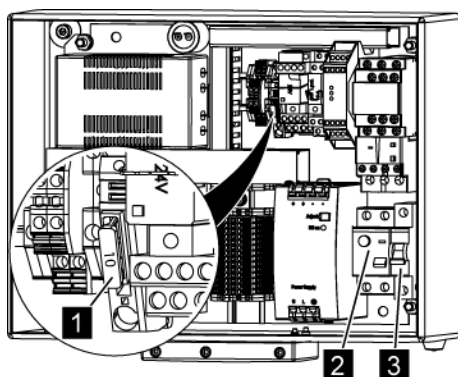


Fig. 234: Lift boom holder control box

No.	Description	Assign-ment
1	Sensor equipment	3.15 A
2	Control cards series fuse	3.15 A

Faults

8.5.2.3 Control box on the chassis



No.	Description	Assignment
1	Main fuse 24 V	10 A
2	FI circuit breaker	-
3	Working basket socket fuse	16 A

Fig. 235: Chassis control box

Disposal

9 Disposal

After the service life of the machine has ended, the machine must be disposed of in environmentally-friendly fashion.



WARNING!

Danger of injury through incorrect disposal!

Improper disposal can cause severe injuries.

- Permit disposal only through authorised specialist agencies.

If no there is no take-back or disposal agreement, submit disassembled components for recycling:

- Dispose all liquids in an environmentally correct manner.
- Scrap metals.
- Give plastic elements to recycling.
- Dispose off other components sorted according to their material properties.



NOTICE!

Danger to the environment due to incorrect disposal!

Improper disposal can present a danger to the environment.

- Have electrical scrap, electronic components, lubricants and other auxiliary materials disposed of by an approved operation.
- In case of doubt, obtain information about environmentally-friendly disposal from the local municipal authorities or a special disposal operation.

Index

10 Index

A		Disposal.....	205
Accident.....	35	Double bit key.....	56
Aerial access platform.....	106	Drive unit control box.....	202
Attachment points.....	60	Driving over edges.....	111
B		E	
Battery main switch.....	32	Electric current.....	17
Bracing.....	96	Electric motor.....	41, 49
C		Emergency.....	74
Cable lengths.....	42	Emergency mode.....	138
Cable remote control.....	50, 68	Operation of outriggers.....	143
Chain drive.....	49	Platform operation.....	139
Chassis.....	49	Emergency operation.....	55
Chassis control box.....	203	Emergency stop.....	74
Circuit breaker.....	201	Emergency Stop Button.....	31, 51, 53
Circular level.....	33	Emissions.....	42
Cleaning.....	170	Engine controller.....	146
Combination lock		Engine switch.....	53
Control panel.....	160	Environmental protection	
Shackle lock.....	159	Batteries.....	37
Combustion engine.....	49	Cleaning liquids.....	36
Diesel.....	41	Cooling water.....	37
Petrol.....	41	Frost protection.....	37
Connections.....	56	Fuels.....	36
Consumables.....	43	Hydraulic oil.....	36
Contact person.....	13	Lubricants.....	36
Control lever.....	53	Rechargeable batteries.....	37
Control levers.....	50, 54	F	
Control panel.....	52	Fault code list.....	192
Copyright.....	12	Fault table.....	188
Crawler chassis.....	49, 125	Fire.....	35
Extend mechanically.....	125	First aid.....	35
Retract mechanically.....	127	Fuel tank.....	137
Customer service.....	13	Function keys.....	53
D		Fuse assignment.....	201
Danger zone.....	56	Fuses.....	201
Dimensions.....	39	Chassis control box.....	203
Display.....	53		

Drive unit control box.....	202	Operation.....	106
Lift boom holder control box.....	202	Outrigger latching.....	50
G		Outriggers.....	48
Graphic display.....	53	Overview.....	45
H		Owner.....	24
Hand pump.....	55	P	
Hazards.....	15	Padlock.....	159
Height adjustment.....	125	Personnel.....	25
mechanical.....	125	Platform.....	47
Home key.....	53	Platform operation.....	106
Hydraulics.....	20	Productivity.....	40
K		Proper use.....	23
Keys.....	56	Protective equipment.....	28
L		R	
Lamp		Refuelling.....	137
green.....	51, 52	Remaining risks.....	15
red.....	51, 53	Rescue measures.....	74
yellow.....	51	Rotary angle sensor.....	33
Latching.....	50	Rotary drive.....	181
Lift boom holder control box.....	202	Rotating assembly.....	182
Limit switch.....	32	S	
Loads.....	41	Safety devices.....	29, 30
Locking.....	50	Safety harness.....	57
Lowering		Screw tightening torque.....	182
automatic.....	122	Service.....	13
manual.....	118	Service mode.....	146
Lubricants.....	181	Chain drive.....	153
Lubrication schedule.....	181	Operation of outriggers.....	151
M		Platform operation.....	148
Maintenance work		Shackle lock.....	159
Cleaning the machine.....	170	Storage.....	64
Motor.....	49	Symbols	
Moving.....	89	in this Manual.....	9
Moving the machine.....	89	on the machine.....	34
N		T	
Noise.....	42	Tightening torque.....	182
O		Tilt sensor.....	33
Oil recommendations.....	43	Toggle switch	
Operating conditions.....	42	Function selection.....	53


Index

Transportation		W	
Crane.....	60	Warranty provisions.....	12
Trailer.....	61	Weight.....	41
Truck.....	61	Width adjustment.....	125
Transport inspection.....	59	mechanical.....	125
Transport position.....	113	Work area.....	56
Type plate.....	43	Work diagram.....	40
U		Working basket.....	48
Use.....	23	replacing.....	133
V		swivel.....	54
Valve assignment		Work position.....	98
Outriggers.....	158		
Platform.....	155		
Valves			
Emergency mode.....	33		
Service mode.....	33		

Appendix

Appendix

Table of contents of the appendix

A	Circuit diagram.....	213
B	Hydraulic plan.....	215
C	Combustion engines.....	217
	C.1 Kubota diesel engine.....	219
D	List of the stickers/symbols.....	

Circuit diagram

A Circuit diagram

Circuit diagram

Hydraulic plan

B Hydraulic plan

Combustion engines

C Combustion engines

Combustion engines

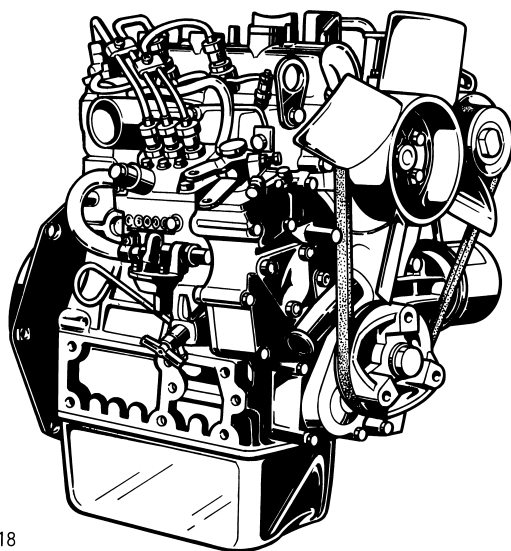
C.1 Kubota diesel engine

OPERATOR'S MANUAL

ENGLISH

KUBOTA DIESEL ENGINE

MODELS Z482-E · Z602-E
 D662-E · D722-E
 D782-E · D902-E



B-1418

READ AND SAVE THIS BOOK

Kubota

FOREWORD

You are now the proud owner of a KUBOTA Engine. This engine is a product of KUBOTA quality engineering and manufacturing. It is made of fine materials and under a rigid quality control system. It will give you long, satisfactory service. To obtain the best use of your engine, please read this manual carefully. It will help you become familiar with the operation of the engine and contains many helpful hints about engine maintenance. It is KUBOTA's policy to utilize as quickly as possible every advance in our research. The immediate use of new techniques in the manufacture of products may cause some small parts of this manual to be outdated. KUBOTA distributors and dealers will have the most up-to-date information. Please do not hesitate to consult with them.



SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use this unit.



DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING : Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.



CAUTION: Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

IMPORTANT : Indicates that equipment or property damage could result if instructions are not followed.

NOTE : Gives helpful information.

CONTENTS

▲ SAFE OPERATION	1
SERVICING OF THE ENGINE	1
NAMES OF PARTS	2
PRE-OPERATION CHECK	3
BREAK-IN	3
DAILY CHECK	3
OPERATING THE ENGINE	4
STARTING THE ENGINE(NORMAL)	4
COLD WEATHER STARTING	5
STOPPING THE ENGINE.....	6
CHECKS DURING OPERATION.....	6
Radiator Cooling water(Coolant)	6
Oil pressure lamp.....	6
Fuel.....	7
Color of exhaust.....	7
Immediately stop the engine if;	7
REVERSED ENGINE REVOLUTION AND REMEDIES.....	7
How to tell when the engine starts running backwards.....	7
Remedies.....	7
MAINTENANCE.....	8
SERVICE INTERVALS	9
PERIODIC SERVICE.....	11
FUEL	11
Fuel level check and refueling	11
Air bleeding the fuel system.....	11
Checking the fuel pipes	12
Cleaning the fuel filter pot	12
ENGINE OIL.....	13
Checking level and adding engine oil	13
Changing engine oil	14
Replacing the oil filter cartridge	15
RADIATOR.....	15
Checking coolant level, adding coolant	15
Changing coolant.....	16
Checking radiator hoses and clamp	16
Precaution at overheating.....	17
Anti-freeze	17
Radiator cement	17
AIR CLEANER	18
For the air cleaner with a dust cup (optional).....	18
BATTERY.....	18
Battery charging.....	19
Direction for long term storage	20
ELECTRIC WIRING	20

CONTENTS

FAN BELT	20
Adjusting Fan Belt Tension.....	20
CARRIAGE AND STORAGE	21
CARRIAGE	21
STORAGE.....	21
TROUBLESHOOTING.....	22
SPECIFICATIONS.....	24
WIRING DIAGRAMS	25



SAFE OPERATION

Careful operation is your best assurance against an accident. Read and understand this section carefully before operating the engine. All operators, no matter how much experience they may have, should read this and other related manuals before operating the engine or any equipment attached to it. It is the owner's obligation to provide all operators with this information and instruct them on safe operation.

Be sure to observe the following for safe operation.

1. OBSERVE SAFETY INSTRUCTIONS

- Read and understand carefully this "OPERATOR'S MANUAL" and "LABELS ON THE ENGINE" before attempting to start and operate the engine.
- Learn how to operate and work safely. Know your equipment and its limitations. Always keep the engine in good condition.
- Before allowing other people to use your engine, explain how to operate and have them read this manual before operation.
- DO NOT modify the engine. UNAUTHORIZED MODIFICATIONS to the engine may impair the function and/or safety and affect engine life. If the engine does not perform properly, consult your local Kubota Engine Distributor first.



1AAACAAAP008B

2. WEAR SAFE CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

- DO NOT wear loose, torn or bulky clothing around the machine that may catch on working controls and projections or into fans, pulleys and other moving parts causing personal injury.
- Use additional safety items-PPE, e.g. hard hat, safety protection, safety goggles, gloves, etc., as appropriate or required.
- DO NOT operate the machine or any equipment attached to it while under the influence of alcohol, medication, or other drugs, or while fatigued.
- DO NOT wear radio or music headphones while operating the engine.



1AEAAAAAP0130

3. CHECK BEFORE STARTING & OPERATING THE ENGINE

- Be sure to inspect the engine before operation. Do not operate the engine if there is something wrong with it. Repair it immediately.
- Ensure all guards and shields are in place before operating the engine. Replace any that are damaged or missing.
- Check to see that you and others are a safe distance from the engine before starting.
- Always keep the engine at least 3 feet (1 meter) away from buildings and other facilities.
- DO NOT allow children or livestock to approach the machine while the engine is running.
- DO NOT start the engine by shorting across starter terminals. The machine may start in gear and move. Do not bypass or defeat any safety devices.



1BAABADAP0010

4. KEEP THE ENGINE AND SURROUNDINGS CLEAN

- Be sure to stop the engine before cleaning.
- Keep the engine clean and free of accumulated dirt, grease and trash to avoid a fire. Store flammable fluids in proper containers and cabinets away from sparks and heat.
- Check for and repair leaks immediately.
- DO NOT stop the engine without idling; Allow the engine to cool down, first. Keep the engine idling for about 5 minutes before stopping unless there is a safety problem that requires immediate shut down.



