TEUPEN®

...work safely aloft

Serial number: _____

Translation of the original operating instructions

LE 30 T LE 36 T

Aerial access platform

Leo30T&Leo36T_GB

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1 General

1.1 Information about these instructions

These instructions enable the safe and efficient handling of the 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

Safety instructions

The safety instructions provided in this manual are marked by symbols. The safety instructions are introduced by keywords used to express the extent of the danger.

Strictly adhere to all safety instructions and use caution to prevent accidents, personal injury and material damage.

DANGER!
This combination of symbol and keyword points to a situation of immediate danger which may lead to serious injury or death unless avoided.

WARNING!
This combination of symbol and keyword points to a situation of possible danger which may lead to serious injury or death unless avoided.

CAUTION!
This combination of symbol and keyword points to a possibly dangerous situation which may lead to slight or minor injury unless avoided.

NOTICE!
This combination of symbol and keyword points to a possibly dangerous situation which may lead to material and environmental damage unless avoided.

Tips and recommendations

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

Special safety instructions

The following symbols are used in the safety instructions to draw attention to specific dangers:

DANGER!
This combination of symbol and signal word indicates dangers posed by electric power. If the safety instructions are not observed, there is a danger of serious or fatal injuries.

Signs used in this manual

The following signs and highlighting is used in this manual to identify instructions, descriptions of results, numerations, references and other elements:

Sign	Explanation
	Identifies step-by-step instructions.
⇨	Identifies a state or automatic sequence as result of steps.
	Identifies references to chapters in this manual and to other valid documents.

Sign	Explanation
■	Identifies random numerations and list entries.
[Key]	Indicates names of keys, buttons and other operating controls.

1.3 Limitation of liability

All specifications and instructions in this manual have been compiled taking account of applicable standards and regulations, the current state of technology and the experience and insights we have gained over the years.

The manufacturer accepts no liability for damage due to:

- Failure to observe this manual
- Improper use
- Deployment of untrained personnel
- Unauthorised modifications
- Technical modifications
- Use of unauthorised spare parts

The actual scope of supply may differ from the explanations and depictions in this manual in the case of special designs, take-up of additional ordering options, or as a result of the latest technical modifications.

The undertakings agreed in the supply contract as well as the manufacturer's Terms and Conditions and Terms of Delivery and the legal regulations applicable at the time of conclusion of the contract shall apply.

1.4 Copyright

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 that is at the front of the machine record and send it back to Teupen directly after handover of the machine to the owner. If the warranty card is not filled out properly, we cannot process the warranty application since important data that is necessary for the processing has not been made available to us.

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:

Fig. 1: Sample warranty card

1.7 Customer Service

Our Customer Service is available for technical information. Please see page 2 for the contact data.

In addition, our employees are constantly interested in new information and experiences which arise from usage and could be valuable for the improvement of our products.

2 Safety

This section provides an overview of all the main safety aspects involved in ensuring optimal personnel protection and safe and smooth operation.

Non-compliance with the action guidelines and safety instructions contained in this manual may result in serious hazards.

2.1 Basic hazards

The following section specifies residual risks which may result from using the machine and have been established by means of a risk assessment.

In order to minimize health hazards and avoid dangerous situations, follow the safety instructions specified here as well as in the following chapters of this manual.

2.1.1 General hazards in the workplace

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!

Danger of falling over!

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

- While in the working basket, always wear a safety harness (in compliance with EN 361), do not swing or move jerkily.
- 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 through poisoning and suffocation by exhaust gases!

Exhaust gases can lead to suffocation if inhaled, as also severe poisoning and marked damage to the respiratory system.

- While operating the machine in diesel mode, always ensure the supply of fresh air.
- In case of inhalation of exhaust gases, immediately take the affected person into fresh air. Call a doctor in.

2.1.2 Danger due to electric current

Electric power

DANGER!

Danger to life due to electric power!

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 voltage 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.
- Adhere to cable strengths according to ↳ *Chapter 3 'Technical data' on page 43*.
- Lay (extension) cables so that they cannot be driven over, they do not come into contact with liquids, they are not sharply nicked or otherwise stressed.
- Keep outlet easily accessible at all times.
- 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.

2.1.3 Danger due to mechanism

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!
Danger of injury due to insufficient stability!
With insufficient stability, there is a danger that the machine will tip. This can cause severe injuries or even death.

- Make sure that the ground has sufficient load capacity (↬ *Chapter 3 'Technical data' on page 43*).
- Do not exceed the maximum slope (↬ *Chapter 3 'Technical data' on page 43*).

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 Danger 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.

2.1.5 Danger 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 Danger due to chemicals

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 Danger 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.

2.2 Proper use

The machine is designed and constructed exclusively for the proper use described here.

The machine is to be used exclusively to convey people and tools up to the maximum allowable working basket load 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 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.

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.
- 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.

Kubota qualified personnel
Due to their technical training, knowledge and experience, as well as their knowledge of the applicable provisions, Kubota qualified personnel is in a position to perform the work entrusted to it and to detect and avoid possible dangers. To perform the work due, contact Kubota customer service.

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.

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 is used to protect the personnel from dangers which could affect their safety or health while working.

The personnel must wear personal protective equipment while carrying out the different operations at and with the machine. This equipment will be indicated separately in the individual chapters of this manual. This personal protective equipment is described below:

- It is mandatory to put on the personal protective equipment specified in the different chapters of this manual before starting work.
- Always comply with the instructions governing personal protective equipment posted in the work area.

Description of the personal protective equipment

Protective clothing
Protective clothing are tight fitting working clothes with low tear resistance, with tight sleeves and without any parts sticking out. These clothes primarily protect against getting caught by moving machine parts. Do not wear rings, chains, necklaces, and other jewellery.

Protective helmet
The protective helmet provides protection against falling and flying parts and materials.

Safety boots
Safety boots are intended to protect against slipping hazards or foot hazards like heavy gear.

Safety goggles
Safety goggles are intended protect the eyes against flying debris and liquid spray.

Safety harness
The safety harness is used as a protection against falling where there is an increased risk of falling. Such a risk exists if certain height differentials are exceeded and the work location is not safeguarded by a railing.

Put on the safety harness so that the lifeline is connected to the safety harness, as well as to a fixed attachment point, if necessary provide shock absorbers.

Only persons who have been specially trained in the use of safety harnesses may use the safety harness.

2.6 Safety equipment

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 equipment

View from the left side

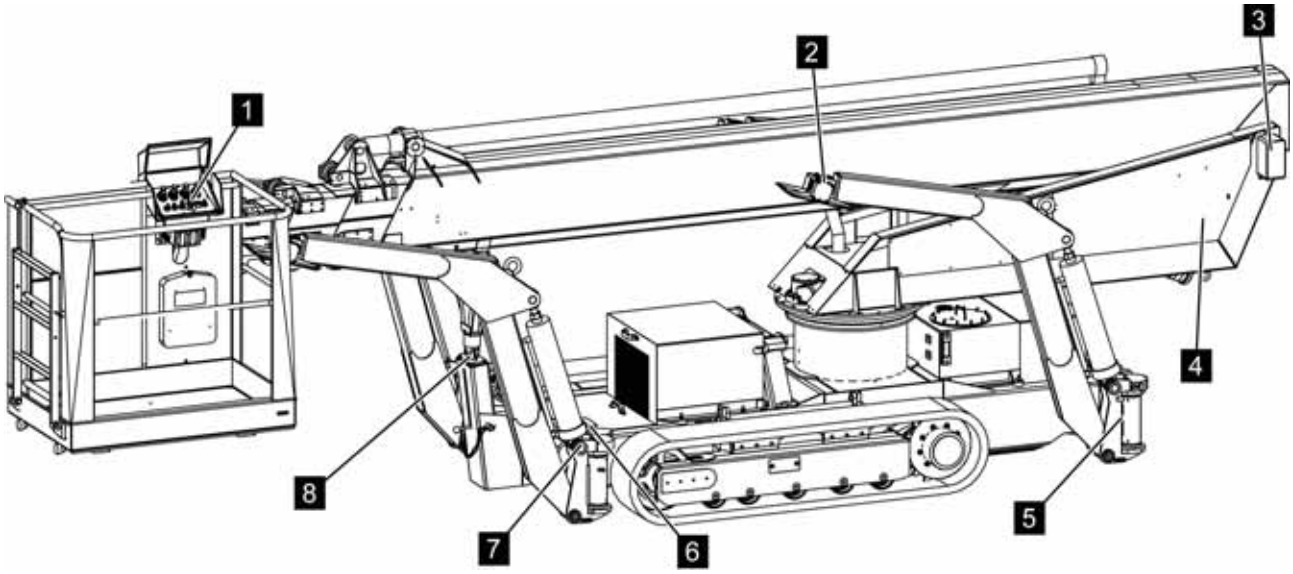


Fig. 2: Position of the safety equipment

1 Emergency stop button for the radio control
2 Limit switch outriggers (4x)
3 Angle transmitter
4 Valves for emergency operation platform function
5 Limit switch bracing height (4x)
6 Limit switch outriggers (4x)
7 Limit switch bracing variant (narrow/wide) (4x)
8 Limit switch telescopic arm attachment

View from the right side

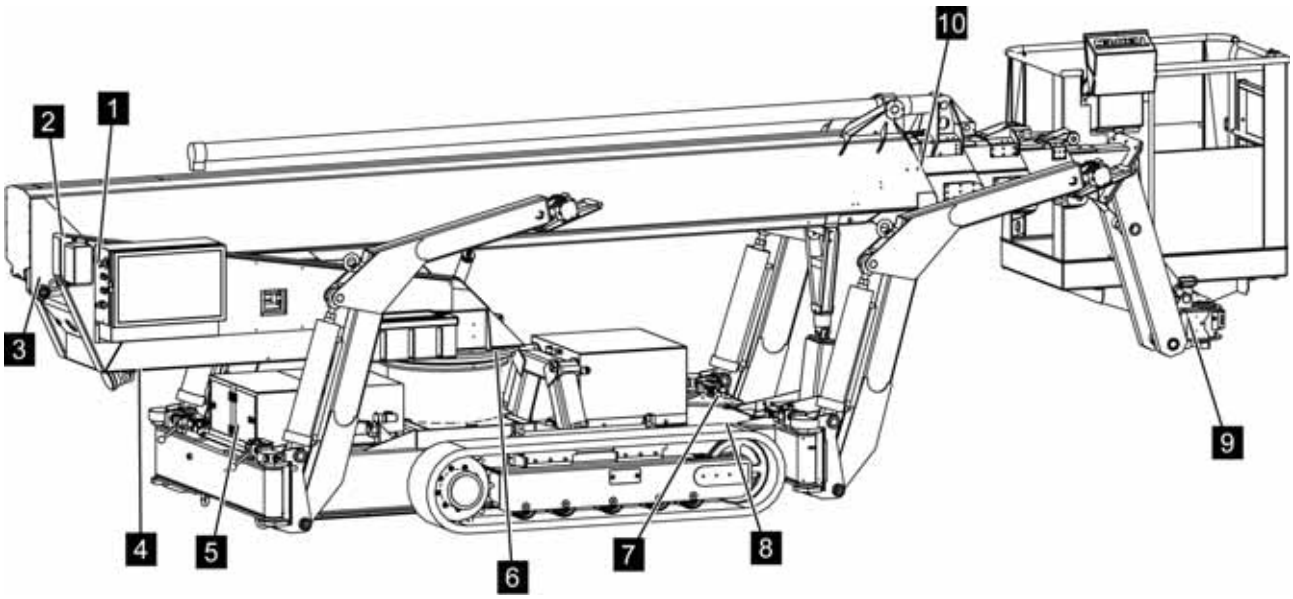


Fig. 3: Position of the safety equipment

1 Emergency Stop button on the lower control
2 Angle transmitter
3 Limit switch "Telescoped in"
4 Pressure sensors
5 Valves for emergency operation chains/ bracing function
6 Working range limit switch
7 Circular level
8 Tilt sensor (covered)
9 Ring switch tubes basket level
10 Limit switch "Height switch-off" (option)

2.6.2 Description of the installed safety equipment

Emergency Stop button

By pressing the Emergency Stop button, the machine is stopped due to immediate switching off of the power supply. After the Emergency Stop button has been pressed, it must be unlocked by turning it in order to switch the machine on again.

Fig. 4: Emergency Stop button

WARNING!

Danger to life due to uncontrolled switching on again!

Uncontrolled switching on again of the machine can cause severe injuries or even death.

- Ensure before switching on again that the cause of the emergency stop has been eliminated and all safety equipment is mounted and functioning properly.
- Only unlock the Emergency Stop button if there is no more danger.

Limit switch

Fig. 5: Limit switch

Limit switches find out the correct position of definite components. Thus they can, for example prevent unintended movement of the machine.

Tilt sensor and circular level (bubble level)

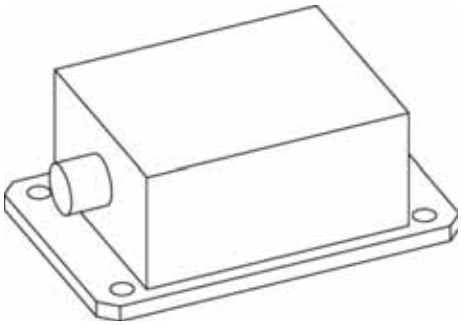


Fig. 6: Tilt sensor

During automatic bracing, the aerial access platform is aligned horizontally automatically with the help of the tilt sensor (Fig. 6). The maximum permissible inclination is 1°; this must be checked visually with the circular level (Fig. 7).