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5. SAFE HANDLING OF FUEL AND LUBRICANTS -KEEP AWAY FROM FIRE

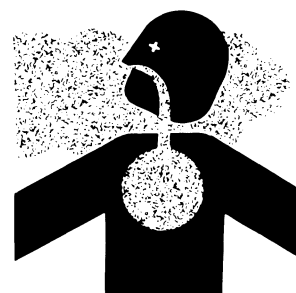
- Always stop the engine before refueling and/or lubricating.
- DO NOT smoke or allow flames or sparks in your work area. Fuel is extremely flammable and explosive under certain conditions.
- Refuel at a well ventilated and open place. When fuel and/or lubricants are spilled, refuel after letting the engine cool down.
- DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause a fire or severe engine damage.
- Do not use unapproved containers e.g. buckets, bottles, jars. Use approved fuel storage containers and dispensers.



1AAACAAAP001A

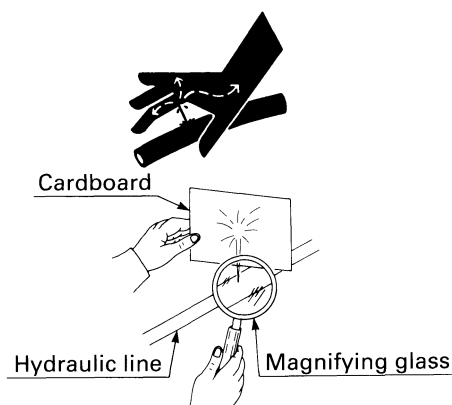
6. EXHAUST GASES & FIRE PREVENTION

- Engine exhaust fumes can be very harmful if allowed to accumulate. Be sure to run the engine in a well ventilated location and where there are no people or livestock near the engine.
- The exhaust gas from the muffler is very hot. To prevent a fire, do not expose dry grass, mowed grass, oil or any other combustible materials to exhaust gas. Keep the engine and muffler clean at all times.
- To avoid a fire, be alert for leaks of flammable substances from hoses and lines. Be sure to check for leaks from hoses or pipes, such as fuel and hydraulic fluid by following the maintenance check list.
- To avoid a fire, do not short across power cables and wires. Check to see that all power cables and wirings are in good condition. Keep all electrical connections clean. Bare wire or frayed insulation can cause a dangerous electrical shock and personal injury.



7. ESCAPING FLUID

- Relieve all pressure in the air, the oil and the cooling systems before disconnecting any lines, fittings or related items.
- Be cautious of possible pressure relief when disconnecting any device from a pressurized system that utilizes pressure. DO NOT check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- Escaping fluid under pressure has sufficient force to penetrate skin causing serious personal injury.
- Fluid escaping from pinholes may be invisible. Use a piece of cardboard or wood to search for suspected leaks: do not use hands and body. Use safety goggles or other eye protection when checking for leaks.
- If injured by escaping fluid, see a medical doctor immediately. This fluid can produce gangrene or severe allergic reaction.



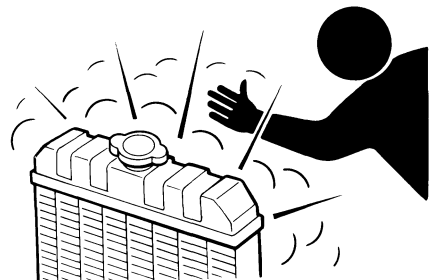
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8. CAUTIONS AGAINST BURNS & BATTERY EXPLOSION

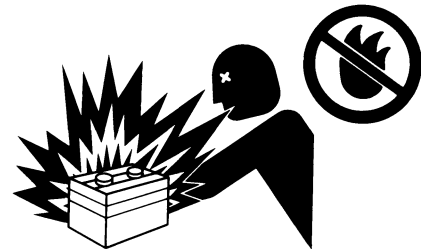
- To avoid burns, be cautious of hot components, e.g. muffler, muffler cover, radiator, hoses, engine body, coolants, engine oil, etc. during operation and after the engine has been shut off.
- DO NOT remove the radiator cap while the engine is running or immediately after stopping. Otherwise hot water will spout out from the radiator. Wait until the radiator is completely cool to the touch before removing the cap. Wear safety goggles.
- Be sure to close the coolant drain valve, secure the pressure cap, and fasten the pipe band before operating. If these parts are taken off, or loosened, it will result in serious personal injury.
- The battery presents an explosive hazard. When the battery is being charged, hydrogen and oxygen gases are extremely explosive.
- DO NOT use or charge the battery if its fluid level is below the LOWER mark.
Otherwise, the component parts may deteriorate earlier than expected, which may shorten the service life or cause an explosion. Immediately, add distilled water until the fluid level is between the UPPER and LOWER marks.
- Keep sparks and open flames away from the battery, especially during charging. DO NOT strike a match near the battery.
- DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.
- DO NOT charge a frozen battery. There is a risk of explosion. When frozen, warm the battery up to at least 16° C (61° F).



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9. KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

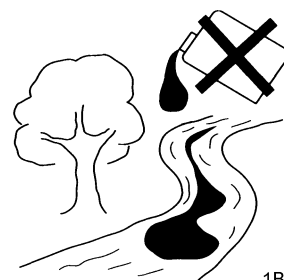
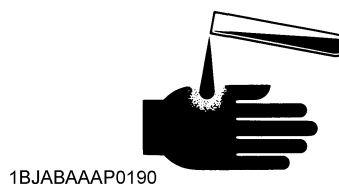
- Be sure to stop the engine before checking or adjusting the belt tension and cooling fan.
- Keep your hands and body away from rotating parts, such as the cooling fan, V-belt, fan drive V-belt, pulley or flywheel. Contact with rotating parts can cause severe personal injury.
- DO NOT run the engine without safety guards. Install safety guards securely before operation.



1ABAAAAAP1470

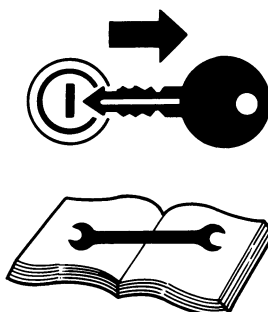
10. ANTI-FREEZE & DISPOSAL OF FLUIDS

- Anti-freeze contains poison. Wear rubber gloves to avoid personal injury. In case of contact with skin, wash it off immediately.
- DO NOT mix different types of Anti-freeze. The mixture can produce a chemical reaction causing harmful substances. Use approved or genuine KUBOTA Anti-freeze.
- Be mindful of the environment and the ecology. Before draining any fluids, determine the correct way to dispose of them. Observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.
- When draining fluids from the engine, place a suitable container underneath the engine body.
- DO NOT pour waste onto the ground, down a drain, or into any water source. Dispose of waste fluids according to environmental regulations.

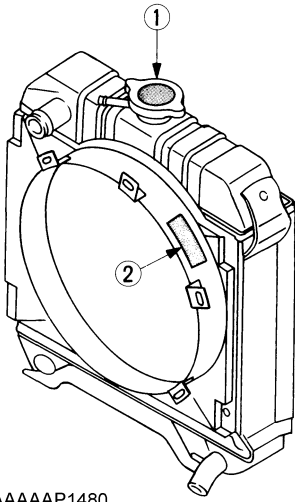


11. CONDUCTING SAFETY CHECKS & MAINTENANCE

- When inspecting the engine or servicing, place the engine on a large flat surface. DO NOT work on anything that is supported ONLY by lift jacks or a hoist. Always use blocks or the correct stands to support the engine before servicing.
- Disconnect the battery from the engine before conducting service. Put a "DO NOT OPERATE!" tag on the key switch to avoid accidental starting.
- To avoid sparks from an accidental short circuit always disconnect the battery's ground cable (-) first and reconnect it last.
- Be sure to stop the engine and remove the key when conducting daily and periodic maintenance, service and cleaning.
- Check or conduct maintenance after the engine, coolant, muffler, or muffler cover have cooled off completely.
- Always use the appropriate tools and fixtures. Verify that they are in good condition before performing any service work. Make sure you understand how to use them before service.
- Use ONLY correct engine barring techniques for manually rotating the engine. DO NOT attempt to rotate the engine by pulling or prying on the cooling fan and V-belt. This practice can cause serious personal injury or premature damage to the cooling fan and belt.
- Replace fuel pipes and lubricant pipes with their hose clamps every 2 years or earlier whether they are damaged or not. They are made of rubber and age gradually.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Keep a first aid kit and fire extinguisher handy at all times.



12. WARNING AND CAUTION LABELS



1ABAAAAAP1480

- ① Part No.19077-8724-1 or 16667-8724-1
(55mm in diameter) (37mm in diameter)



1ABAAAAAP1490

- ② Part No.TA040-4957-1
Stay clear of engine fan and fan belt



1ABAAAAAP1500

13. CARE OF WARNING AND CAUTION LABELS

1. Keep warning and caution labels clean and free from obstructing material.
2. Clean warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing warning and caution labels with new labels from your local KUBOTA dealer.
4. If a component with warning and caution label(s) affixed is replaced with a new part, make sure the new label(s) is (are) attached in the same location(s) as the replaced component.
5. Mount new warning and caution labels by applying to a clean dry surface and pressing any bubbles to the outside edge.

SERVICING OF THE ENGINE

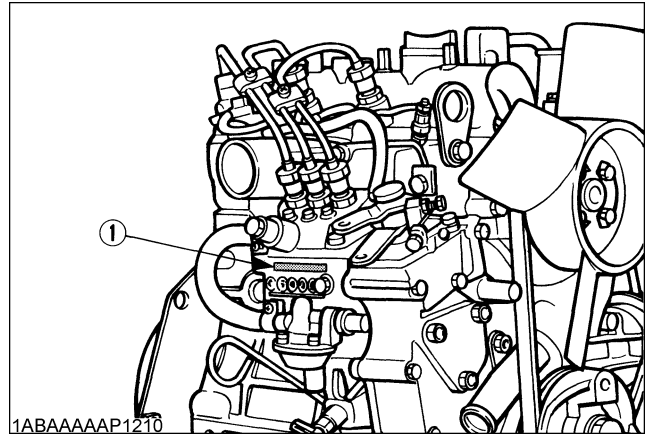
Your dealer is interested in your new engine and has the desire to help you get the most value from it. After reading this manual thoroughly, you will find that you can do some of the regular maintenance yourself.

However, when in need of parts or major service, be sure to see your KUBOTA dealer.

For service, contact the KUBOTA Dealership from which you purchased your engine or your local KUBOTA dealer. When in need of parts, be prepared to give your dealer the engine serial number.

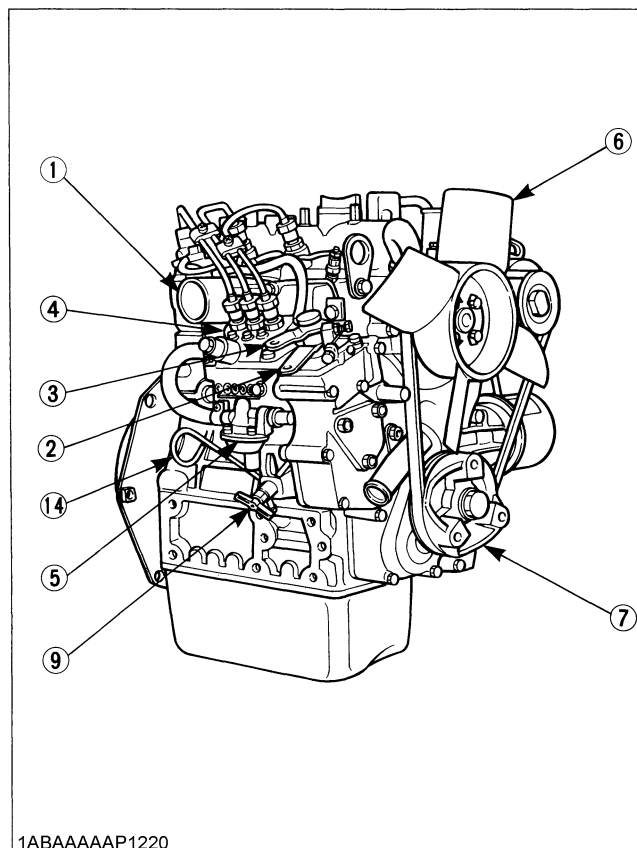
Locate the serial number now and record them in the space provided.

	Type	Serial No.
Engine		
Date of Purchase		
Name of Dealer		
(To be filled in by purchaser)		

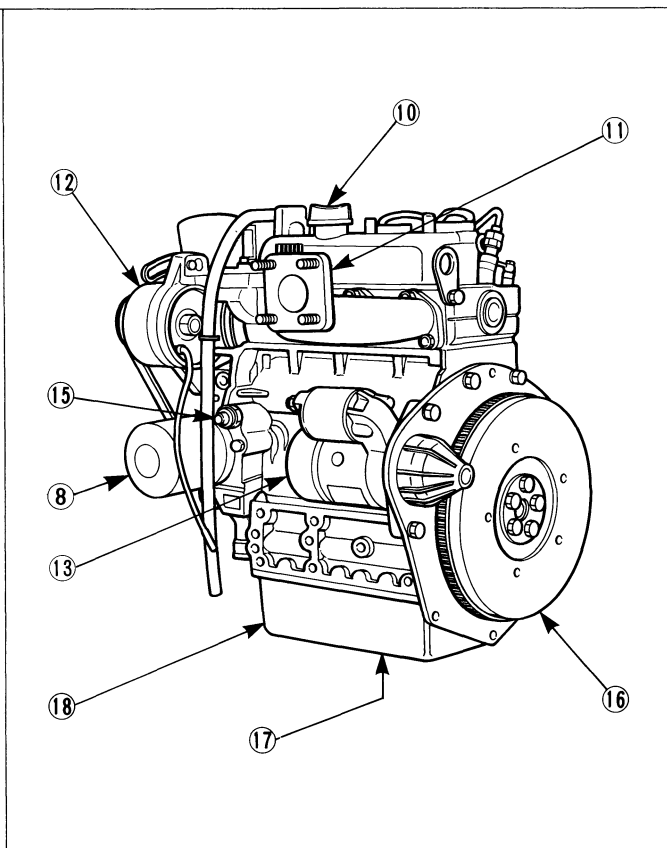


(1) Engine serial number

NAMES OF PARTS



- (1) Intake manifold
- (2) Speed control lever
- (3) Engine stop lever
- (4) Injection pump
- (5) Fuel feed pump
- (6) Cooling fan
- (7) Fan drive pulley
- (8) Oil filter cartridge
- (9) Water drain cock



- (10) Oil filler plug
- (11) Exhaust manifold
- (12) Alternator
- (13) Starter
- (14) Oil level gauge
- (15) Oil pressure switch
- (16) Flywheel
- (17) Oil drain plug
- (18) Oil pan

PRE-OPERATION CHECK

BREAK-IN

During the engine break-in period, observe the following by all means:

1. Change engine oil and oil filter cartridge after the first 50 hours of operation (See "ENGINE OIL" in Periodic Service Section).
2. When ambient temperature is low, operate the machine after the engine has been completely warmed up.

DAILY CHECK

To prevent trouble from occurring, it is important to know the conditions of the engine well. Check it before starting.



CAUTION

To avoid personal injury:

- Be sure to install shields and safeguards attached to the engine when operating.
- Stop the engine at a flat and wide space when checking.
- Keep dust or fuel away from the battery, wiring, muffler and engine to prevent a fire. Check and clear them before operating everyday. Pay attention to the heat of the exhaust pipe or exhaust gas so that it can not ignite trash.

Item		Ref. page
1. Parts which had trouble in previous operation		-
2. By walking around the machine	(1) Oil or water leaks	13 to 15
	(2) Engine oil level and contamination	13
	(3) Amount of fuel	11
	(4) Amount of coolant	15
	(5) Dust in air cleaner dust cup	18
	(6) Damaged parts and loosened bolts and nuts	-
3. By inserting the key into the starter switch	(1) Proper functions of meters and pilot lamps; no stains on these parts	-
	(2) Proper function of glow lamp timer	-
4. By starting the engine	(1) Color of exhaust fumes	7
	(2) Unusual engine noise	7

OPERATING THE ENGINE

STARTING THE ENGINE(NORMAL)



CAUTION

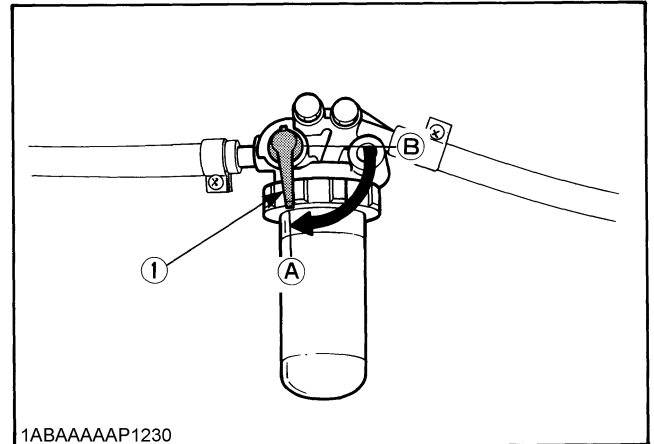
To avoid personal injury:

- Do not allow children to approach the machine while the engine is running.
- Be sure to install the machine on which the engine is installed, on a flat place.
- Do not run the engine on gradients.
- Do not run the engine in an enclosed area. Exhaust gas can cause air pollution and exhaust gas poisoning.
- Keep your hands away from rotating parts (such as fan, pulley, belt, flywheel etc.) during operation.
- Do not operate the machine while under the influence of alcohol or drugs.
- Do not wear loose, torn or bulky clothing around the machine. It may catch on moving parts or controls, leading to the risk of accident. Use additional safety items, e.g. hard hat, safety boots or shoes, eye and hearing protection, gloves, etc., as appropriate or required.
- Do not wear radio or music headphones while operating engine.
- Check to see if it is safe around the engine before starting.
- Reinstall safeguards and shields securely and clear all maintenance tools when starting the engine after maintenance.

IMPORTANT :

- Do not use ether or any starting fluid for starting the engine, or a severe damage will occur.
- When starting the engine after a long storage (of more than 3 months), first set the stop lever to the "STOP" position and then activate the starter for about 10 seconds to allow oil to reach every engine part.

1. Set the fuel lever to "ON".

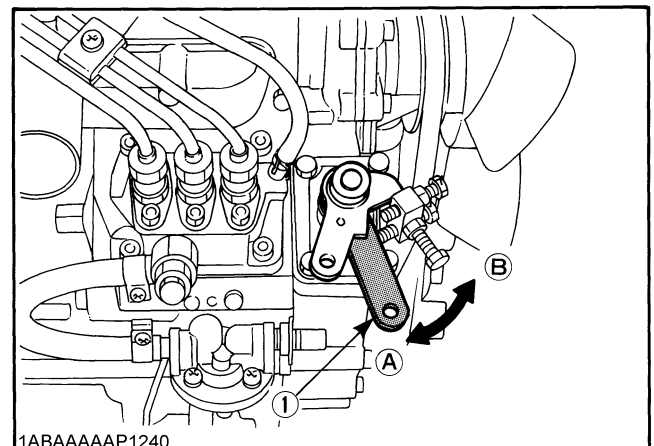


(1) Fuel lever

(A) "ON"

(B) "OFF"

2. Place the engine stop lever in the "START" position.
3. Place the speed control lever at more than half "OPERATION"

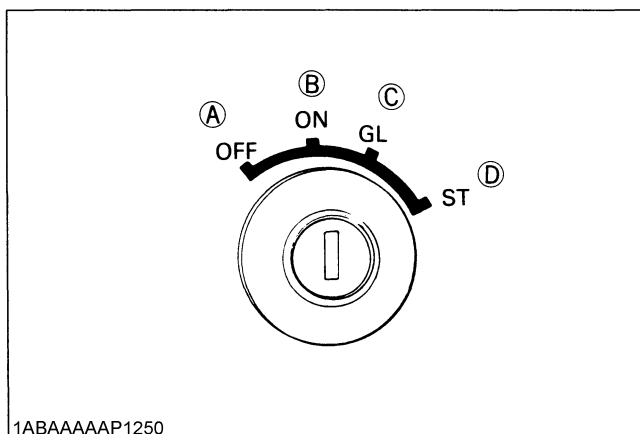


(1) Speed Control lever

(A) "OPERATION"

(B) "IDLING"

4. Insert the key into the key switch and turn it "ON".



- (A) "OFF" SWITCHED OFF
(B) "ON" OPERATION
(C) "GL" PREHEATING
(D) "ST" STARTING

5. Turn the starter switch to the "PREHEATING" position to allow the glow lamp to redden.
6. Turn the key to the "STARTING" position and the engine should start. Release the key immediately when the engine starts.
7. Check to see that the oil pressure lamp and charge lamp are off. If the lamps are still on, immediately stop the engine, and determine the cause.

(See "CHECKS DURING OPERATION" in Operating the Engine Section)

NOTE :

- If the oil pressure lamp should be still on, immediately stop the engine and check;
 - if there is enough engine oil.
 - if the engine oil has dirt in it.
 - if the wiring is faulty.

8. Warm up the engine at medium speed without load.

IMPORTANT :

- If the glow lamp should redden too quickly or too slowly, immediately ask your KUBOTA dealer to check and repair it.
- If the engine does not catch or start at 10 seconds after the starter switch is set at "STARTING" position, wait for another 30 seconds and then begin the engine starting sequence again. Do not allow the starter motor to run continuously for more than 20 seconds.

COLD WEATHER STARTING

If the ambient temperature is below* -5°C (23°F) and the engine is very cold, start it in the following manner: Take steps (1) through (4) left.

5. Turn the key to the "PREHEATING" position and keep it there for a certain period mentioned below.

IMPORTANT :

- Shown below are the standard preheating times for various temperatures. This operation, however, is not required, when the engine is warmed up.

Ambient temperature	Preheating time	
	Ordinary heat type	With glow lamp timer
Above 10°C (50°F)	NO NEED	See NOTE:
10°C (50°F) to -5°C (23°F)	Approx. 5 seconds	
*Below -5°C (23°F)	Approx. 10 seconds	
Limit of continuous use	20 seconds	

NOTE :

- In case of installing standard glow lamp, glow lamp goes off after about 6 seconds, when the starter switch key is turned to the "PREHEATING" position. However if necessary, keep the starter switch key at the "PREHEATING" position for longer time, according to the left recommendation.

6. Turn the key to the "STARTING" position and the engine should start.

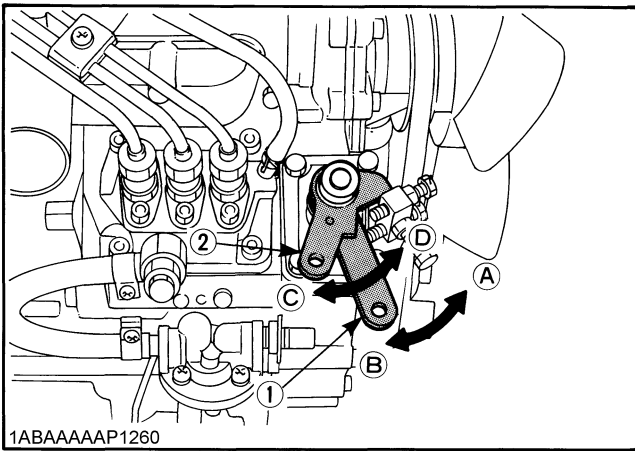
(If the engine fails to start after 10 seconds, turn off the key for 5 to 30 seconds. Then repeat steps (5) and (6).)

IMPORTANT :

- Do not allow the starter motor to run continuously for more than 20 seconds.
- Be sure to warm up the engine, not only in winter, but also in warmer seasons. An insufficiently warmed-up engine can shorten its service life.
- When there is fear of temperature dropping below -15°C (5°F) detach the battery from the machine, and keep it indoors in a safe area, to be reinstalled just before the next operation.

STOPPING THE ENGINE

1. Return the speed control lever to low idle, and run the engine under idling
2. Set the engine stop lever to "STOP" position.
3. With the starter switch placed at "OFF" position, remove the key. (Be sure to return the stop lever as it was after stopping the engine, and get ready for the next starting.)



- | | |
|-------------------------|-----------------|
| (1) Speed control lever | (A) "IDLING" |
| (2) Engine stop lever | (B) "OPERATION" |
| | (C) "START" |
| | (D) "STOP" |

CHECKS DURING OPERATION

While running, make the following checks to see that all parts work well.

■ Radiator Cooling water (Coolant)



WARNING

To avoid personal injury:

- Do not remove radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop position, to relieve any pressure, before removing cap completely.

When the engine overheats and hot coolant overflows through the radiator and hoses, stop the engine immediately and make the following checks to determine the cause of trouble:

Check item

1. Check to see if there is any water leak;
2. Check to see if there is any obstacle around the cooling air inlet or outlet;
3. Check to see if there is any dirt or dust between radiator fin and tube;
4. Check to see if the fan belt is too loose;
5. Check to see if radiator water pipe is clogged;
6. Check to see if anti-freeze is mixed into coolant in warm seasons.

■ Oil pressure lamp

The lamp lights up to warn the operator that the engine oil pressure has dropped below the prescribed level. If this should happen during operation or should not go off even after the engine is accelerated more than 1000rpm, immediately stop the engine and check the following:

1. Engine oil level (See "ENGINE OIL" in Maintenance Section).
2. Lubricant system (See "ENGINE OIL" in Maintenance Section).