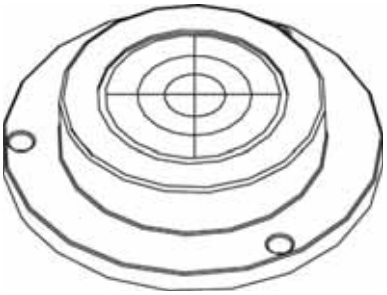
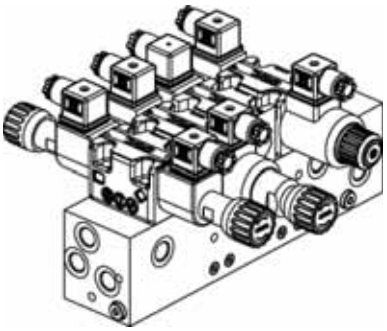


Fig. 7: Circular level

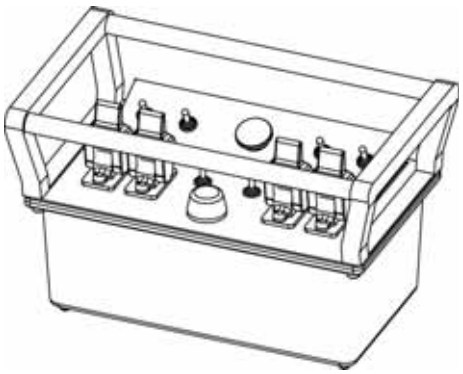
Valves for emergency operation



The aerial access platform can be operated in emergency mode in case of failure of energy supply or for maintenance purposes. Using various valves (Fig. 8), it is possible to address and move the corresponding components without power supply.

Fig. 8: Example: Valve block

Magnet query



The functions *'lift'* and *'telescope out'* are protected by a magnet query via reed switch. That is, these functions can only be performed if the radio control (Fig. 9) is in the bracket in the working basket.

Fig. 9: Radio control

Torque measurement device

The torque measurement device serves to calculate the lateral range. The torque measurement device consists of angle transmitters and pressure sensors.

The angle transmitters determine the angle position of the telescopic arm.

Pressure sensors measure the pressure in the telescopic arm cylinder.

The lateral range is limited based on the measurement values. If the load limit has been reached, then only "non-critical" movements are possible (stability).

Ring switch tubes

The ring switch tubes monitor the working basket level and stop the platform movements if necessary.

2.7 Symbols on the machine

The following symbols and indicator plates are on the machine.

WARNING!

Danger of injury due to illegible symbols!

In the course of time, stickers and signs can get soiled or become illegible in other ways, so that hazards are not recognised and necessary operating instructions cannot be followed. This creates a danger of injury.

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

With specification of the item number, the stickers can be ordered from the manufacturer. Please see page 2 for the contact data.

Sample item number

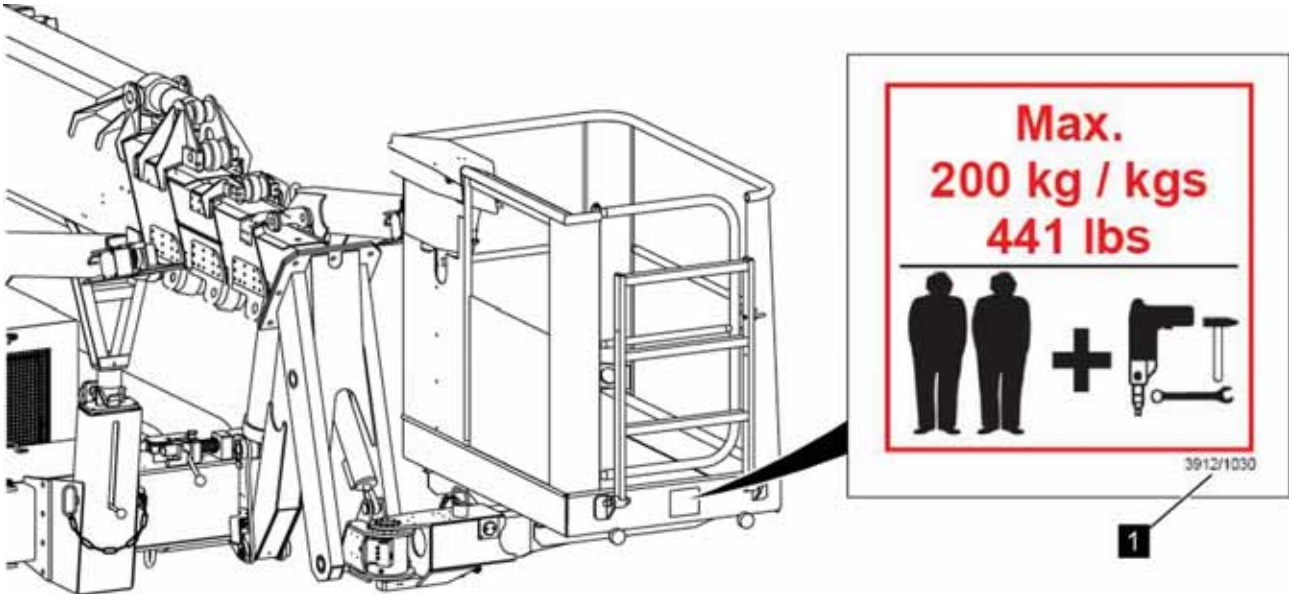


Fig. 10: Sample item number

Each sticker has an item number (example: Fig. 10/1). This item number can be found in various positions on the sticker. The item numbers always consist of the numeric sequence 3912 followed by a 4-digit number. In the example Fig. 10: 3912/1030.