■ Fuel



CAUTION

To avoid personal injury:

- Fluid escaping from pinholes may be invisible. Do not use hands to search for suspected leaks; Use a piece of cardboard or wood, instead. If injured by escaping fluid, see a medical doctor at once. This fluid can produce gangrene or a severe allergic reaction.
- Check any leaks from fuel pipes or fuel injection pipes. Use eye protection when checking for leaks.

Be careful not to empty the fuel tank. Otherwise air may enter the fuel system, requiring fuel system bleeding. (See "FUEL" in Maintenance Section).

■ Color of exhaust

While the engine is run within the rated output range:

- The color of exhaust remains colorless.
- If the output slightly exceeds the rated level, exhaust may become a little colored with the output level kept constant.
- If the engine is run continuously with dark exhaust emission, it may lead to trouble.

■ Immediately stop the engine if;

- The engine suddenly slow down or accelerates.
- Unusual noises suddenly appear.
- Exhaust fumes suddenly become very dark.
- The oil pressure lamp or the water temperature alarm lamp lights up.

REVERSED ENGINE REVOLUTION AND REMEDIES



CAUTION

To avoid personal injury:

- Reversed engine operation can make the machine reverse and run it backwards. It may lead to serious trouble.
- Reversed engine operation may make exhaust gas gush out into the intake side and ignite the air cleaner; It could catch fire.

Reversed engine revolution must be stopped immediately since engine oil circulation is cut quickly, leading to serious trouble.

■ How to tell when the engine starts running backwards

1. Lubricating oil pressure drops sharply. Oil pressure warning light, if used, will light.
2. Since the intake and exhaust sides are reversed, the sound of the engine changes, and exhaust gas will come out of the air cleaner.
3. A louder knocking sound will be heard when the engine starts running backwards.

■ Remedies

1. Immediately set the engine stop lever to "STOP" position to stop the engine.
2. After stopping the engine, check the air cleaner, intake rubber tube and other parts and replace parts as needed.

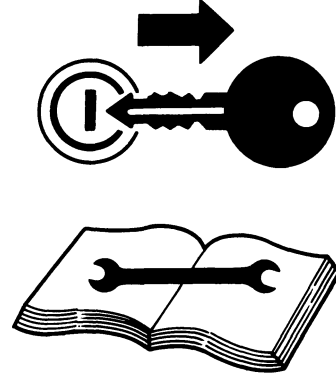
MAINTENANCE



CAUTION

To avoid personal injury:

- Be sure to conduct daily checks, periodic maintenance, refueling or cleaning on a level surface with the engine shut off and remove the key.
- Before allowing other people to use your engine, explain how to operate, and have them read this manual before operation.
- When cleaning any parts, do not use gasoline but use regular cleanser.
- Always use proper tools, that are in good condition. Make sure you understand how to use them, before performing any service work.
- When installing, be sure to tighten all bolts lest they should be loose. Tighten the bolts by the specified torque.
- Do not put any tools on the battery, or battery terminals may short out. Severe burns or fire could result. Detach the battery from the engine before maintenance.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result.



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SERVICE INTERVALS

Observe the following for service and maintenance.

The lubricating oil change intervals listed in the table below are for Classes CF, CE and CD lubricating oils of API classification with a low-sulfur fuel in use. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals than recommended in the table below depending on the operating condition.

Interval	Item	Ref.page		
Every 50 hours	Check of fuel pipes and clamp bands	12		@
See NOTE	Change of engine oil (depending on the oil pan)	13,14	◎	
Every 100 hours	Cleaning of air cleaner element	18,18	*1	@
	Cleaning of fuel filter	12		
	Check of battery electrolyte level	19,20		
	Check of fan belt tightness	20		
Every 200 hours	Check of radiator hoses and clamp bands	16		
	Replacement of oil filter cartridge (depending on the oil pan)	15	◎	
	Check of intake air line	-		@
Every 400 hours	Replacement of fuel filter element	12		@
Every 500 hours	Removal of sediment in fuel tank	-		
	Cleaning of water jacket (radiator interior)	-		
	Replacement of fan belt	20		
Every one or two months	Recharging of battery	19,20		
Every year or every 6 cleanings of air cleaner element	Replacement of air cleaner element	18,18	*2	@
Every 800 hours	Check of valve clearance	22		
Every 1500 hours	Check of fuel injection nozzle injection pressure	-	*3	@
Every 3000 hours	Check of turbo charger	-	*3	@
	Check of injection pump	-	*3	@
	Check of fuel injection timer	-	*3	@
Every two years	Replacement of battery	19,20		
	Replacement of radiator hoses and clamp bands	16		
	Replacement of fuel pipes and clamps	12	*3	@
	Change of radiator coolant (L.L.C.)	15		
	Replacement of intake air line	-	*4	@

IMPORTANT :

- The jobs indicated by ◎ must be done after the first 50 hours of operation.
- *1 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
- *2 After 6 times of cleaning.
- *3 Consult your local KUBOTA Dealer for this service.
- *4 Replace only if necessary.
- The items listed above (@ marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA nonroad emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction.
Please see the Warranty Statement in detail.

NOTE :

- **Changing interval of Engine oil and oil filter cartridge.**

		*Oil pan depth	
		101 mm (3.98 in.)	121 mm (4.76 in.)
Z602-E D902-E	Engine oil	50 Hrs (Initial)	-
		100 Hrs	
	Oil filter cartridge	200 Hrs	
Z482-E D662-E D722-E	Engine oil	50 Hrs (Initial)	
		75 Hrs	100 Hrs
	Oil filter cartridge	150 Hrs	200 Hrs
D782-E	Engine oil	-	50 Hrs (Initial)
			100 Hrs
	Oil filter cartridge		200 Hrs

* 101 mm (3.98 in.) oil pan depth is optional for Z482-E, D662-E, D722-E.

**Standard replacement interval

- API service classification: above CD grade
- Ambient temperature: below 35° C (95° F)

- **Lubricating oil**

With the emission control now in effect, the CF-4 and CG-4 lubricating oils have been developed for use of a low-sulfur fuel on on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the CF, CD or CE lubricating oil with a high total base number. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals.

- **Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.**

○ : Recommendable X : Not recommendable

Lubricating oil class	Fuel		Remarks
	Low-sulfur	High-sulfur	
CF	○	○	TBN ≥ 10
CF-4	○	X	
CG-4	○	X	

PERIODIC SERVICE

FUEL

Fuel is flammable and can be dangerous. You should handle fuel with care.



CAUTION

To avoid personal injury:

- Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.
- Be careful not to spill fuel during refueling. If fuel should spill, wipe it off at once, or it may cause a fire.
- Do not fail to stop the engine before refueling. Keep the engine away from the fire.
- Be sure to stop the engine while refueling or bleeding and when cleaning or changing fuel filter or fuel pipes. Do not smoke when working around the battery or when refueling.
- Check the above fuel systems at a well ventilated and wide place.
- When fuel and lubricant are spilled, refuel after letting the engine cool off.
- Always keep spilled fuel and lubricant away from engine.

Fuel level check and refueling

1. Check to see that the fuel level is above the lower limit of the fuel level gauge.
2. If the fuel is too low, add fuel to the upper limit. Do not overfill.

No.2-D is a distillate fuel oil of lower volatility for engines in industrial and heavy mobile service.

(SAE J313 JUN87)

Grade of Diesel Fuel Oil According to ASTM D975

Flash Point, °C (°F)	Water and Sediment, volume %	Carbon Residue on, 10 percent Residuum, %	Ash, weight %
Min	Max	Max	Max
52 (125)	0.05	0.35	0.01

Distillation Temperatures, °C(°F) 90% Point		Viscosity Kinematic cSt or mm ² /s at 40°C		Viscosity Saybolt, SUS at 37.8°C(100°F)	
Min	Max	Min	Max	Min	Max
282 (540)	338 (640)	1.9	4.1	32.6	40.1

Sulfur, weight %	Copper Strip Corrosion	Cetane Number
Max	Max	Min
0.40	No. 3	40

The cetane number is required not less than 45.

IMPORTANT :

- Be sure to use a strainer when filling the fuel tank, or dirt or sand in the fuel may cause trouble in the fuel injection pump.
- For fuel, always use diesel fuel. You are required not to use alternative fuel, because its quality is unknown or it may be inferior in quality. Kerosene, which is very low in cetane rating, adversely affects the engine. Diesel fuel differs in grades depending on the temperature.
- Be careful not to let the fuel tank become empty, or air can enter the fuel system, necessitating bleeding before next engine start.

Air bleeding the fuel system



CAUTION

To avoid personal injury;

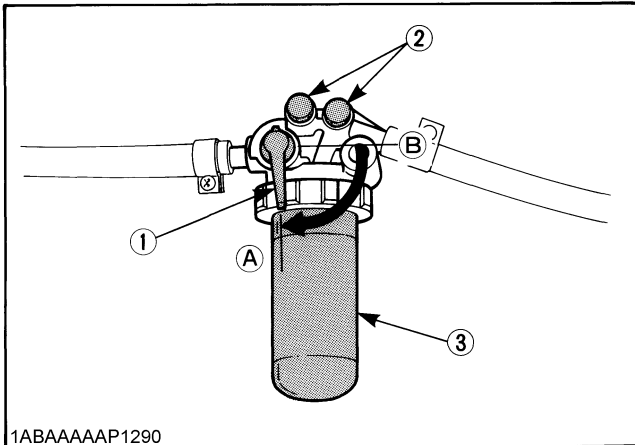
- Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.

Air bleeding of the fuel system is required if;

- after the fuel filter and pipes have been detached and refitted;
- after the fuel tank has become empty; or
- before the engine is to be used after a long storage.

[PROCEDURE]

1. Fill the fuel tank to the fullest extent. Open the fuel filter lever.
2. Loosen air vent plug of the fuel filter a few turns.
3. Screw back the plug when bubbles do not come up any more.
4. Open the air vent plug on top of the fuel injection pump.
5. Retighten the plug when bubbles do not come up any more.



- | | |
|-----------------------|-----------|
| (1) Fuel filter lever | (A) "ON" |
| (2) Air vent plug | (B) "OFF" |
| (3) Fuel filter pot | |

■Checking the fuel pipes



CAUTION

To avoid personal injury;

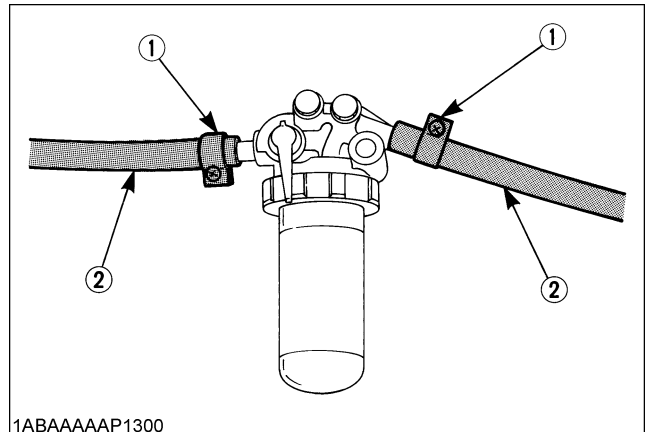
- Check or replace the fuel pipes after stopping the engine. Broken fuel pipes can cause fires.

Check the fuel pipes every 50 hours of operation. When if;

1. If the clamp band is loose, apply oil to the screw of the band, and tighten the band securely.
2. If the fuel pipes, made of rubber, became worn out, replace them and clamp bands every 2 years.
3. If the fuel pipes and clamp bands are found worn or damaged before 2 years' time, replace or repair them at once.
4. After replacement of the pipes and bands, air-bleed the fuel system.

IMPORTANT :

- When the fuel pipes are not installed, plug them at both ends with clean cloth or paper to prevent dirt from entering. Dirt in the pipes can cause fuel injection pump malfunction.

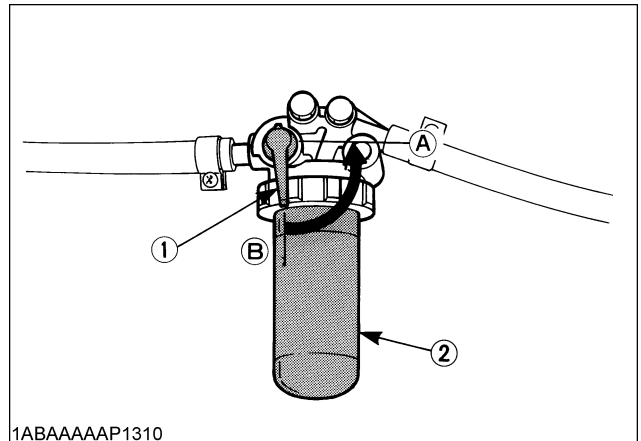


- | |
|----------------|
| (1) Clamp band |
| (2) Fuel pipe |

■Cleaning the fuel filter pot

Every 100 hours of operation, clean the fuel filter in a clean place to prevent dust intrusion.