2.7.1 Symbols on Leo30T

Language-neutral symbols
Leo30T

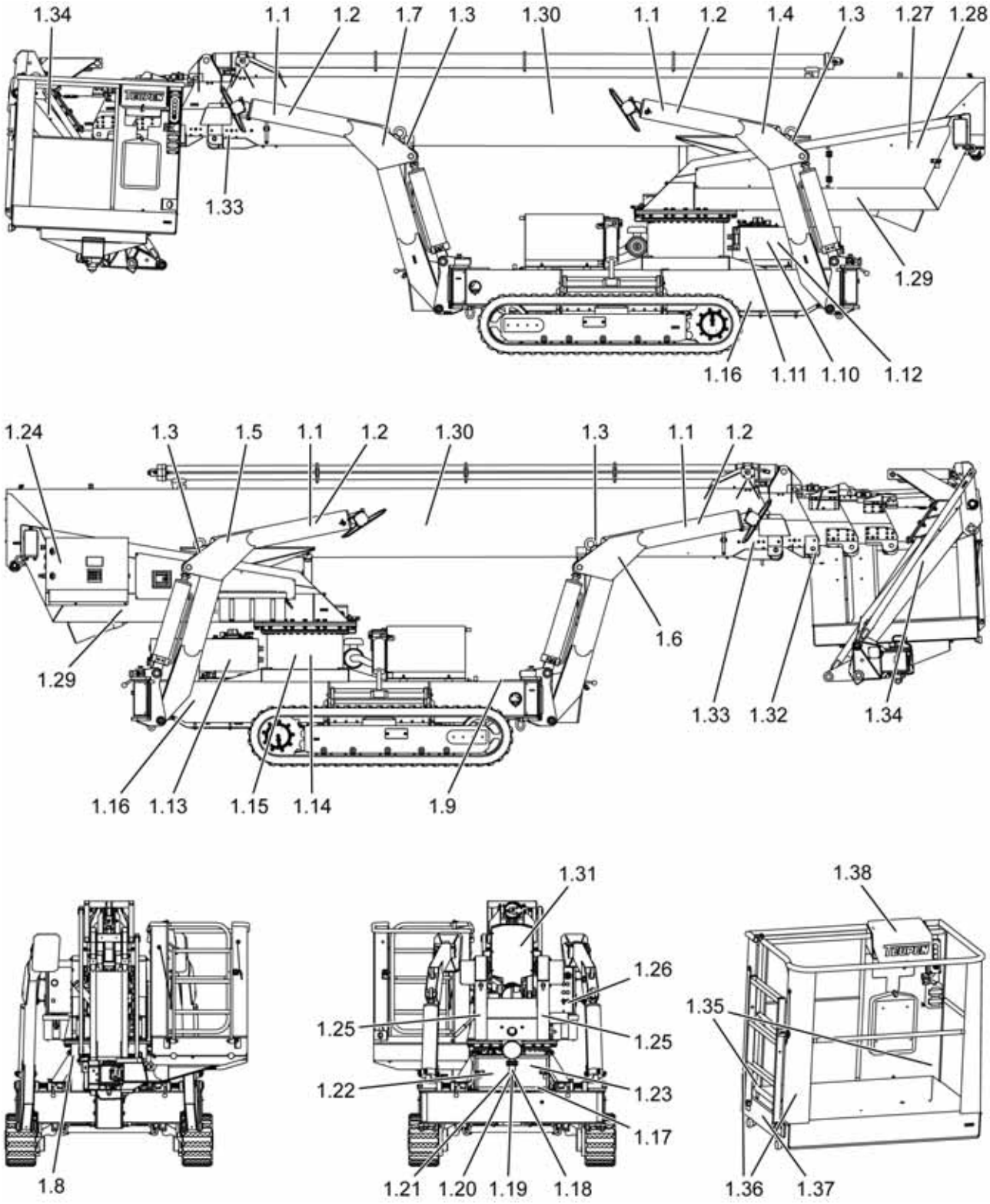


Fig. 11: Language-neutral symbols

Language-specific symbols
Leo30T

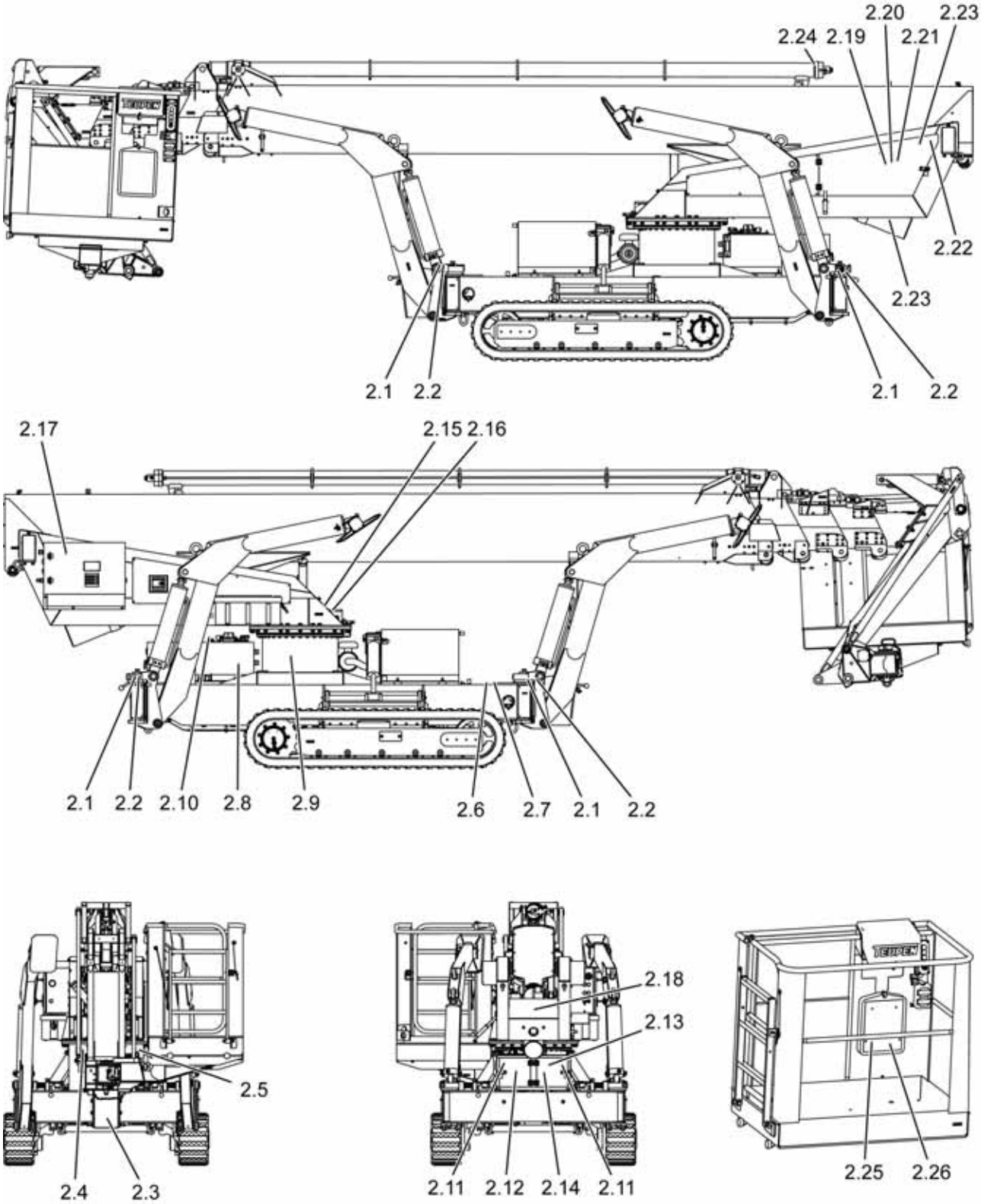


Fig. 12: Language-specific symbols

Safety

List of the symbols Leo30T

Componant	Position	Item no.	Quantity	Note:
Outrigger	1.1	3912/0606	4	
	1.2	3912/0500	4	
	1.3	3912/0605	4	
	1.4	3912/1051	2	
	1.5	3912/1052	2	
	1.6	3912/1053	2	
	1.7	3912/1054	2	
	2.1	3912/1093	4	
	2.2	3912/1094	4	
Chassis	2.3	3912/1090	1	
	1.8	3912/0203	1	
	2.4	3912/1096	1	
	2.5	3912/0935	1	
	1.9	3912/0203	1	Under the flap on the electrical box
	2.6	3912/1124	1	Under the flap on the electrical box
	2.7	3912/1095	1	Under the flap on the electrical box
	1.10	3912/0488	1	
	1.11	3912/0610	1	
	1.12	3912/0206	1	
	1.13	3912/0206	1	
	2.8	3912/1086	1	
	1.14	3911/0042	1	
	1.15	3912/0077	1	
	2.9	3912/0600	1	
	2.10	3912/1239	1	
	1.16	3912/0727	2	
	2.11	3912/1097	2	
	1.17	3912/0787	1	
	1.18	3912/0962	1	Under the cover on the valves
	1.19	3912/1019	1	Under the cover on the valves
	1.20	3912/1020	2	Under the cover on the valves
	1.21	3912/1021	1	Under the cover on the valves
	2.12	3912/1095	1	From inside on the flap
	1.22	3912/0788	1	From inside on the flap
	2.13	3912/1095	1	From inside on the flap
	1.23	3912/1024	1	From inside on the flap
	2.14	3912/1319	1	From inside on the flap
Lift arm holder	2.15	3912/1091	1	
	2.16	3912/1092	1	
	2.17	3912/1124	1	
	1.24	3912/0203	1	
	1.25	3912/0008	2	
	2.18	3912/1089	1	
	1.26	3912/0673	1	
	2.19	3912/1095	1	From inside on the flap
	2.20	3912/1210	1	From inside on the flap
	2.21	3912/1206	1	From inside on the flap
	1.27	3912/0721	1	Behind the flap on the valves
	1.28	3912/0721	1	Behind the flap on the valves
	2.22	3912/1378	1	Behind the flap on the service button
	1.29	3912/0143	2	
	2.23	3912/1097	2	
Profile package	1.30	3912/0818	2	
	2.24	3912/1097	1	
	1.31	3912/0206	1	
	1.32	3912/0118	8	On the profiles at the load limit
Basket arm	1.33	3912/0735	2	
Working basket	1.34	3912/0544	2	
	1.35	3912/0971	2	
	1.36	3912/0008	4	
	1.37	3912/1030	1	
	2.25	3912/1209	1	
	1.38	3912/0203	1	
	2.26	3912/0604	1	

2.7.2 Symbols on Leo36T

Language-neutral symbols
Leo36T

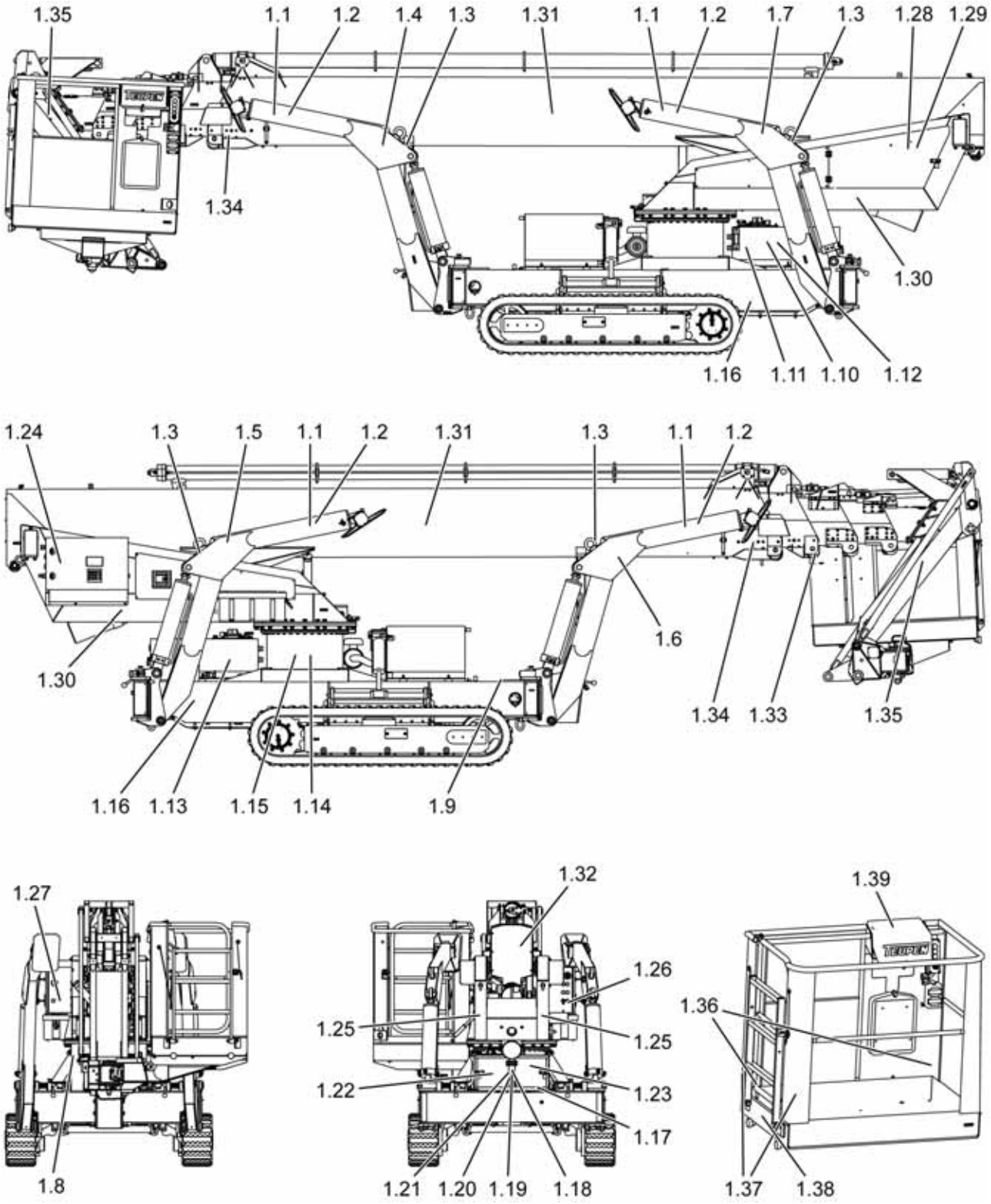


Fig. 13: Language-neutral symbols

Language-specific symbols
Leo36T

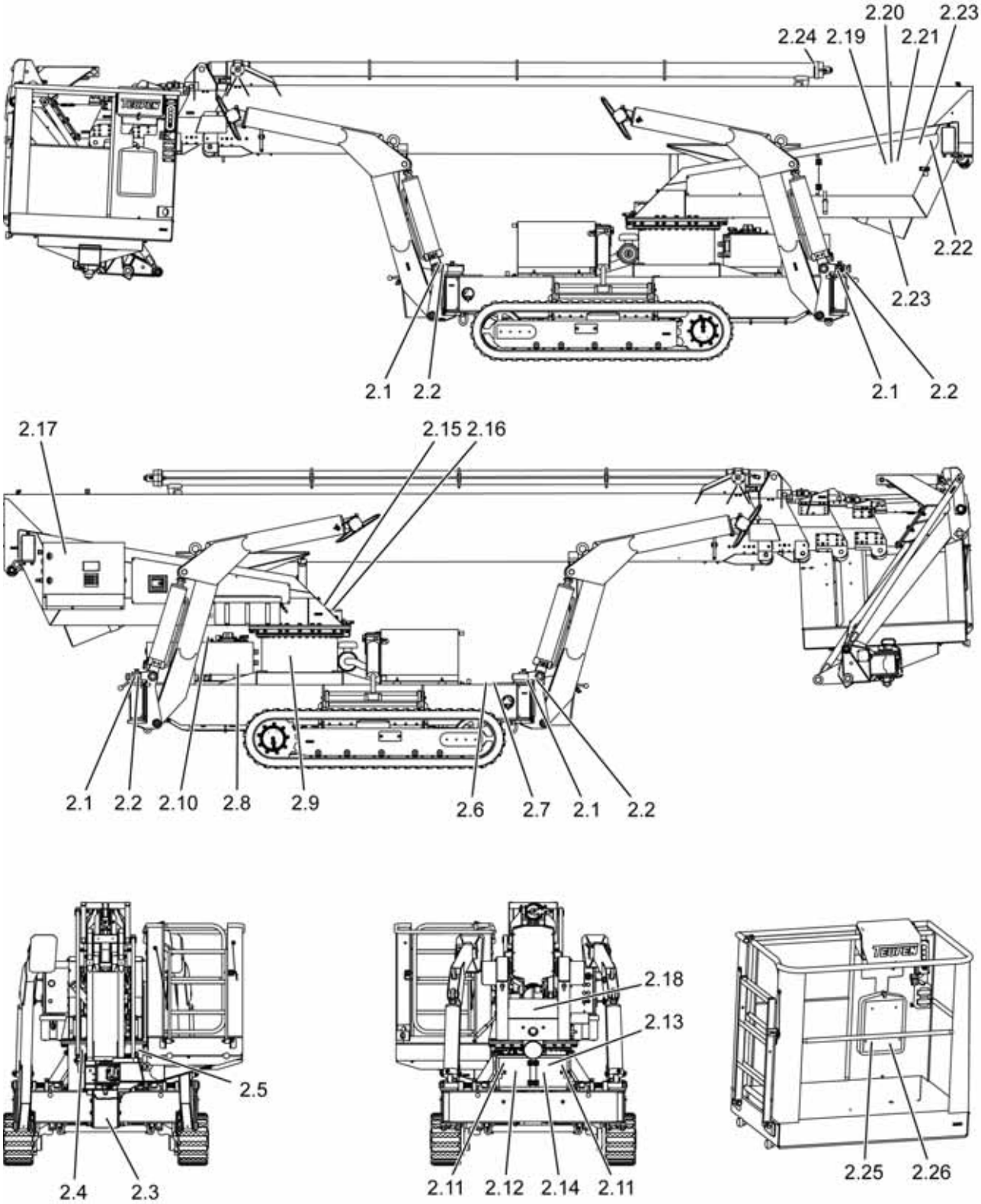


Fig. 14: Language-specific symbols

List of the symbols Leo36T

Componant	Position	Item no.	Quantity	Note:
Outrigger	1.1	3912/0606	4	
	1.2	3912/0500	4	
	1.3	3912/0605	4	
	1.4	3912/1051	2	
	1.5	3912/1052	2	
	1.6	3912/1053	2	
	1.7	3912/1054	2	
	2.1	3912/1093	4	
	2.2	3912/1094	4	
Chassis	2.3	3912/1090	1	
	2.4	3912/1207	1	
	1.8	3912/0203	1	
	2.5	3912/1096	1	
	2.6	3912/0935	1	
	1.9	3912/0203	1	Under the flap on the electrical box
	2.7	3912/1124	1	Under the flap on the electrical box
	2.8	3912/1095	1	From inside on the flap
	1.10	3912/0488	1	
	1.11	3912/0610	1	
	1.12	3912/0206	1	
	1.13	3912/0206	1	
	2.9	3912/1086	1	
	1.14	3911/0042	1	
	1.15	3912/0077	1	
	2.10	3912/0600	1	
	2.11	3912/1239	1	
	1.16	3912/0728	2	
	2.12	3912/1097	2	
	1.17	3912/0787	1	
	1.18	3912/0962	1	Under the cover on the valves
	1.19	3912/1019	1	Under the cover on the valves
	1.20	3912/1020	2	Under the cover on the valves
	1.21	3912/1021	1	Under the cover on the valves
	2.13	3912/1095	1	From inside on the flap
	1.22	3912/0788	1	From inside on the flap
	2.14	3912/1095	1	From inside on the flap
	1.23	3912/1024	1	From inside on the flap
	2.15	3912/1319	1	From inside on the flap
Lift arm holder	2.16	3912/1091	1	
	2.17	3912/1092	1	
	2.18	3912/1124	1	
	1.24	3912/0203	1	
	1.25	3912/0008	2	
	2.19	3912/1089	1	
	1.26	3912/0673	1	
	1.27	3912/0984	1	
	2.20	3912/1095	1	From inside on the flap
	2.21	3912/1210	1	From inside on the flap
	2.22	3912/1206	1	From inside on the flap
	1.28	3912/0721	1	Behind the flap on the valves
	1.29	3912/0721	1	Behind the flap on the valves
	2.23	3912/1378	1	Behind the flap on the service button
	1.30	3912/0143	2	
	2.24	3912/1097	2	
Profile package	1.31	3912/0818	2	
	2.25	3912/1097	1	
	1.32	3912/0206	1	
	1.33	3912/0118	10	On the profiles at the load limit
Basket arm	1.34	3912/0735	2	
Working basket	1.35	3912/0544	2	
	1.36	3912/0971	2	
	1.37	3912/0008	4	
	1.38	3912/1030	1	
	2.26	3912/1209	1	
	1.39	3912/0203	1	
	2.27	3912/0604	1	

2.8 Behaviour in case of fire or accidents

Preventive measures

- Be prepared for fire and accidents at all times!
- Keep first-aid equipment (first-aid kit, blankets, etc.) and fire extinguishing devices operational and readily available.
- Make your personnel familiar with accident reporting equipment as well as first-aid and rescue equipment.
- Keep access paths clear for rescue vehicles.