1. Close the fuel filter lever.

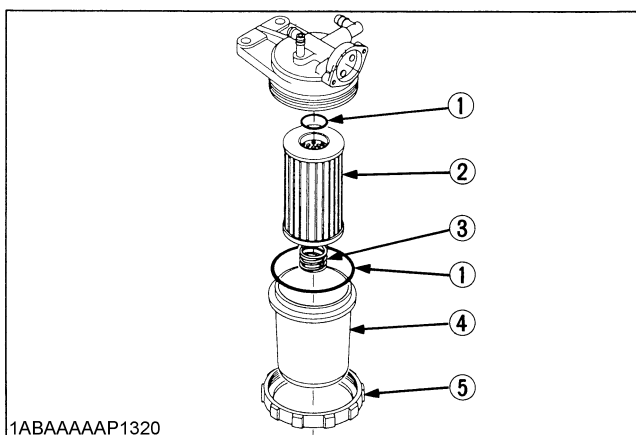


- | | |
|-----------------------|-----------|
| (1) Fuel filter lever | (A) "OFF" |
| (2) Fuel filter pot | (B) "ON" |

2. Remove the top cap, and rinse the inside with diesel fuel.
3. Take out the element, and rinse it with diesel fuel.
4. After cleaning, reinstall the fuel filter, keeping out of dust and dirt.
5. Air-bleed the injection pump.

IMPORTANT :

- Entrance of dust and dirt can cause a malfunction of the fuel injection pump and the injection nozzle. Wash the fuel filter cup periodically.



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- (1) O ring
- (2) Filter element
- (3) Spring
- (4) Filter bowl
- (5) Screw ring

ENGINE OIL



CAUTION

To avoid personal injury:

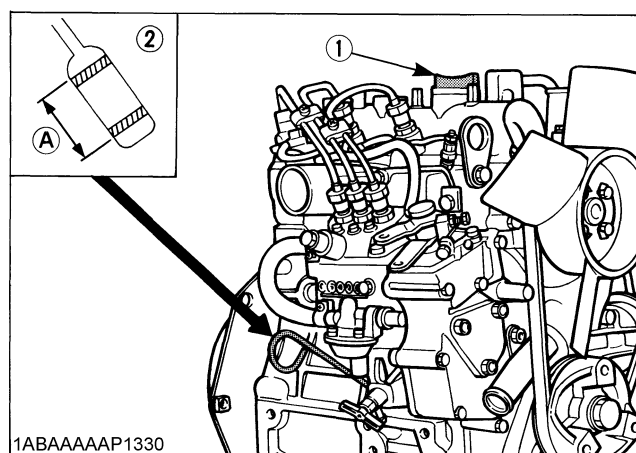
- Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result. Always stop the engine and allow it to cool before conducting inspections, maintenance, or for a cleaning procedure.
- Contact with engine oil can damage your skin. Put on gloves when using engine oil. If you come in contact with engine oil, wash it off immediately.

NOTE :

- Be sure to inspect the engine, locating it on a horizontal place. If placed on gradients accurately, oil quantity may not be measured.
- Be sure to keep the oil level between upper and lower limits of the oil gauge. Too much oil may cause a drop in output or excessive blow-by gas. On the closed breather type engine in which mist is sucked through port, too much oil may cause oil hammer. While too little oil, may seize the engine's rotating and sliding parts. (The closed breather is an option.)

■ Checking level and adding engine oil

1. Check the engine oil level before starting or more than 5 minutes after stopping the engine.
2. Remove the oil level gauge, wipe it clean and reinstall it.
3. Take the oil level gauge out again, and check the oil level.



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- (1) Oil filler plug
- (2) Oil level gauge

[Lower end of oil level gauge]
 (A): Engine oil level within this range is proper.

4. If the oil level is too low, remove the oil filler plug, and add new oil to the prescribed level.
5. After adding oil, wait more than 5 minutes and check the oil level again. It takes same time for the oil to come down to the oil pan.

Engine oil quantity

Models	Oil pan depth	
	*101 mm (3.98 in.)	121 mm (4.76 in.)
Z482-E	2.1 L (0.55 U.S.gals.)	2.5 L (0.66 U.S.gals.)
D662-E D722-E	3.2 L (0.84 U.S.gals.)	3.8 L (1.0 U.S.gals.)
D782-E	-	3.6 L (0.95 U.S.gals.)
Z602-E	101 mm (3.98 in.)	-
	2.5 L (0.66 U.S.gals.)	
D902-E	101 mm (3.98 in.)	-
	3.7 L (0.98 U.S.gals.)	

*101mm(3.98in.) oil pan depth is optional.

Oil quantities shown are for standard oil pans.

IMPORTANT :

- Engine oil should be MIL-L-2104C or have properties of API classification CD grades or higher.
Change the type of engine oil according to the ambient temperature.

above 25° C (77° F)	SAE30	or SAE10W-30 SAE10W-40
0° C to 25° C (32° F to 77° F)	SAE20	or SAE10W-30 SAE10W-40
below 0° C (32° F)	SAE10	or SAE10W-30 SAE10W-40

- When using oil different from the previous one, be sure to drain all the previous oil before adding the new engine oil.

■ Changing engine oil

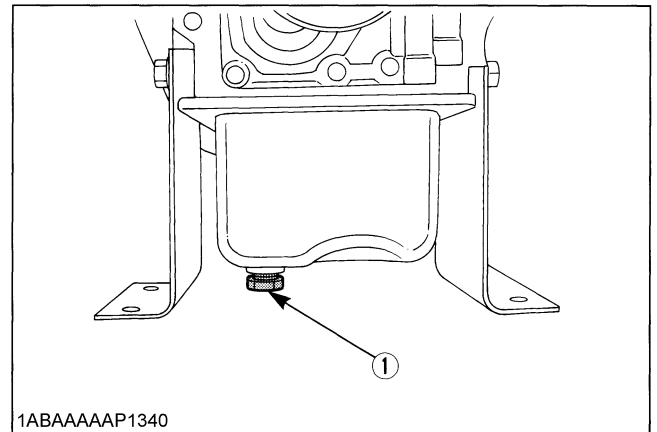


CAUTION

To avoid personal injury:

- Be sure to stop the engine before draining engine oil.
- When draining engine oil, place some container underneath the engine and dispose it according to local regulations.
- Do not drain oil after running the engine. Allow engine to cool down sufficiently.

1. Change oil after the initial 50 hours of operation and every 100 hours thereafter.
2. Remove the drain plug at the bottom of the engine, and drain all the old oil. Drain oil easier and completely while the engine is hot.



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(1) Oil drain plug

3. Add new engine oil up to the upper limit of the oil level gauge.

■ Replacing the oil filter cartridge

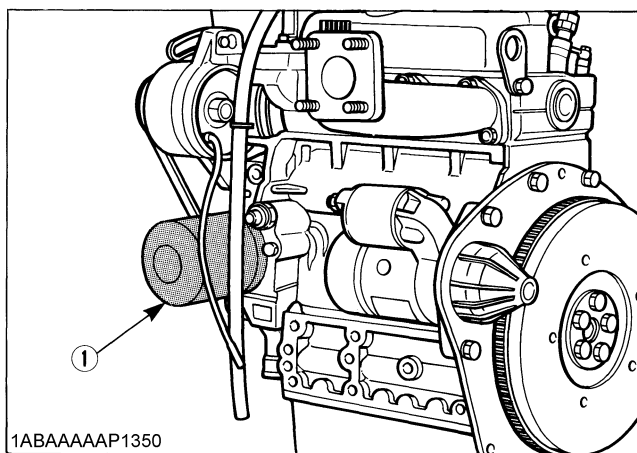


CAUTION

To avoid personal injury:

- Be sure to stop the engine before changing the oil filter cartridge.
- Allow engine to cool down sufficiently, oil can be hot and cause burns.

1. Replace the oil filter cartridge after the initial 50 hours of operation and every 200 hours thereafter.
2. Remove the old oil filter cartridge with a filter wrench.
3. Apply a film of oil to the gasket for the new cartridge.
4. Screw in the cartridge by hand. When the gasket contacts the seal surface, tighten the cartridge enough by hand. Because, if you tighten the cartridge with wrench, it will be tightened too much.



- (1) Oil filter cartridge
Remove with a filter wrench
(Tighten with your hand)

5. After the new cartridge has been replaced, the engine oil level normally decreases a little. Thus, run the engine for a while and check oil leaks through the seal before checking the engine oil level. Add oil if necessary.

NOTE :

- Wipe off any oil sticking to the machine completely.

RADIATOR

Coolant will last for one day's work if filled all the way up before operation start. Make it a rule to check the coolant level before every operation.



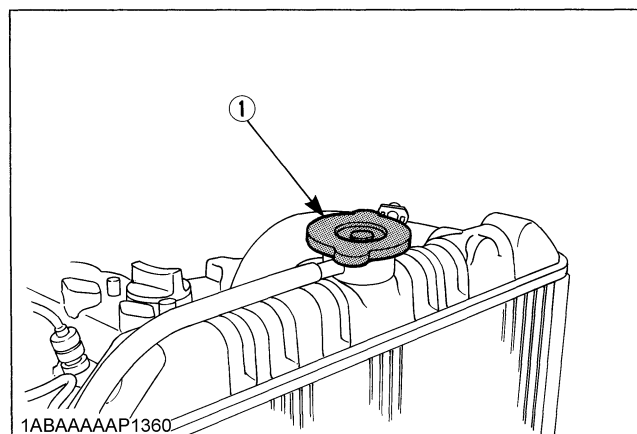
WARNING

To avoid personal injury:

- Do not stop the engine suddenly, stop it after about 5 minutes of unloaded idling.
- Work only after letting the engine and radiator cool off completely (more than 30 minutes after it has been stopped).
- Do not remove the radiator cap while coolant is hot. When cool to the touch, rotate cap to the first stop to allow excess pressure to escape. Then remove cap completely. If overheats should occur, steam may gush out from the radiator or reserve tank; Severe burns could result.

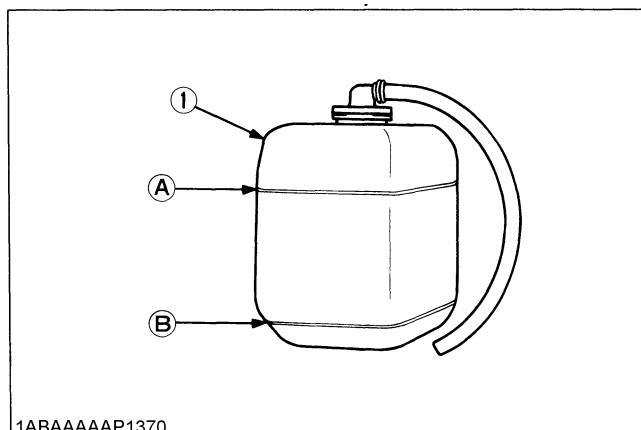
■ Checking coolant level, adding coolant

1. Remove the radiator cap after the engine has completely cooled, and check to see that coolant reaches the supply port.

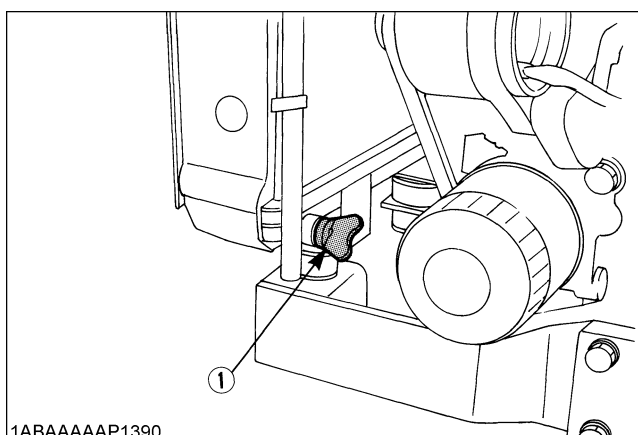
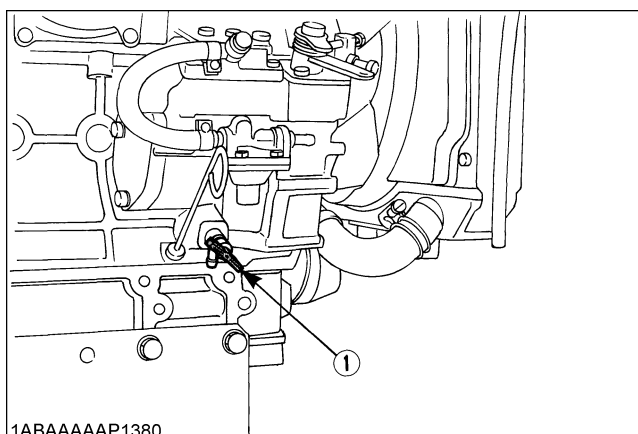


- (1) Radiator pressure cap

2. If the radiator is provided with a reserve tank, check the coolant level of the reserve tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.



- (1) Reserve tank (A) "FULL"
(B) "LOW"
- When the coolant level drops due to evaporation, add water only up to the full level.
 - Check to see that two drain cocks; one is at the crankcase side and the other is at the lower part of the radiator as figures below.



(1) Coolant drain cock

IMPORTANT :

- If the radiator cap has to be removed, follow the caution and securely retighten the cap.
- If coolant should be leak, consult your local KUBOTA dealer.
- Make sure that muddy or sea water does not enter the radiator.
- Use clean, fresh water and 50% anti-freeze to fill the recovery tank.
- Do not refill reserve tank with coolant over the "FULL" level mark.
- Be sure to close the radiator cap securely. If the cap is loose or improperly closed, coolant may leak out and decrease quickly.

Changing coolant

- To drain coolant, always open both drain cocks and simultaneously open the radiator cap as well. With the radiator cap kept closed, a complete drain of water is impossible.
- Remove the overflow pipe of the radiator pressure cap to drain the reserve tank.
- Prescribed coolant volume (U.S.gallons)

Models	Quantity
Z482-E, Z602-E	2.8L (0.74 U.S.gals.)
D662-E, D722-E, D782-E, D902-E	3.1L (0.82 U.S.gals.)

NOTE :

- Coolant quantities shown are for standard radiators.

- An improperly tightened radiator cap or a gap between the cap and the seat quickens loss of coolant.
- Coolant (Radiator cleaner and anti-freeze)

Season	Coolant
Summer	Pure water and radiator cleaner
Winter (when temperature drops below 0° C (32° F) or all season)	Pure water and anti-freeze (See "Anti-freeze" in Maintenance Section)

Checking radiator hoses and clamp



CAUTION

To avoid personal injury:

- Be sure to check radiator hoses and hose clamps periodically. If radiator hose is damaged or coolant leaks, overheats or severe burns could occur.

Check to see if radiator hoses are properly fixed every 200 hours of operation or 6 months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten hose clamp securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.

Replace hoses and hose clamps every 2 years or earlier, if checked and found that hoses are swollen, hardened or cracked.

■Precaution at overheating

Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating". Take these actions if the engine's alarm buzzer sounds or the alarm lamp lights up.

1. Stop the engine operation in a safe place and keep the engine unloaded idling.
2. Do not stop the engine suddenly. Stop it after about 5 minutes of unloaded idling.
3. If the engine stalls within about 5 minutes of running under no load, immediately leave and keep yourself away from the machine. Never open the hood and any other part.
4. Keep yourself and others well away from the engine for further 10 minutes or while the steam blown out.
5. Checking that there gets no danger such as burn, get rid of the causes of overheating according to the manual, see "Troubleshooting" section. And then, start again the engine.

■Anti-freeze



CAUTION

To avoid personal injury:

- When using anti-freeze, put on some protection such as rubber gloves.
- If should drink anti-freeze, throw up at once and take medical attention.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of anti-freeze.
- Keep fire and children away from anti-freeze.
- Be mindful of the environment and ecology. Before draining any fluids, find out the correct way of disposing by checking with local codes.
- Also, observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.

If it freezes, coolant can damage the cylinders and radiator. It is necessary, if the ambient temperature falls below 0°C (32°F), to remove coolant after operating or to add anti-freeze to it.

1. There are 2 types of anti-freeze available; use the permanent type (PT) for this engine.
2. Before adding anti-freeze for the first time, clean the radiator interior by pouring fresh water and draining it a few times.

3. The procedure for mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.
4. Mix the anti-freeze with water, and then fill in to the radiator.

IMPORTANT :

- When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50%.

Vol % Anti-freeze	Freezing Point		Boiling Point *	
	°C	°F	°C	°F
40	-24	-12	106	222
50	-37	-34	108	226

*At 1.013 x 10⁵Pa (760 mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

NOTE :

- The above data represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.
- When the coolant level drops due to evaporation, add water only to keep the anti-freeze mixing ratio less than 50%. In case of leakage, add anti-freeze and water in the specified mixing ratio before filling into the radiator.
- Anti-freeze absorbs moisture. Keep unused anti-freeze in a tightly sealed container.
- Do not use radiator cleaning agents when anti-freeze has been added to the coolant. (Anti-freeze contains an anti-corrosive agent, which will react with the radiator cleaning agent forming sludge which will affect the engine parts.)

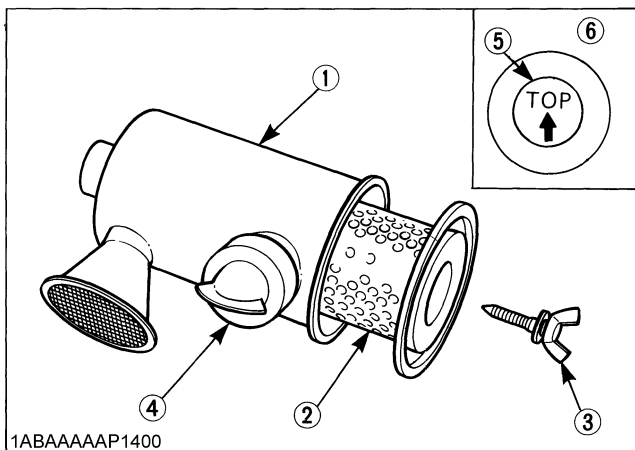
■Radiator cement

As the radiator is solidly constructed, there is little possibility of water leakage. Should this happen, however, radiator cement can easily fix it. If leakage is serious, contact your local KUBOTA dealer.

AIR CLEANER

As the element of the air cleaner employed on this engine is a dry type, never apply oil to it.

1. Open the evacuator valve once a week under ordinary conditions-or daily when used in a dusty place-to get rid of large particles of dust and dirt.
2. Wipe the inside air cleaner clean with cloth or the like if it is dirty or wet.
3. Avoid touching the element except when cleaning.
4. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 205kPa (2.1kgf/cm², 30psi).
5. When carbon or oil adheres to the element, soak the element in detergent for 30 minutes, then wash it several times in water, rinse with clean water and dry it naturally.
6. After element is fully dried, inspect inside of the element with a light and check if it is damaged or not. (referring to the instructions on the label attached to the element.)
7. Replace the element every year or every six cleanings.



- (1) Air cleaner body
- (2) Element
- (3) Wing bolt
- (4) Evacuator valve
- (5) "TOP" mark
- (6) Dust cup

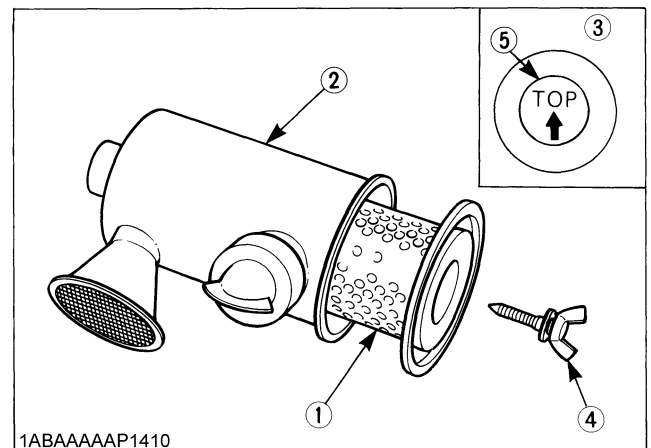
IMPORTANT :

- Make sure the wing bolt for the element is tight enough. If it is loose, dust and dirt may be sucked, wearing down the cylinder liner and piston ring earlier and thereby resulting in poor power output.

■For the air cleaner with a dust cup (optional)

Remove and clean out the dust cup before it becomes half full with dust; usually once a week, or even every day if the working surroundings are dusty.

Install the air cleaner dust cup with "TOP" indicated on the rear of the cup in the upside. (However, it may be installed in either direction when the cover is placed at the lower part.)



- (1) Element
- (2) Air cleaner body
- (3) Dust cup
- (4) Wing bolt
- (5) "TOP" mark

IMPORTANT :

- If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.

BATTERY



CAUTION

To avoid personal injury:

- Be careful not to let the battery electrolyte contact your body or clothing.
- Wear eye protection and rubber gloves, since the diluted sulfuric acid solution burns skin and eats holes in clothing. Should this occur, immediately wash it off with running water and get medical attention.

Mishandling of the battery shortens the service life and adds to maintenance costs. Obtain the maximum performance and the longest life of the battery by handling properly and with care.

Engine starting will be more difficult, if the battery charge is low. Be careful to recharge it at an early occasion before it is too late.

■ Battery charging



DANGER

The battery comes in two types: refillable and non-refillable.

- For using the refillable type battery, follow the instructions below.

Do not use or charge the battery if its fluid level stands below the LOWER (lower limit level) mark.

Otherwise, the battery component parts may deteriorate earlier than expected, which may shorten the battery's service life or cause an explosion.

Immediately, add distilled water until the battery's fluid level is between the UPPER and LOWER levels.

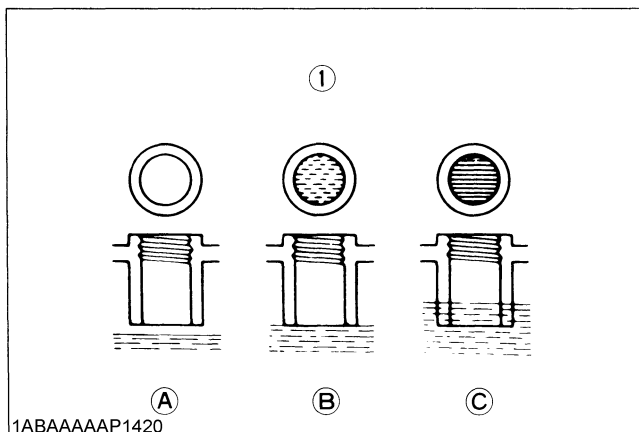


CAUTION

To avoid personal injury:

- When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.
- When charging the battery, remove the battery vent plugs.
- When disconnecting the cable from the battery, start with the negative terminal, and when connecting them, start with the positive terminal first.
- DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.

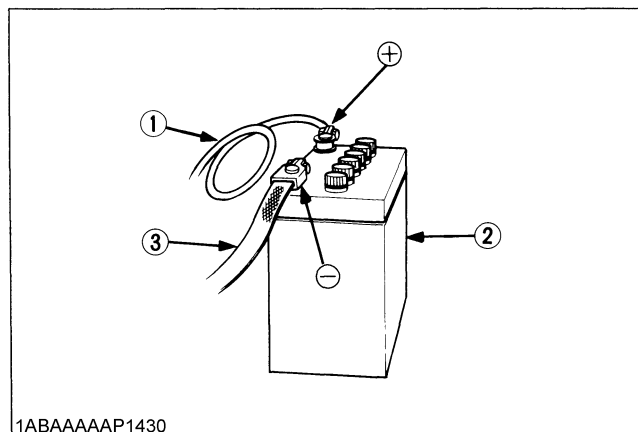
1. Make sure each electrolyte level is to the bottom of vent wells, if necessary, add only distilled water in a well-ventilated place.



(1) Battery electrolyte level

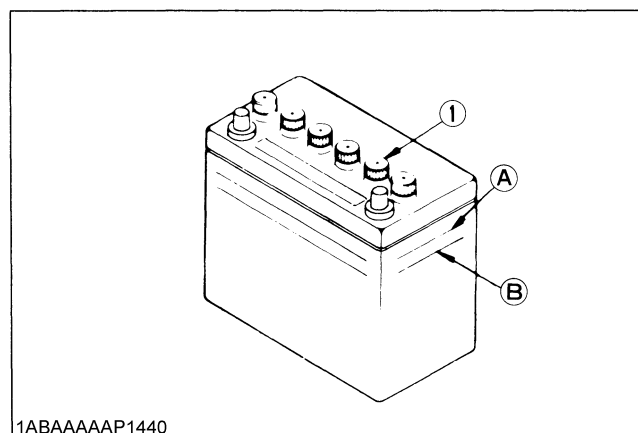
- (A) "TOO LOW"
(B) "PROPER"
(C) "TOO HIGH"

2. To slow charge the battery, connect the charger positive terminal to the battery positive terminal, and negative to the negative.
3. Quick recharging charges the battery at a high rate in a short time. As this is only for emergencies.
4. Recharge the battery as early as possible, or battery life will be extremely shortened.
5. When exchanging an old battery into new one, use battery of equal specification shown in page 26.