Steps in case of fire and accidents

- Immediately trigger an Emergency Stop using EMERGENCY-STOP devices.
- Provided your own health is not in danger, rescue all personnel from the danger area.
- If necessary, initiate first aid measures.
- Alert the fire department and/or emergency medical services.
- In case of fire: provided your own health is not in danger, extinguish the fire using fire extinguishing equipment and continue to do so until the fire department arrives.
- Notify the person in charge at the machine's place of installation.
- Clear access paths for rescue vehicles.
- Wave rescue vehicles into position.

2.9 Environmental protection

NOTICE!

Danger to the environment from incorrect handling of pollutants!

Incorrect handling of pollutants, particularly incorrect waste disposal, may cause serious damage to the environment.

– Always observe the instructions below regarding handling and disposal of pollutants.
– Take the appropriate actions immediately if pollutants escape accidentally into the environment. If in doubt, inform the responsible municipal authorities about the damage and ask about the appropriate actions to be taken.

The following pollutants 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 specialist 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.
Cooling water - 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.

3 Technical data

3.1 Dimension sheets

3.1.1 Main dimensions Leo30T

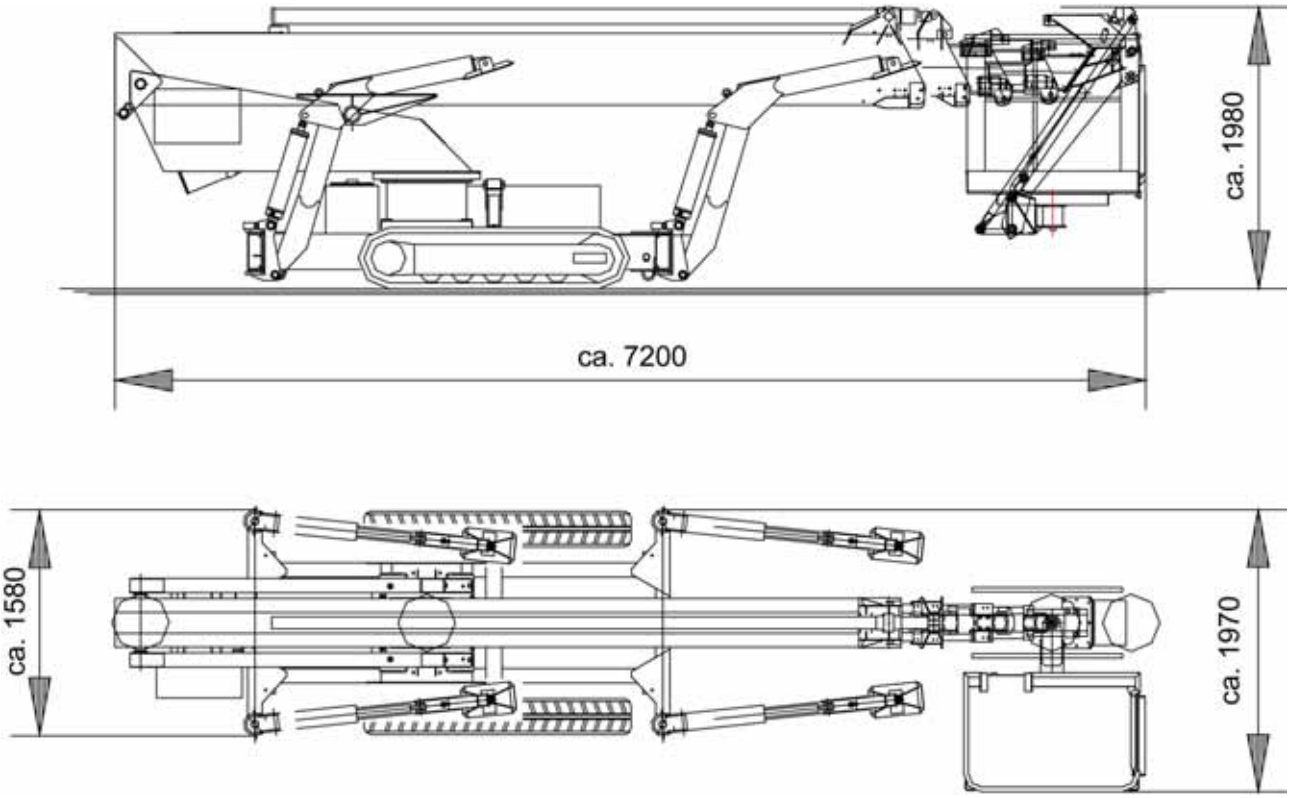


Fig. 15: Main dimensions Leo30T

3.1.2 Main dimensions Leo30T

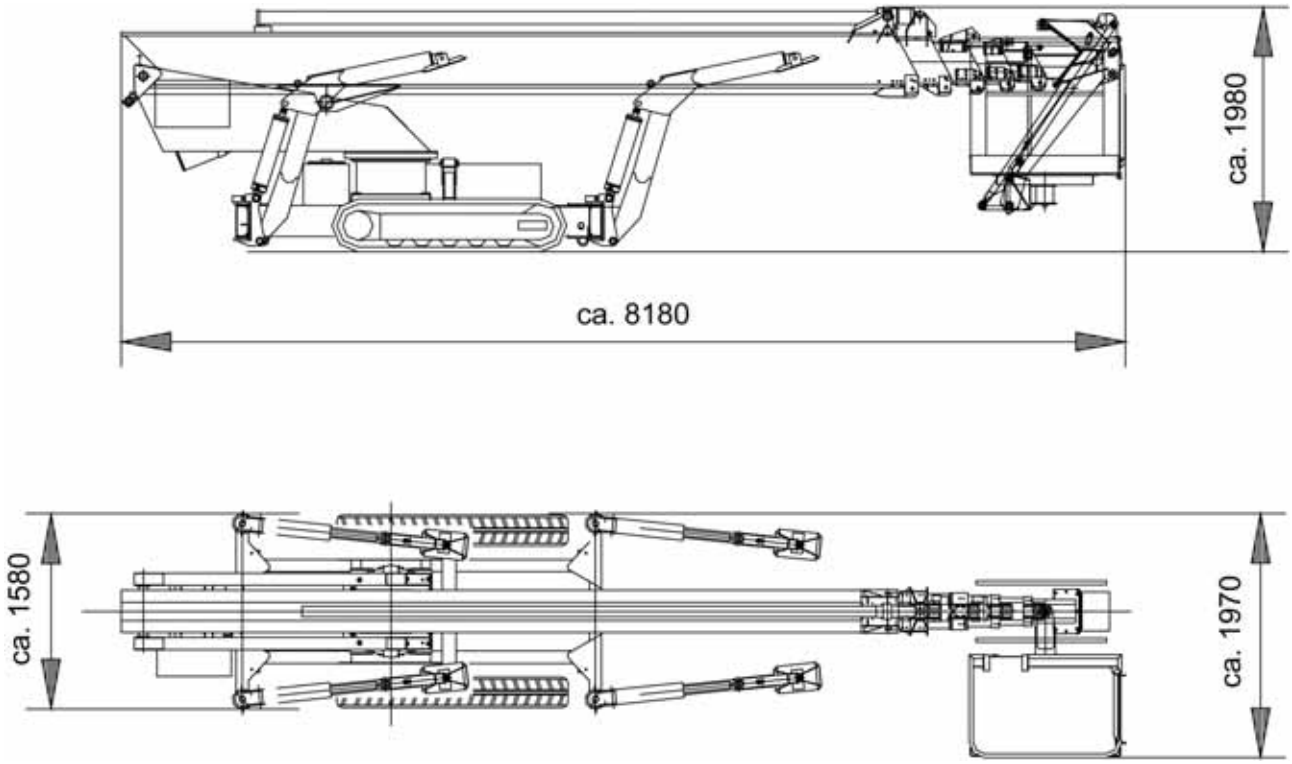


Fig. 16: Main dimensions Leo30T

3.1.3 Work diagram Leo30T

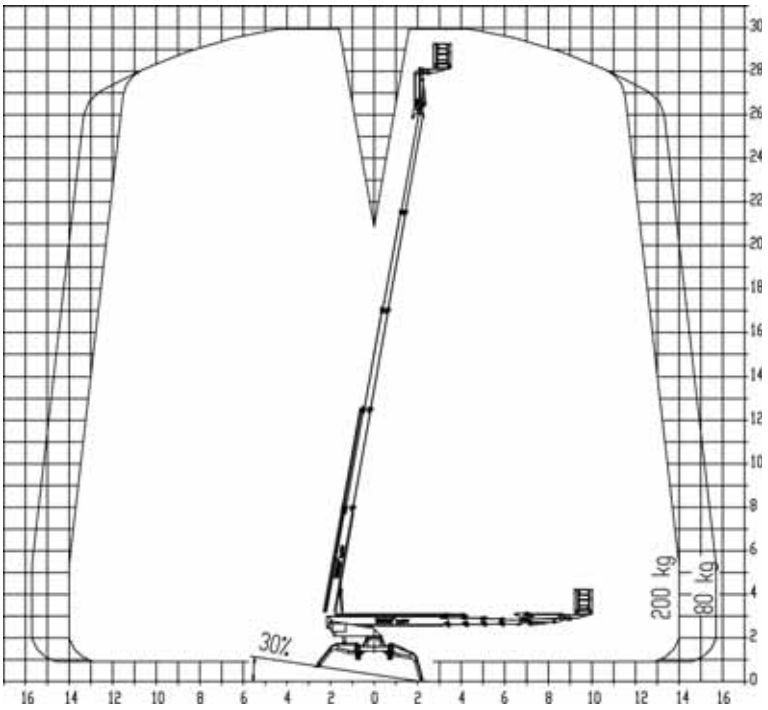


Fig. 17: Work diagram

3.1.4 Work diagram Leo36T

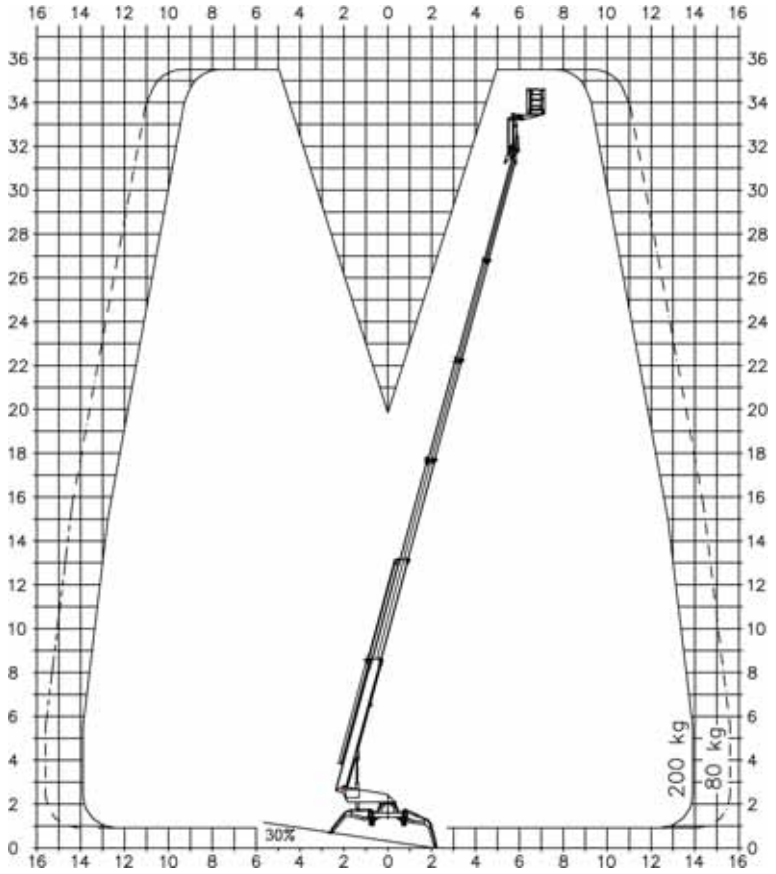


Fig. 18: Work diagram

3.2 Machine

3.2.1 Machine Leo30T

Data	Value	Unit
Overall length with working basket (min.)	7,20	m
Overall width (min)	1,58	m
Overall height (min)	1,98	m
Floor pressure when driving	5,7	N/cm^2
Load per surface unit in standard work position	2,0	kN/m^2
Permissible number of people on the work platform	2	

Data	Value	Unit
Control voltage	24	V
Range of the radio control	approx. 100	m
Gross weight*	4300	kg

* Possible weight deviation due to:

- - 1 % production tolerance
- ± 2.5 % production tolerance and permanently-installed accessories

3.2.2 Machine Leo36T

Data	Value	Unit
Overall length with working basket (min.)	8,18	m
Overall width (min)	1,58	m
Overall height (min)	1,98	m
Floor pressure when driving	6,4	N/cm^2
Load per surface unit in standard work position	2,4	kN/m^2
Permissible number of people on the work platform	2	
Control voltage	24	V
Range of the radio control	approx. 100	m
Gross weight*	4900	kg