1ABAAAAAP1430

- (1) Thick black cable
(2) Battery case
(3) Earth cable



1ABAAAAAP1440

- (1) Plug
(A) "HIGHEST LEVEL"
(B) "LOWEST LEVEL"

IMPORTANT :

- Connect the charger positive terminal to the battery positive terminal, and negative to the negative.
- When disconnecting the cable from the battery, start with the negative terminal first. When connecting the cable to the battery, start with the positive terminal first. If reversed, the contact of tools on the battery may cause a short.

■ Direction for long term storage

1. When storing the engine for long periods of time, remove the battery, adjust the electrolyte to the proper level, and store in a dry and dark place.
2. The battery naturally discharges while it is stored. Recharge it once a month in summer, and every 2 months in winter.

ELECTRIC WIRING



CAUTION

To avoid personal injury:

- ◆ Shorting of electric cable or wiring may cause a fire.
 - Check to see if electric cables and wiring are swollen, hardened or cracked.
 - Keep dust and water away from all power connections.
- Loose wiring terminal parts, make bad connections. Be sure to repair them before starting the engine.

Damaged wiring reduces the capacity of electrical parts. Change of repair damaged wiring immediately.

1. Use automobile low voltage wiring cables for this wiring harness.
2. Use fuse and slow blow fuse as wiring protection.
3. Generally, available current of each fuse and size of wire in this drawing are recommendable value showed by Kubota, use suitable size fuses and wires for each machine to consideration to wiring setting and connection with another lines.
4. Install slow blow fuse near by battery, and install fuse box near by key switch.
5. Do not connect any parts which may cause induction current like motors to AC line.
6. Use heatproof cables, if room temperature around wire harness become over 75°C (167°F).
7. Remove painting at connecting position before installation of each cable to any parts.

FAN BELT

■ Adjusting Fan Belt Tension



CAUTION

To avoid personal injury:

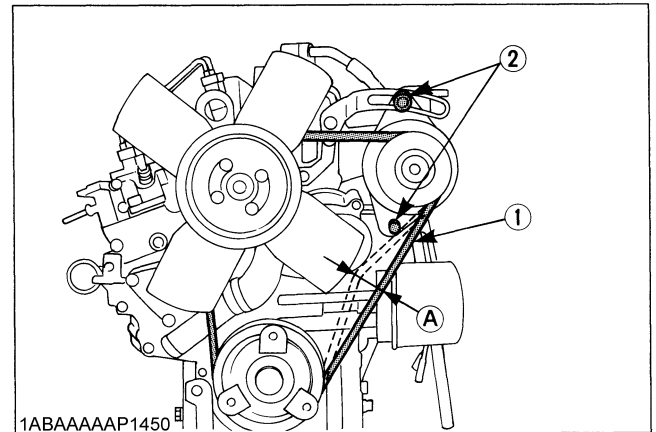
- Be sure to stop the engine and remove the key before checking the belt tension.
- Be sure to reinstall the detached safety shield after maintenance or checking.

Proper fan belt tension	A deflection of between 7 to 9 mm (0.28 to 0.35 in.) when the belt is pressed in the middle of the span.
-------------------------	--

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between the pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
4. Replace fan belt if it is damaged.

IMPORTANT :

- If belt is loosen or damaged and the fan is damaged, it could result in overheats or insufficient charging. Correct or replace belt.



- (1) Fan belt
(2) Bolt and nut

(A) 7 to 9 mm (0.28 to 0.35 in.)
(under load of 10 kgf (22.1 lbs))

CARRIAGE AND STORAGE

CARRIAGE



CAUTION

To avoid personal injury:

- Fix the engine securely not to fall during operation.
- Do not stand near or under the engine while carrying it.
- The engine is heavy. In handling it, be very alert not to get your hands and body caught in.

1. Use carrier such as crane when carrying the engine, or hurt your waist and yourself. Support the engine securely with rope not to fall while carrying it.
2. When lifting the engine, put the hook securely to metal fittings attached to the engine. Use strong hook and fittings enough to hang the engine.

STORAGE



CAUTION

To avoid personal injury:

- Do not clean the machine with engine running.
- To avoid the danger of exhaust fume poisoning, do not operate the engine in a closed building without proper ventilation.
- When storing the engine just after running, let the engine cool off.

Before storing the engine for more than a few months, remove any dirt on the machine, and:

1. Drain the coolant in the radiator. Open the cock at the bottom of the radiator, and remove the pressure cap to drain water completely. Leave the cock open. Hang a note written "No water" on the pressure cap. Since water may freeze when the temperature drops below 0° C (32° F), it is very important that no water is left in the machine.
2. Remove dirty engine oil, fill with new oil and run the engine for about 5 minutes to let the oil penetrate to all the parts.
3. Check all the bolts and nuts, and tighten if necessary.
4. Remove the battery from the engine, adjust the electrolyte level, and recharge it. Store the battery in a dry and dark place.
5. When the engine is not used for a long period of time, run it for about 5 minutes under no load every 2 to 3 months to keep it free from rust. If the engine is stored without any running, moisture in the air may condense into dew over the sliding parts of the engine, resulting in rust there.
6. If you forget to run the engine for longer than 5 to 6 months, apply enough engine oil to the valve guide and valve stem seal and make sure the valve works smoothly before starting the engine.
7. Store the engine in a flat place and remove the key from engine.
8. Do not store the engine in a place where has flammable materials such as dry grass or straw.
9. When covering the engine for storage, let engine and muffler cool off completely.
10. Operate the engine after checking and repairing damaged wirings or pipes, and clearing flammable materials carried by mouse.

TROUBLESHOOTING

If the engine does not function properly, use the following chart to identify and correct the cause.

■ When it is difficult to start the engine

Cause	Countermeasures
Fuel is thick and doesn't flow.	<ul style="list-style-type: none"> *Check the fuel tank and fuel filter. *Remove water, dirt and other impurities. *As all fuel will be filtered by the filter, if there should be water or other foreign matters on the filter, clean the filter with kerosene.
Air or water mixed in fuel system	<ul style="list-style-type: none"> *If air is in the fuel filter or injection lines, the fuel pump will not work properly. To attain proper fuel injection pressure, check carefully for loosened fuel line coupling, loose cap nut, etc. *Loosen air vent screws stop fuel filter and fuel injection pump to eliminate all the air in the fuel system.
Thick carbon deposits on orifice of injection nozzle.	<ul style="list-style-type: none"> *This is caused when water or dirt is mixed in the fuel. Clean the nozzle injection piece, being careful not to damage the orifice. *Check to see if nozzle is working properly or not. If not, install a new nozzle.
Valve clearance is wrong.	<ul style="list-style-type: none"> *Adjust valve clearance to 0.145-0.185mm(0.0057-0.0072in) when the engine is cold.
Leaking valves	<ul style="list-style-type: none"> *Grind valve.
Fuel injection timing is wrong.	<ul style="list-style-type: none"> *Adjust injection timing *The injection timing is 0.366 rad(20°) before top dead center.
Engine oil becomes thick in cold weather and engine cranks slow.	<ul style="list-style-type: none"> *Change grade of oil according to the weather (temperature.)
Low compression	<ul style="list-style-type: none"> *Bad valve or excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts.
Battery is discharged and the engine will not crank.	<ul style="list-style-type: none"> *Charge battery. *In winter, always remove battery from machine, charge fully and keep indoors. Install in machine at time of use.

■ When output is insufficient

Cause	Countermeasures
Carbon stuck around orifice of nozzle piece	<ul style="list-style-type: none"> *Clean orifice and needle valve, being very careful not to damage the nozzle orifice. *Check nozzle to see if good. If not, replace with new parts.
Compression is insufficient. Leaking valves	<ul style="list-style-type: none"> *Bad valve and excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts. *Grind valves.
Fuel is insufficient.	<ul style="list-style-type: none"> *Check fuel system.
Overheating of moving parts	<ul style="list-style-type: none"> *Check lubricating oil system. *Check to see if lubricating oil filter is working properly. *Filter element deposited with impurities would cause poor lubrication. Change element. *Check the clearance of bearing are within factory specs. *Check injection timing. *Adjust timing 0.366 rad(20°) before top dead center.
Valve clearance is wrong.	<ul style="list-style-type: none"> *Adjust to proper valve clearance of 0.145 to 0.185 mm(0.0057 to 0.0072 in.) with engine cold.
Air cleaner is dirty	<ul style="list-style-type: none"> *Clean the element every 100 hours of operation.
Fuel injection pressure is wrong.	<ul style="list-style-type: none"> *Adjust to proper pressure. 13.7Mpa (140 kgf/cm²; 1991 psi)
Injection pump wear	<ul style="list-style-type: none"> *Do not use poor quality fuel for it will cause wear of the pump. Only use No. 2-D diesel fuel. *Check the fuel injection pump element and delivery valve assembly and replace as necessary.

NOTE :

- If the cause of trouble can not be found, contact your KUBOTA dealer.

■ When engine suddenly stops

Cause	Countermeasures
Lack of fuel	*Check the fuel tank and refill the fuel, if necessary. *Also check the fuel system for air or leaks.
Bad nozzle	*If necessary, replace with a new nozzle.
Moving parts are overheated due to shortage of lubrication oil or improper lubrication.	*Check amount of engine oil with oil level gauge. *Check lubricating oil system. *At every 2 times of oil change, oil filter cartridge should be replaced. *Check to see if the engine bearing clearances is within factory specs.

NOTE :

- When the engine has suddenly stopped, decompress the engine by the decomp and turn the engine lightly by pulling on the fan belt. If the engine turns easily without abnormalities, the cause of the trouble is usually lack of fuel or bad nozzle.

■ When color of exhaust is especially bad

Cause	Countermeasures
Fuel governing device bad	*Contact dealer for repairs.
Fuel is of extremely poor quality.	*Select good quality fuel. Use No. 2-D diesel fuel only.
Nozzle is bad.	*If necessary, replace with new nozzle.
Combustion is incomplete.	*Cause is poor atomization, improper injection timing, etc. Because of trouble in injection system or in poor valve adjustment, or compression leakage, poor compression, etc. Check for the cause.

■ When engine must be stopped immediately

Cause	Countermeasures
Engine revolution suddenly decreases or increases.	*Check the adjustments, injection timing and the fuel system.
Unusual sound is heard suddenly.	*Check all moving parts carefully.
Color of exhaust suddenly turns dark.	*Check the fuel injection system, especially the fuel injection nozzle.
Bearing parts are overheated.	*Check the lubricating system.
Oil lamp lights up during operation.	*Check the lubricating system. *Check, if the engine bearing clearances are within factory specs. *Check the function of the relieve valve in the lubricating system. *Check pressure switch. *Check filter base gasket.

■ When engine overheats

Cause	Countermeasures
Engine oil insufficient	*Check oil level. Replenish oil as required.
Fan belt broken or elongated	*Change belt or adjust belt tension.
Coolant insufficient	*Replenish coolant.
Excessive concentration of antifreeze	*Add water only or change to coolant with the specified mixing ratio.
Radiator net or radiator fin clogged with dust	*Clean net or fin carefully.
Inside of radiator or coolant flow route corroded	*Clean or replace radiator and parts.
Fan or radiator or radiator cap defective	*Replace defective parts.
Thermostat defective	*Check thermostat and replace if necessary.
Temperature gauge or sensor defective	*Check temperature with thermometer and replace if necessary.
Overload running	*Reduce load.
Head gasket defective or water leakage	*Replace parts.
Incorrect injection timing	*Adjust to proper timing.
Unsuitable fuel used	*Use the specified fuel.