* Possible weight deviation due to:

- - 1 % production tolerance
- ± 2.5 % production tolerance and permanently-installed accessories

3.3 Bracing

3.3.1 Bracing Leo30T

Data	Value	Unit
Bracing width (min)	4,75	m
Bracing width one-sided narrow (min)	3,85	m
Bracing width both sides narrow (min)	3,00	m
Bracing length (min)	4,89	m
Bracing length (max.)	6,22	m
Bracing possible up to slope of	30	%

3.3.2 Bracing Leo36T

Data	Value	Unit
Bracing width (min)	4,75	m
Bracing width one-sided narrow (max.)	3,85	m
Bracing length (min)	4,89	m
Bracing length (max.)	6,22	m
Bracing possible up to slope of	30	%

3.4 Platform system

3.4.1 Platform system Leo30T

Data	Value	Unit
Working height	30	m
Lateral outreach at 80 kg	15,70	m
Lateral outreach at 200 kg	14,00	m
Max. basket load	200	kg
Working basket working range	180	°

Data	Value	Unit
Basket arm movement	180	°
Working basket (LxWxH)	1.2 x 0.8 x 1.1	m
Max. working range	450	°
Working range one side narrow	220	°
Working range both sides narrow	2 x 20	°

3.4.2 Platform system Leo36T

Data	Value	Unit
Working height	35,50	m
Working height at setting for 29m work platform	29,00	m
Lateral outreach at 80 kg	15,60	m
Lateral outreach at 200 kg	13,90	m
Max. basket load	200	kg
Working basket working range	180	°
Basket arm movement	180	°
Working basket (LxWxH)	1.2 x 0.8 x 1.1	m
Max. working range	450	°
Working range one-sided narrow	220	°

3.5 Chassis

3.5.1 Chassis Leo30T

Data	Value	Unit
Height adjustable	0,22	m
Climbing ability	16,7/30	°/%
Slope angle	16,7/30	°/%

Data	Value	Unit
Chain (LxW)	192 x 25	cm
Travel speed max.	3	km/h
Max. chassis clearance	31	cm

3.5.2 Chassis Leo36T

Data	Value	Unit
Height adjustable	0,22	m
Climbing ability	30	%
Slope angle	30	%
Chain (LxW)	192 x 25	cm
Travel speed max.	3	km/h
Max. chassis clearance	31	cm

3.6 Drive engines

3.6.1 Diesel engine

Diesel engine Kubota D 1005-# Water cooled 3-cylinder 4-stroke diesel engine

Data	Value	Unit
Cylinder capacity	1001	cm^3
Power at 2400 min^{-1}	15,1 (20)	kW (PS)
Fuel type	Diesel fuel	
Fill quantity	approx. 40	l
Noise emission value (7 m distance)	approx. 77	dB(A)

3.6.2 Electric motor

Electric motor Hawe (under oil unit)

Data	Value	Unit
Nominal input voltage	210–230	V

Data	Value	Unit
Current consumption	10	A
Output	1,5	kW

Cable lengths

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

3.7 Operating conditions

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

3.8 Hydraulic system

Response pressure of the pressure limiting valves

Data	Value	Unit
Platform functions (max.)	165	bar
Outrigger functions (max.)	165	bar
Crawler chassis (max.)	210	bar

Fill quantities

Data	Value	Unit
Fill quantity of the hydraulic system	approx. 90 (23.7)	l (gal)
Fill quantity of the hydraulic tank	approx. 75 (19.8)	l (gal)
Fill quantity between min and max	21 (5.5)	l (gal)

3.9 Lubricants

Lubricant	Type	TEUPEN item number	Fill quantity	Unit
Gearbox oil	-	3917/0122 *	max. 1	l
Hydraulic oil	Plantohyd 32-S	3917/0066 *	90	l
Multi-purpose lubricant	-	3917/0095 (cartridge)	0,5	kg
Motor oil	Titan 15W-40	3917/0049	3,7	l
Cooling water	-	-	3,1	l
Diesel fuel	-	-	40	l

* upon order, please specify order quantity in litres

Oil recommendations

The hydraulic system of the aerial access platform is filled with the abovementioned 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 ℃	BP Energol HLP-D 22	HLPD-OEL 22	Renolin MR 5	Shell Hydrol DO 22

3.10 Type plate

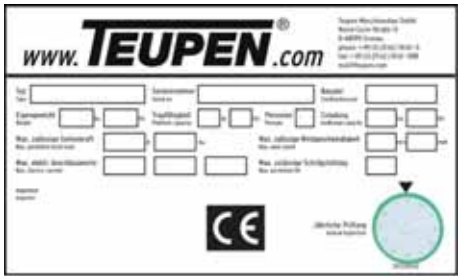


Fig. 19: Sample type plate

The type plate is located on the chassis (on the left in the direction of travel) and includes the following details:

- Manufacturer
- Type
- Serial number
- Year of manufacture
- Net weight
- Load capacity
- Permitted number of people
- Payload
- Maximum permissible lateral force
- Maximum permissible wind speed
- Maximum electrical connection values
- Maximum permissible slope
- Time of the annual check
- CE mark

4 Structure and function

4.1 Overview

View from the left side

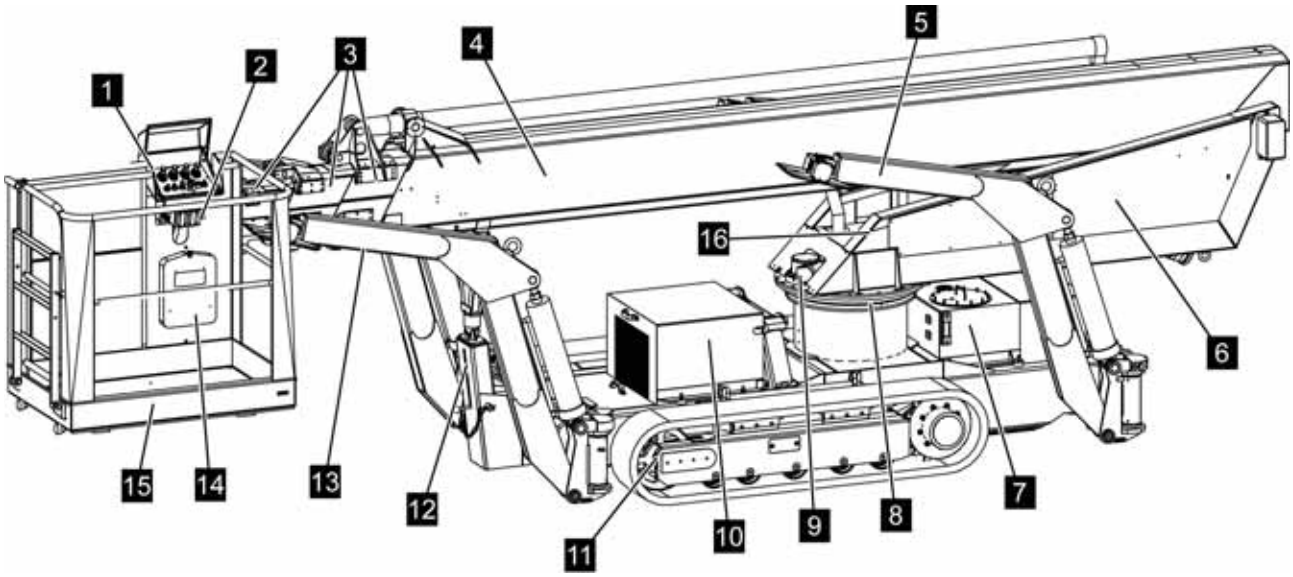


Fig. 20: Overview

1 Radio control transmitter
2 230V outlets (2x)
3 Telescopic arm bearings (4x)
4 Telescopic arm
5 Outrigger 4
6 Door for valve blocks
7 Hydraulic tank
8 Rotating assembly
9 Swing gear
10 Cover for diesel engine
11 Left crawler chassis
12 Telescopic arm holder
13 Outrigger 1
14 Document box
15 Working basket
16 Radio control receiver (covered)

View from the right side

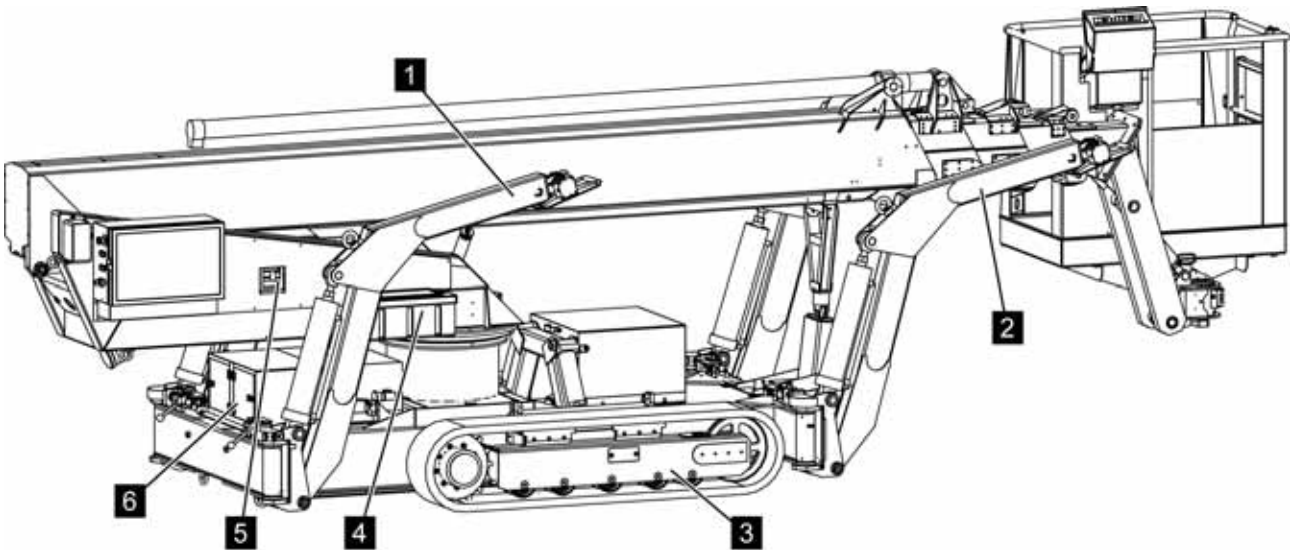


Fig. 21: Overview

1 Outrigger 3
2 Outrigger 2
3 Right crawler chassis
4 Stowage space radio control
5 FI circuit breaker
6 Door for valve blocks

4.1.1 Brief description

The aerial access platform helps to perform work in high places. Control takes place via the radio control (Fig. 20/1) from the working basket (Fig. 20/15) or from the floor. If the radio control (Fig. 20/1) is not in the bracket in the working basket (Fig. 20/15), the functions *'Lift'* and *'Telescope out'* do not work.

In order to put the aerial access platform in working position, the chassis is lifted with the help of the outriggers 1 to 4 (Fig. 20/5, 13 and Fig. 21/1, 2) with the automatic bracing or manually. Only when the chassis is levelled correctly (visual check using the circular level) can platform operation be started.

The bracing can be set independently of one another in three bracing positions (narrow, wide and one side narrow/wide).

The left (Fig. 20/11) and right (Fig. 21/3) crawler chassis are independent of one another and their height can be adjusted hydraulically.

The working basket (Fig. 20/15) is always kept horizontal by a hydrostatic balancing system. In order to narrow down or reduce the clearance or in order to reach places that are difficult to access, the working basket (Fig. 20/15) can be swivelled out dismantled.

The power is supplied either by the mains supply (construction side feed) using an extension cable or by the serial-production diesel engine.

4.2 Assembly description

4.2.1 Platform

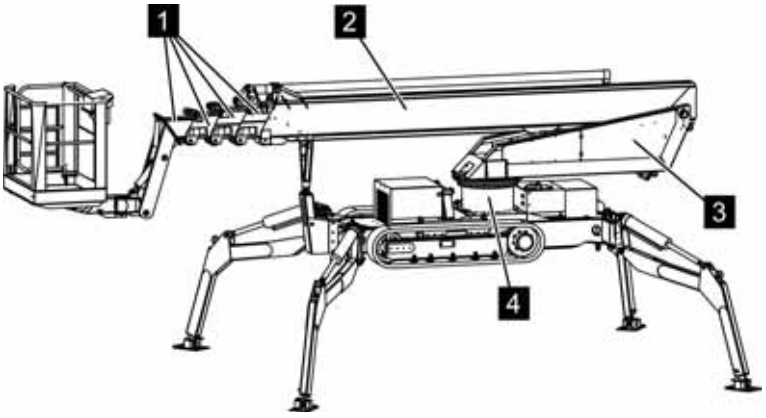


Fig. 22: Platform

The work platform consists essentially of the telescopes (Fig. 22/1), the telescopic arm (Fig. 22/2), the lift arm holder (Fig. 22/3) and the rotating assembly (Fig. 22/4).

4.2.2 Outriggers

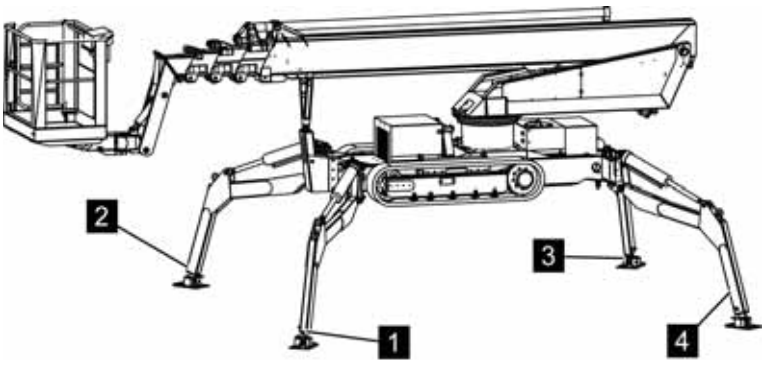


Fig. 23: Outriggers

With the help of the outriggers (Fig. 23/1 to 4), the chassis is lifted and the aerial access platform is thus put into the working position. The supports 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

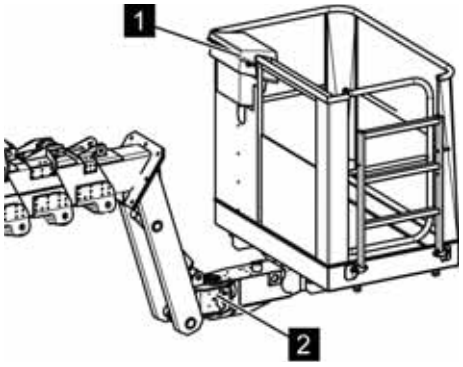


Fig. 24: Working basket

In the working basket there is space for a maximum of two people. The control panel is located in the control head (Fig. 24/1). The hydraulic motor (Fig. 24/2) serves to swivel the working basket.

4.2.4 Crawler chassis

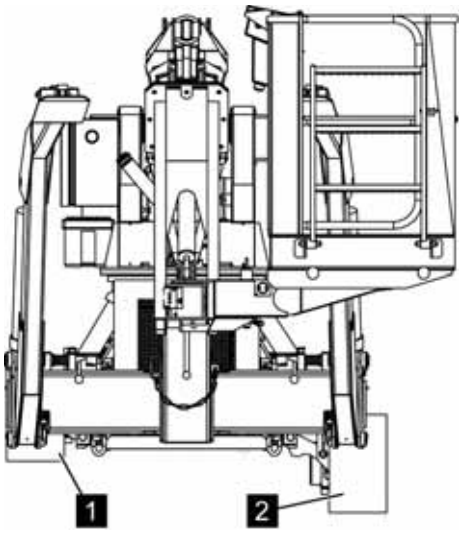


Fig. 25: Crawler chassis

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. The height of the carriage drives can be adjusted steplessly independently of each other. In Fig. 25, the left chassis (1) is completely retracted and the right chassis (2) is completely extended. The height adjustment is done hydraulically.

4.2.5 Diesel engine

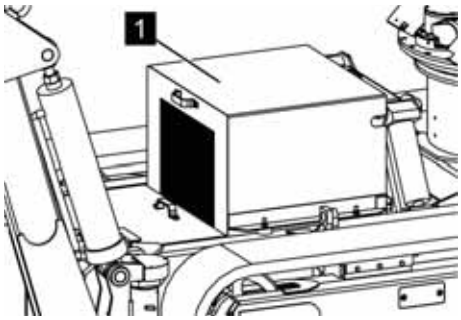


Fig. 26: Cover of the diesel engine

The diesel engine (Fig. 26/1), together with the hydraulic aggregate supplies the necessary hydraulic pressure.

4.2.6 Electric motor

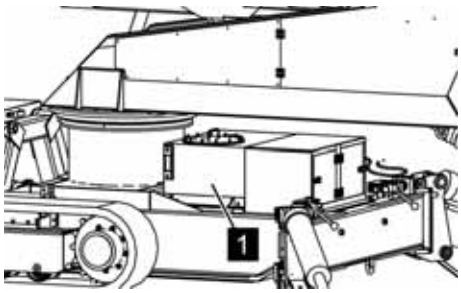


Fig. 27: Electric motor

As an alternative to the diesel engine, the necessary hydraulic pressure can be generated by the electric motor. This is in the hydraulic tank (Fig. 27/1). The connection is provided by the customer through a 230V connection.

4.3 Operating elements

4.3.1 Outrigger latching

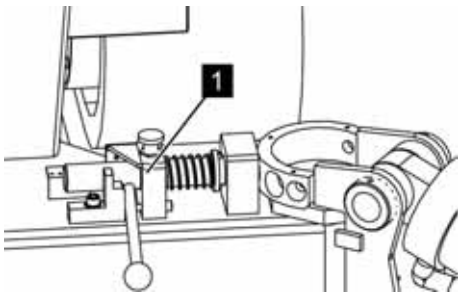


Fig. 28: Outrigger latching

The individual outriggers can be latched with the help of the latching device (Fig. 28/1) in the narrow or wide working position as well as in the transport position.

4.3.2 Control box

Side view

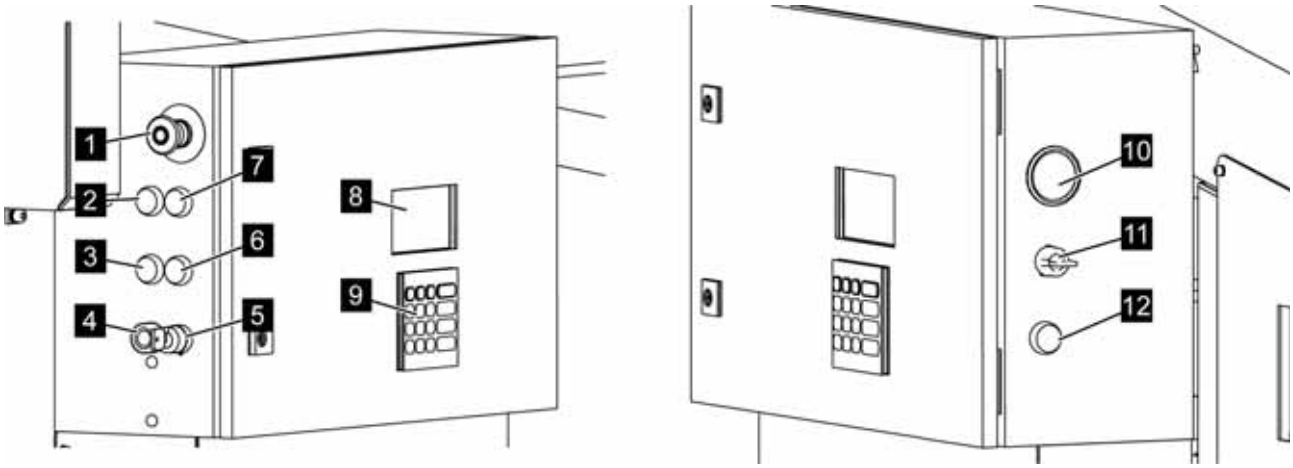


Fig. 29: Side view from left and right

1 Emergency Stop button
2 Control lamp cooling water
3 Control lamp pre-heating
4 Pre-heating switch
5 Key switch start/stop diesel engine
6 Control lamp battery
7 Control lamp oil pressure
8 Display
9 Keyboard
10 Tank indicator
11 Key switch working height (optional for Leo30T)
12 Control lamp bracing

4.3.3 Radio control

The control takes place using the radio control.

> *The functions 'Lift' and 'Telescope out' can only be used if the radio control is in the bracket in the working basket.*

Fig. 30: Radio control

1 Toggle switch switch crawler chassis/ platform/outriggers
2 Status lamp (green)
3 Toggle switch crawl/fast speed, manual/ automatic operation, start
4 Emergency Stop button
5 Toggle switch tip working basket
6 Rechargeable battery light (red)
7 Toggle switch swivel working basket
8 Control lever
9 Control lever
10 Toggle switch height adjustment right crawler chassis
11 Toggle switch height adjustment left crawler chassis
12 Control lever
13 Control lever
14 Rotary switch remote control on/off

1 - Toggle switch crawler chassis/platform/outriggers

This switch is used to select the various operating functions. The possible operating functions are drive (crawler chassis), platform and outriggers.

2 - Status lamp (green)

Condition	Description
blinks slowly	Transmitter transmits
blinks fast	Emergency Stop active

3 - Toggle switch crawl/fast speed, manual/automatic operation, start

This switch is programmed several ways:

- set crawl speed or fast speed
- set manual operation or automatic operation of the bracing
- log radio control onto receiver

4 - Emergency Stop button

An Emergency Stop button is located on the control panel. This must be unlocked after activation by pulling so that the machine is ready for operation again.

5 - Toggle switch tip working basket

Serves to manually tip the working basket within the limits of ± 2.5° to balance out the telescope profile bending..

6 - Rechargeable battery light (red)

Indicates the charge state of the rechargeable battery.

Condition	Description
blinks 2x when switched on	log radio control onto receiver
blinks constantly	Charge state of the rechargeable battery critical. Immediate change of the rechargeable battery required!

As soon as the rechargeable battery lamp (Fig. 30/6) starts to blink, it will be about 15 minutes until the rechargeable battery is completely discharged and no further operation is possible.

7 - Toggle switch swivel working basket

Serves to swivel the working basket.

8, 9, 12, 13 - control lever

With the control levers, depending on the operating function selected, the appropriate functions marked in colour are carried out.

10 - Toggle switch height adjustment right crawler chassis

Serves to adjust the height of the right crawler chassis.

11 - Toggle switch height adjustment left crawler chassis

Serves to adjust the height of the left crawler chassis.

14 - Rotary switch remote control on/off

Serves to switch the radio control on and off. It can be locked.

4.3.4 Toolbar

There is a toolbar in the working basket on the right next to the bracket for the remote control.

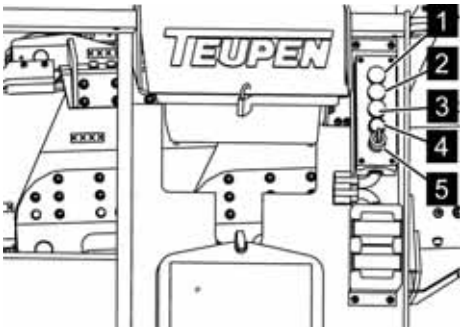


Fig. 31: Toolbar

1 Warning lamp (red)
2 Control lamp (green)
3 Control lamp pre-heating
4 Pre-heating switch
5 Key switch start/stop diesel engine

The display and operating elements of the toolbar will be explained in detail below.

1 - Warning lamp (red)

Condition	Description
blinks	Maximum load limit reached
lights up permanently	Fault in the machine

Info load limit

If the warning lamp (Fig. 31/1) on the toolbar is blinking, only "non-critical" movements are possible. These are

- *'Lift the telescopic arm'*
- *'Retract the telescopic arm'*
- *'Swivel (only Leo30T)'*
- *'Basket arm up/down'*
- *'Swivel working basket'*

2 - Control lamp (green)

Condition	Description
lights up permanently	Machine is braced correctly.
blinks slowly	Machine is not braced

3 - Control lamp pre-heat — Lights up while the diesel engine is pre-heating.

4 - Pre-heat button — Serves to pre-heat the diesel engine.

5 - Start/stop key switch diesel engine — Serves to start the diesel engine.

4.3.5 Emergency control

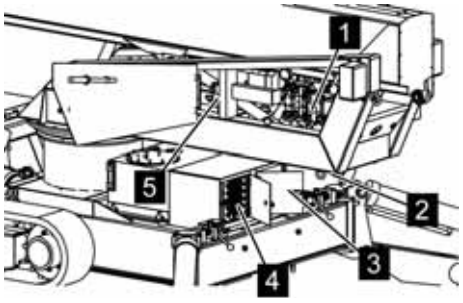


Fig. 32: Emergency control

1 Valve block platform function
2 Proportional valve *[Lower telescopic arm]*
3 Valve block bracing and carriage drive function
4 Shuttle valves
5 Hand pump

In case of a power failure, the outriggers can be operated with the help of the valves (Fig. 32/3) and the platform with the help of the valves (Fig. 32/1 and 2). The required hydraulic pressure is achieved with the hand pump (Fig. 32/5). Switching to the function in question is done with the shuttle valves (Fig. 32/4).

4.4 Connections

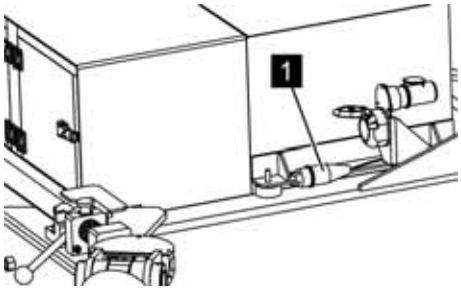


Fig. 33: Power connection

The electric motor is connected by the customer to a 230V connection (Fig. 33/1).