SPECIFICATIONS

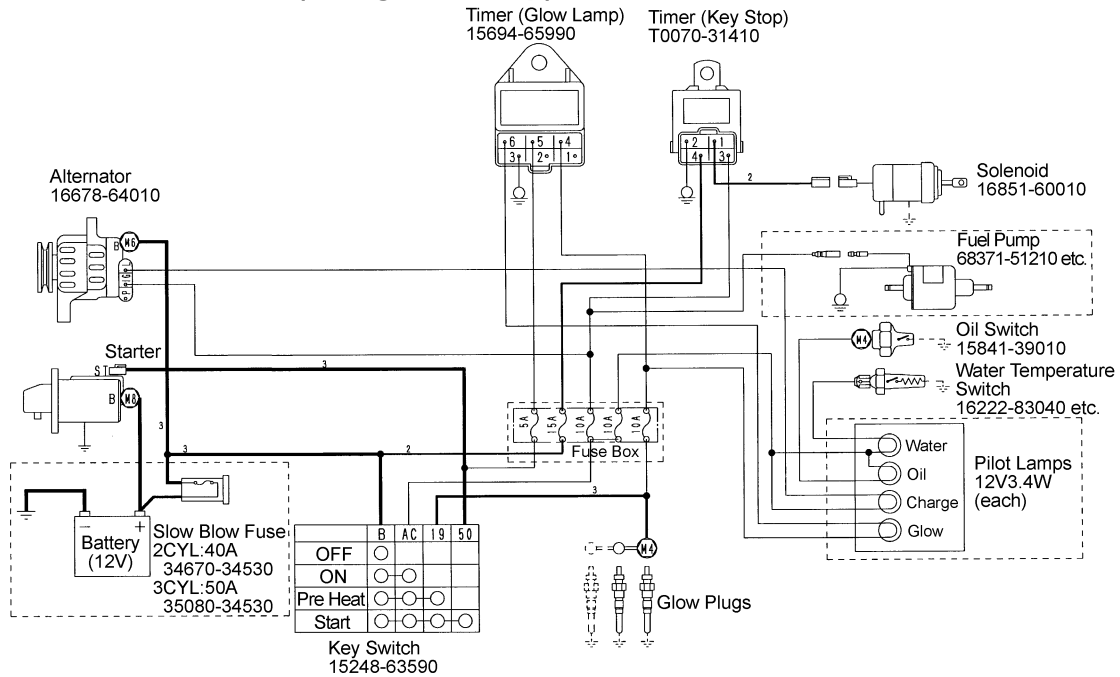
Model	Z482-E	Z602-E	D662-E	D722-E	D782-E	D902-E
Type	Vertical, water-cooled, 4-cycle diesel engine					
Number of cylinders	2		3			
Bore and stroke mm (in.)	67 x 68 (2.64 x 2.68)	72 x 73.6 (2.83 x 2.90)	64 x 68 (2.52 x 2.68)	67 x 68 (2.64 x 2.68)	67 x 73.6 (2.64 x 2.90)	72 x 73.6 (2.83 x 2.90)
Total displacement L (cu.in.)	0.479 (29.23)	0.599 (36.55)	0.656 (40.03)	0.719 (43.88)	0.778 (47.46)	0.898 (54.80)
Combustion chamber	Spherical Type (ETVCS)					
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	9.32 / 3600 (12.5 / 3600)	11.6 / 3600 (15.6 / 3600)	12.9 / 3600 (17.3 / 3600)	14.0 / 3600 (18.8 / 3600)	13.5 / 3200 (18.1 / 3200)	17.5 / 3600 (23.5 / 3600)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	8.05 / 3600 (10.8 / 3600)	10.1 / 3600 (13.5 / 3600)	11.18 / 3600 (15.0 / 3600)	12.15 / 3600 (16.3 / 3600)	11.7 / 3200 (15.7 / 3200)	15.2 / 3600 (20.4 / 3600)
Maximum bare speed rpm	3800	3850	3800		3450	3850
Maximum bare idling speed rpm	800 to 900	900 to 1000	800 to 900			900 to 1000
Order of firing	1-2		1-2-3			
Direction of rotation	Counter-clockwise (viewed from flywheel side)					
Injection pump	Bosch MD Type mini pump					
Injection pressure	13.73 MPa, 1991 psi(140 kgf/cm ²)					
Injection timing (Before T.D.C.)	0.366rad(20°)	0.35rad(20°)	0.366rad(20°)			0.35rad(20°)
Compression ratio	23.5 : 1	24 : 1	23.5 : 1			24 : 1
Fuel	Diesel Fuel No.2-D					
Lubricant (API classification)	above CC grade					
Dimension mm (in.) (length x width x height)	351 x 389 x 520 (13.82 x 15.31 x 20.47)	385 x 421 x 544 (15.16 x 16.57 x 21.42)	426 x 389 x 520 (16.77 x 15.31 x 20.47)			467 x 421 x 544 (18.39 x 16.57 x 21.42)
Dry weight (BB Spec.) kg (lbs.)	53.1 (117.1)	57.0 (125.7)	63.7 (140.4)	63.1 (139.1)	63.5 (140.0)	72.0 (158.7)
Starting system	Cell starter (with glow plug)					
Starting motor	12 V, 0.8 kW	12 V, 1.0 kW	12 V, 0.8 kW			12 V, 1.2 kW
Charging generator	12 V, 150 W	12 V, 480 W	12 V, 150 W			12 V, 480 W
Recommended battery capacity (5Hr capacity)	12 V, 28 AH, equivalent	12 V, 36 AH, equivalent				12 V, 52 AH, equivalent

NOTE :

- Specifications are subject to change without notice.
- The battery capacity is indicated in 5-hour ratio.

WIRING DIAGRAMS

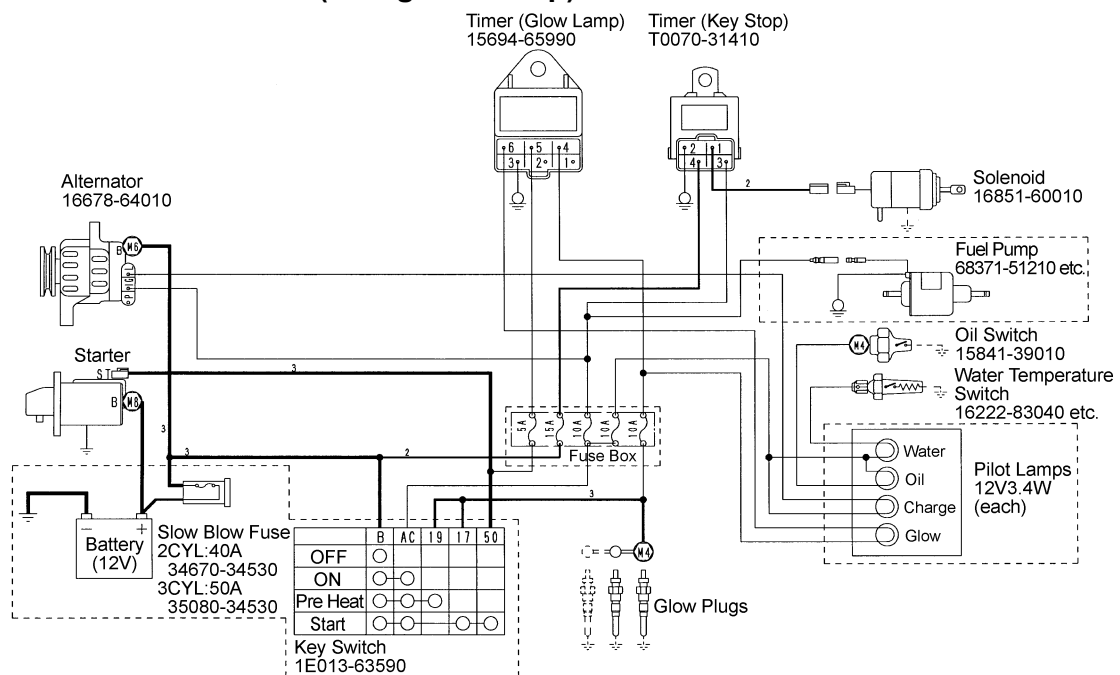
EU standard for Alternator (Energize to stop)



*The parts boxed in [] are reference, NOT equipped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

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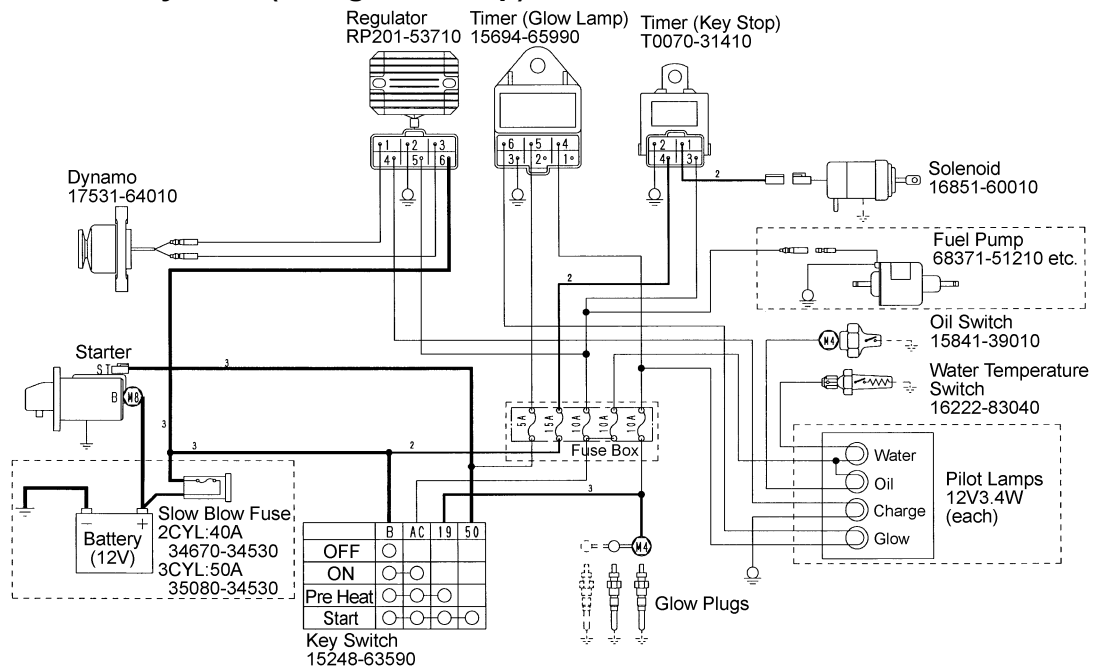
KEA standard for Alternator (Energize to stop)



*The parts boxed in [] are reference, NOT equipped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

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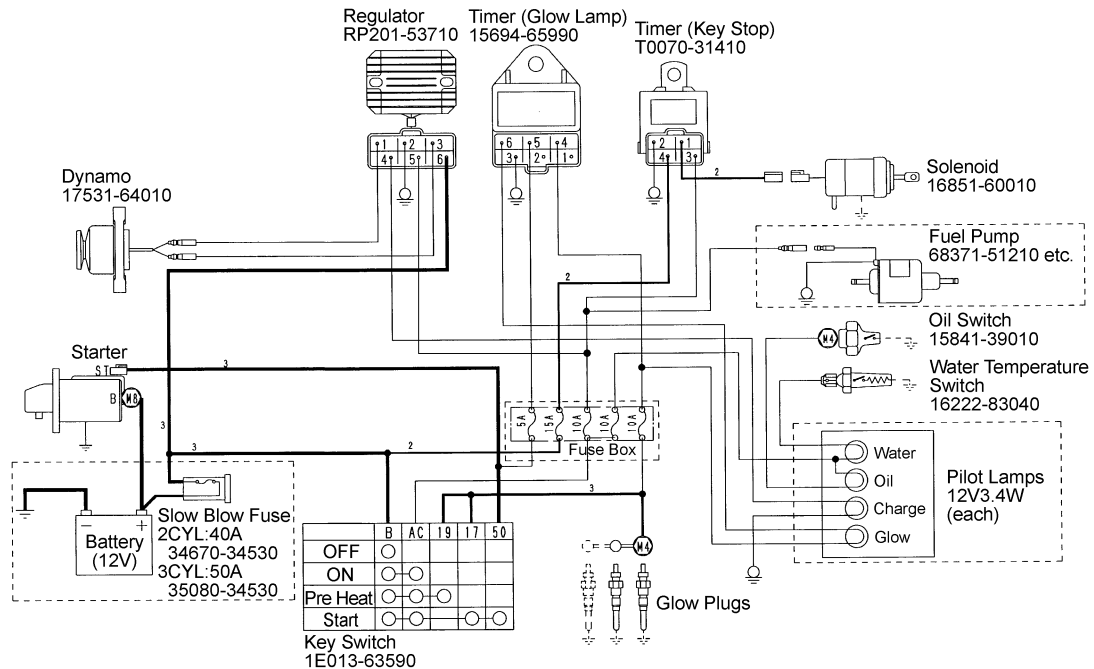
EU standard for Dynamo (Energize to stop)



*The parts boxed in [] are reference, NOT equipped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

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KEA standard for Dynamo (Energize to stop)



*The parts boxed in [] are reference, NOT equipped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

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Code No. 16676-8916-8

List of the stickers/symbols

D List of the stickers/symbols

List of the stickers/symbols