4.5 Work areas and danger zones

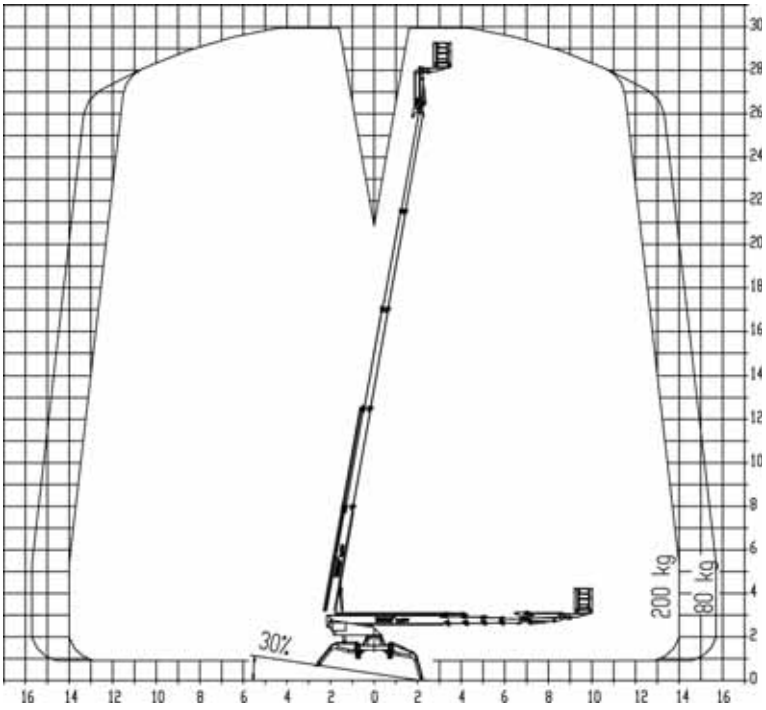


Fig. 34: Work area and danger zone

The work area and danger zone lie within the swivel range of the machine. With a total weight of 200 kg, the inner swivelling range applies. With a total weight of up to 80 kg, the outer swivelling range applies.

4.6 Accessories

4.6.1 Keys

Fig. 35: Keys

The included key ring contains keys for the following components:

- Control box and cover on the bottom control (double bit key)
- Key switch on the bottom control
- Key switch on the control panel
- Filling necks on the hydraulic tank
- Filling necks on the diesel tank
- Cover control panel working basket

4.6.2 Safety harness

A safety harness must be worn for all work in the working basket. This can be ordered from the manufacturer. Please see page 2 for the contact data.

Item no. 8300/0174

5 Transport and storage

5.1 Safety instructions for transport

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 Transport inspection

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 Transport

Attachment points

The following attachment points are provided:

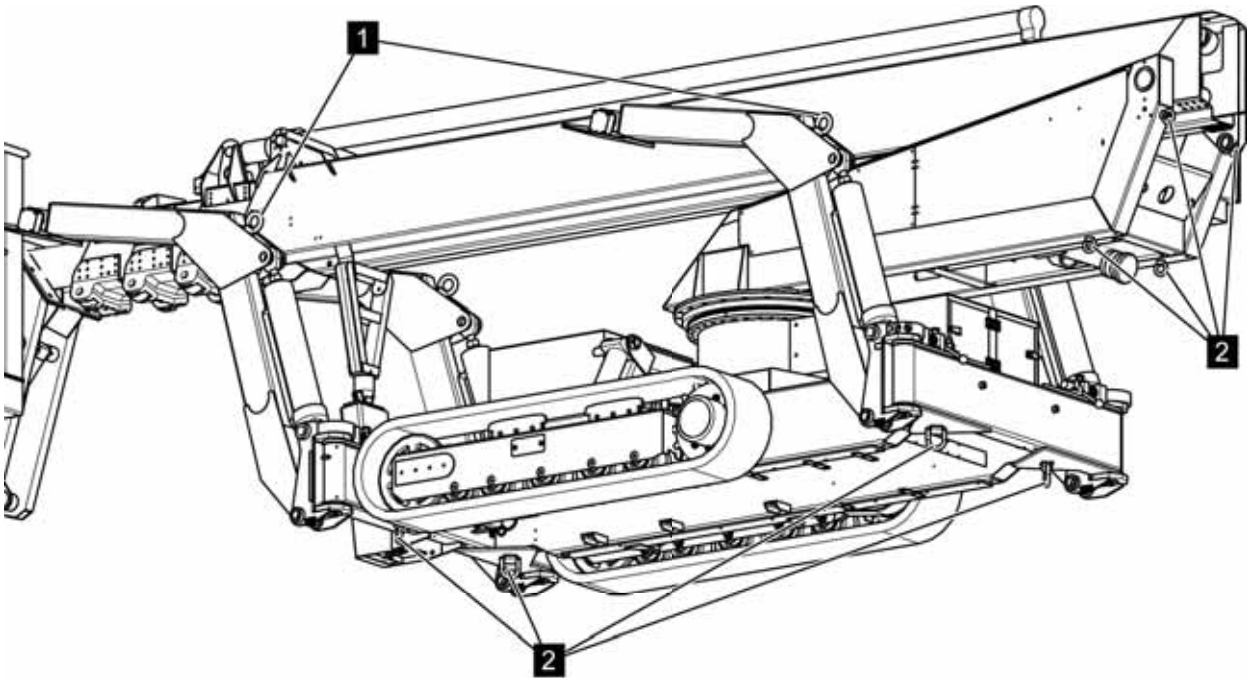


Fig. 36: Attachment points

1 Attachment points for transport with a crane (on both sides)
2 Lashing eyes for transport on a trailer

Fig. 37: Attachment point

The attachment points (Fig. 36/1) are marked with the Fig. 37 symbol.

Transport with a crane

The machine 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 aerial access platform must be in the transport position.
- Belts and chains must be the same length and sufficiently long.

Transport and storage

Attaching

Protective equipment:
- Protective helmet
- Safety boots

WARNING!

Property damage due to improper attachment!

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

– Only use the attachment points specified here.

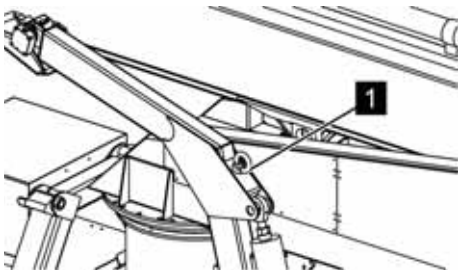


Fig. 38: Attachment point outriggers

1. Put the machine in transport position (*Chapter 6.11 'Putting the machine in transport position' on page 97*).
2. Switch the machine off (*Chapter 6.2 'Switching the machine on/off' on page 74*).
3. Attach belts or chains with shackles to all four attachment points (Fig. 38/1) of the outriggers.

The attachment points are marked with the Fig. 39 symbol.

Fig. 39: Attachment point 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 transport.

Transport on a trailer

The aerial access platform can be transported on a trailer or transporter under the following conditions:

- The trailer or transporter must be designed for the weight and the dimensions of the aerial access platform.
- The aerial access platform must be in the transport position.
- The aerial access platform must be anchored to the means of transport with safety belts on the lashing rings (Fig. 36/2) provided.

Loading

Protective equipment:
- Protective helmet
- Safety boots

WARNING!

Property damage due to improper lashing!

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

– Only use the lashing eyes specified here.

WARNING!

Danger 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 property damage.

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

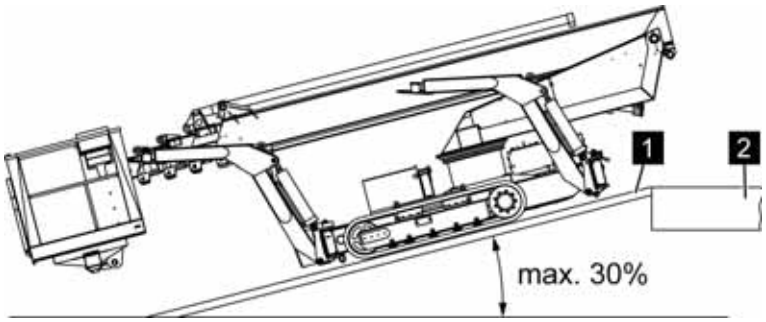


Fig. 40: Transport on a trailer

1. Move the aerial access platform in reverse on the ramps (Fig. 40/1).
2. When the machine begins to tip on the loading area (Fig. 40/2), slow down.

   When the aerial access platform has been set completely on the loading area (Fig. 40/2) with the chains, it is safe to speed up again.

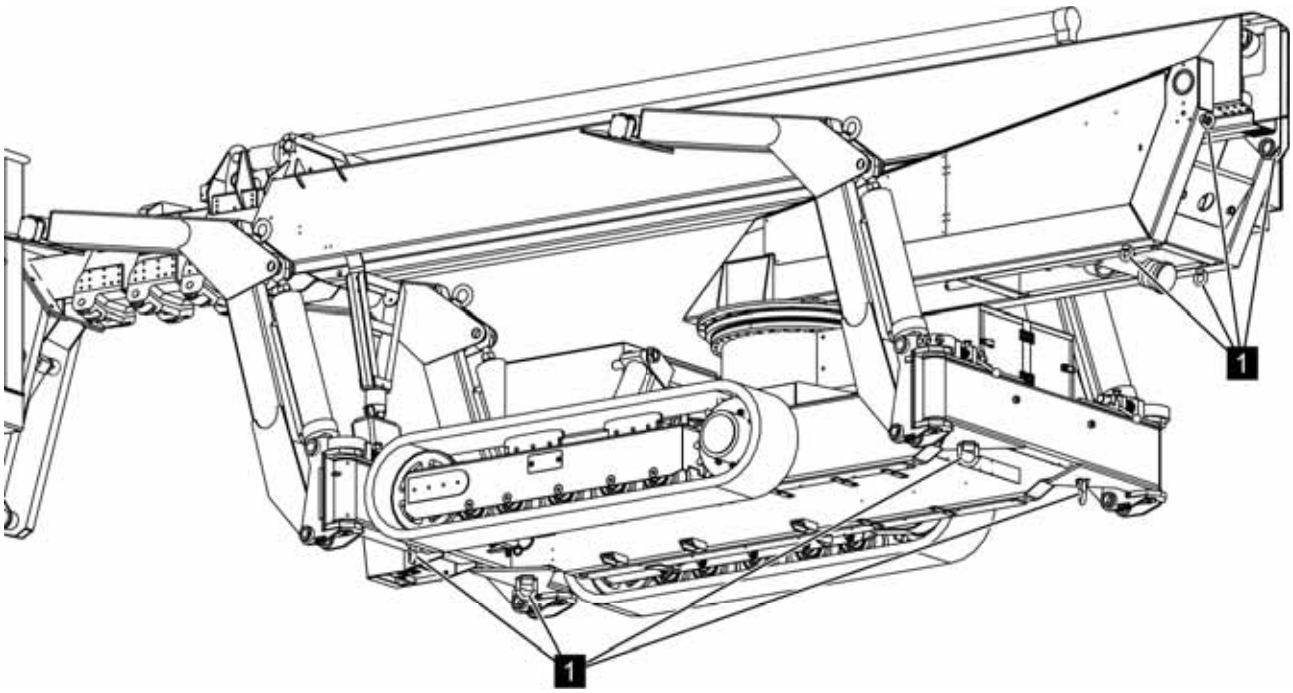


Fig. 41: Lashing eyes

3. Anchor and secure the lifting work platform to the means of transport, e.g. with safety belts in the lashing eyes (Fig. 41/1).
4. Begin transport.

Unloading

Unloading from a loading area takes place while driving forwards. To do this, proceed as follows:

1. Drive the aerial access platform slowly forwards .
2. Before tipping, slow down and drive carefully past the tipping point.

   After passing the tipping point, it is safe to speed up 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.

- 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.

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 Switching the machine on/off

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

The power is supplied either by the power network (construction side feed) using an extension cable (↬ *Chapter 3 'Technical data' on page 43*) or by the diesel engine, which is not connected to the power network.

6.2.1 Switching the machine on/off via the mains supply

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.

- In case of damage to the insulation, switch off the power supply immediately and have the machine repaired.
- Adhere to cable strengths according to ↬ *'Cable lengths' on page 51*.
- Keep humidity away from voltage-conducting parts. This can cause a short-circuit.
- Lay (extension) cables so that they cannot be driven over, they do not come into contact with liquids, they are not sharply nicked or otherwise stressed.
- Keep outlet easily accessible at all times.

Operation

Switching on

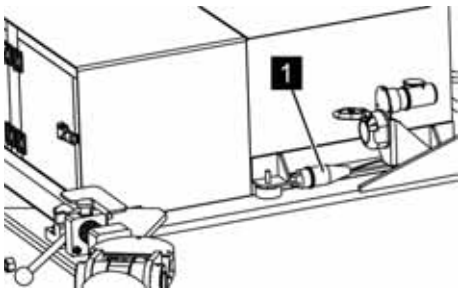


Fig. 42: Power connection

→ Connect the plug (Fig. 42/1) to the extension cable (230V). Here, heed the maximum cable lengths (↯ *Chapter 3 'Technical data' on page 43*).

⇨ The machine is ready for operation when the green light on the bottom control is blinking.

The green light blinks if the machine is not braced.

The green light stays on if the machine is braced.

Switching off

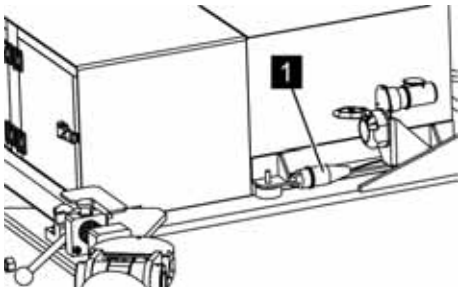


Fig. 43: Power connection

→ Disconnect the plug (Fig. 43/1) from the extension cable or press Emergency Stop.

6.2.2 Switching the machine on/off via the diesel engine

6.2.2.1 Switching on/off on the control box

NOTICE!
Voltage drop of the starter battery
Frequent starting of the diesel engine can cause a voltage drop of the starter battery.
– Avoid frequent starting of the diesel motor:

Switching on

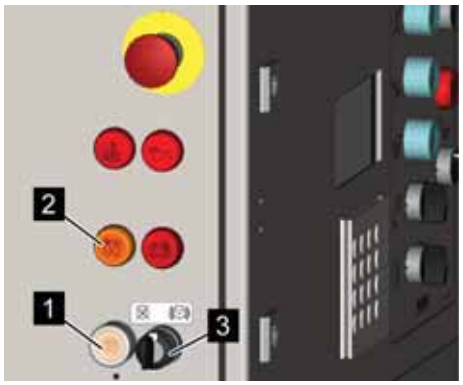


Fig. 44: Pre-heating and starting

1. Check the engine oil level (*Appendix C 'Kubota diesel engine' on page 183*).
2. Press the button (Fig. 44/1) and hold until the control lamp *[Pre-heat]* (Fig. 44/2) goes out.
3. Start the diesel engine by turning and holding the key switch (Fig. 44/3) to and release the toggle switch immediately when the diesel engine has started.

NOTICE!
Long starting processes can cause damage to the starter.

4. Let the diesel engine warm up for approximately 15 seconds before starting to operate the aerial access platform.

Switching off

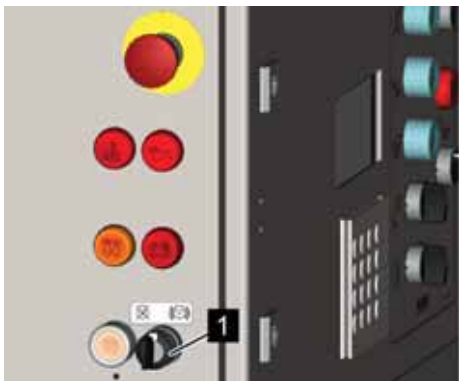


Fig. 45: Key switch

→ To switch off the diesel engine, turn the key switch (Fig. 45) on the bottom control to and hold it until the diesel engine stops.

6.2.2.2 Switching on/off from the working basket

Switching on

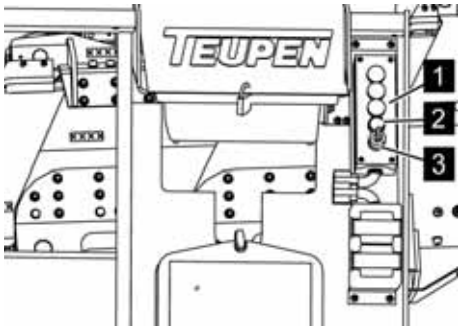


Fig. 46: Toolbar

1. Check the engine oil level (↬ *Appendix C 'Kubota diesel engine' on page 183*).
2. Press the button (Fig. 46/1) and hold until the control lamp *[Pre-heat]* (Fig. 46/2) goes out.
3. Start the diesel engine by turning and holding the key switch (Fig. 46/3) to and release the toggle switch immediately when the diesel engine has started.

> **NOTICE!**
> Long starting processes can cause damage to the starter.

4. Let the diesel engine warm up for approximately 15 seconds before starting to operate the aerial access platform.

Switching off

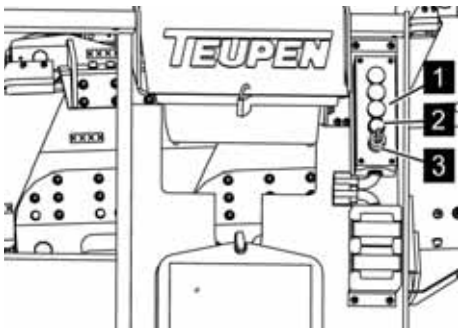


Fig. 47: Toolbar

→ To switch off the diesel engine, turn the key switch (Fig. 47) on the bottom control to and hold it until the diesel engine stops.

6.3 Switching the radio control on/off

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

Switching on and activating

Fig. 48: Radio control

1. Make sure that the Emergency Stop button (Fig. 48/2) is not activated.
2. To switch on the radio control, turn the rotary switch (Fig. 48/4) to the *[I]* position.
   ⇨ The radio control peeps 2x, rechargeable battery lamp (Fig. 48/3) blinks 2x.
3. Press the toggle switch (Fig. 48/1) to the right into the *[Start]* position.
   ⇨ The radio control is logged into the receiver and is now ready for operation.

After a radio interruption (e.g. due to a rechargeable battery change), the radio control must be logged onto the receiver again by pressing the toggle switch (Fig. 48/1) to the [Start] position.

Switching off

Fig. 49: Radio control

- Turn the rotary switch (Fig. 49/1) to the *[0]* position.
  - ⇨ The radio control is switched off.

6.4 Shutting down in case of emergency

In dangerous situations, movements of components must be stopped as quickly as possible and the power supply switched off.

In case of emergency, proceed as follows:

1. Trigger immediate emergency stop with Emergency Stop button.
2. If there is no danger to your own health, rescue people in the danger zone.
3. If necessary, start first aid measures.
4. Inform the fire brigade and/or rescue service.
5. Inform responsible people in the deployment location.
6. Switch off the machine and secure against switching on again.

6.5 Display and keyboard

6.5.1 Principles of operation

The following values are always displayed on the main window:

- Machine type
- Software version
- Time
- Working hours
- Working hours motor
- Setup LCD contrast

If necessary, fault messages are also displayed on the main window (⇘ *Chapter 8.3 'Error code list' on page 161*).

Fig. 50: Display and keyboard

Set LCD contrast

→ Set the LCD contrast with the arrow keys ↑ and ↓.

Calling up menus (example of main menu)

1. Enter the number <1>.
2. Confirm with the Enter key ↵.

   ⇨ The display changes to the main menu.

> *The menu in question can be exited with the Esc key Esc.*

6.5.2 Overview of the menu structure

Main menu	Submenu	Title
<1> Main menu	<1> Main settings	<1> Language
		<2> Buzzer

Main menu	Submenu	Title
		<3> Date
		<4> Time
		<5> Day
	<2> Control information	<1> Angle and pressure
		<2> Digital inputs
		<3> Analog inputs
		<4> Joysticks
	<3> Manufacturer settings	

6.5.3 Main menu

The menu is organised in three submenus.

- <1> Main settings
- <2> Control information
- <3> Manufacturer settings

6.5.3.1 Main settings

The Main settings menu can only be accessed with an access code.

1. Enter access code 24682468.
2. Confirm with the Enter key  .

The following settings can now be changed. To do this, enter the corresponding number and confirm with the Enter key  .

- <1> Language
  Select the appropriate language with the arrow keys and .
- <2> Buzzer
  Switch buzzer on or off with the <2> key. If the buzzer is switched on, there will be a brief tone with each press of the key.
- <3> Date
  Set the day, month and year with the arrow keys and and confirm with the Enter key .
- <4> Time
  Set the hour and minute with the arrow keys and and confirm with the Enter key .
- <5> Day
  By pressing the <5> key, the current day of the week jumps to the next day of the week.

Fig. 51: Display and keyboard

6.5.3.2 Control information

On the Control information menu, no settings can be made; values can only be read out. This menu can be used for error diagnosis.

The Control information menu is organised in four sub-menus:

- <1> Angle and pressure
- <2> Digital inputs
- <3> Analog inputs
- <4> Joysticks

6.5.3.3 Factory settings

This menu is only for TEUPEN employees.

6.6 Setting crawl/fast speed

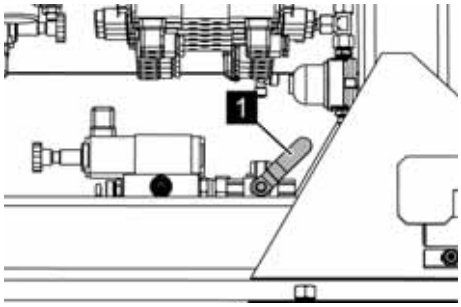


Fig. 52: Ball valve on the chassis

Ball valve on the chassis

The crawl or fast speed for chassis operation is set on the ball valve (Fig. 52/1) on the chassis.

- Ball valve right (turtle symbol): Crawl speed
- Ball valve left (rabbit symbol): Fast

Fig. 53: Radio control

Radio control

The crawl or fast speed for platform operation is set on the radio control.

- Toggle switch (Fig. 53/1) left (snail symbol): Crawl speed
- Toggle switch (Fig. 53/1) in the middle (rabbit symbol): Fast

This results in 4 different combinations, which are described below.

Combination	Description
Ball valve right (crawl speed) Toggle switch left (crawl speed)	Suitable for slow, more precise movements.
Ball valve right (crawl speed) Toggle switch in the middle (fast speed)	Suitable for normal movements of the crawler chassis with maximum power.
Ball valve left (fast speed)	Only suitable for movements for which great speeds without a lot of power should be generated.

Combination	Description
Toggle switch in the middle (fast speed)	Examples: ■ good for quick straight-away driving. ■ Poor for turning around on the spot. ■ Poor for moving on the landing.
Ball valve left (fast speed) Toggle switch left (crawl speed)	Suitable if for the short term driving should be precise and then fast (e.g. for going around an obstacle).

6.7 Moving the machine

Personnel:	■ Trained people
Protective equipment:	■ Protective clothing ■ Safety boots ■ Protective helmet ■ Safety harness

WARNING!

Danger 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.

- 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 200 kg.
- When moving on floor openings, heed indentations, surface changes, etc.
- Do not drive over materials with sharp edges.
- Do not make any abrupt changes of direction.
- In case of stop on an incline, secure the machine against rolling away.
- Make sure that the ladder is folded up and locked.
- When driving across an incline (max. 17° or 30 % with the Leo30T, max. 11° or 20 % with the Leo36T) do not stay on the downslope next to the aerial access platform.
- When driving on an incline (max. 17° or 30 % with the Leo30T, max. 11° or 20 % with the Leo36T) do not stay on the downslope behind the aerial access platform.
- Always carry out movements up and down with the working basket facing downhill.
- Avoid contact of the rubber tracks with oil, gasoline, diesel and salt, and clean if necessary.

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Switch on the radio control (*Chapter 6.3 'Switching the radio control on/off' on page 78*).

Fig. 54: Radio control

3. Switch the toggle switch (Fig. 54/1) to the left to *[Chain function]*.
4. Move the machine with the control levers (Fig. 54/2 and 3) according to *'Table "Moving the machine"' on page 88*.

By pressing the control levers (Fig. 54/2 and 3) slowly, the speed can be adapted.

Table "Moving the machine"

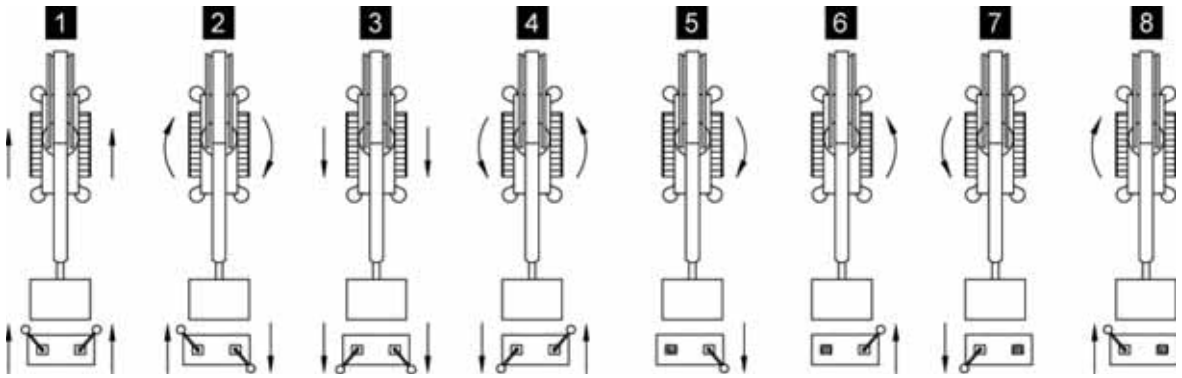


Fig. 55: Driving directions

No.	Operation	Effect
1	Press both control levers forwards	The machine moves backwards
2	Press left control lever forwards and pull right control lever backwards	Machine turns clockwise on the spot
3	Pull both control levers backwards	The machine moves forwards
4	Pull left control lever backwards and push right control lever forwards	Machine turns anti-clockwise on the spot
5	Pull only the right control lever backwards	The machine turns forwards in a clockwise direction
6	Press only the right control lever forwards	The machine turns backwards in an anti-clockwise direction
7	Pull only the left control lever backwards	The machine turns forwards in an anti-clockwise direction
8	Press only the left control lever forwards	The machine turns backwards in a clockwise direction

The possible turning radius can vary depending on the surface properties. Due to small turning radii, the crawler track is loaded more heavily and will wear faster.

6.8 Setting the working position of the outriggers

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

WARNING!

Danger of injury due to improper bracing!

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

– Always perform all work with at least two people.
– Ensure sufficient load capacity of the subsurface (*Chapter 3 'Technical data' on page 43*).
– Heed maximum guard rail angle (*Chapter 3 'Technical data' on page 43*).
– If necessary, use base plates.
– Make sure that the base plates are aligned horizontally (maximum deviation of ± 8°).
– 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.

The individual outriggers can each be latched in two working positions (narrow and wide) In total, the following bracing variants (Fig. 56) are possible:

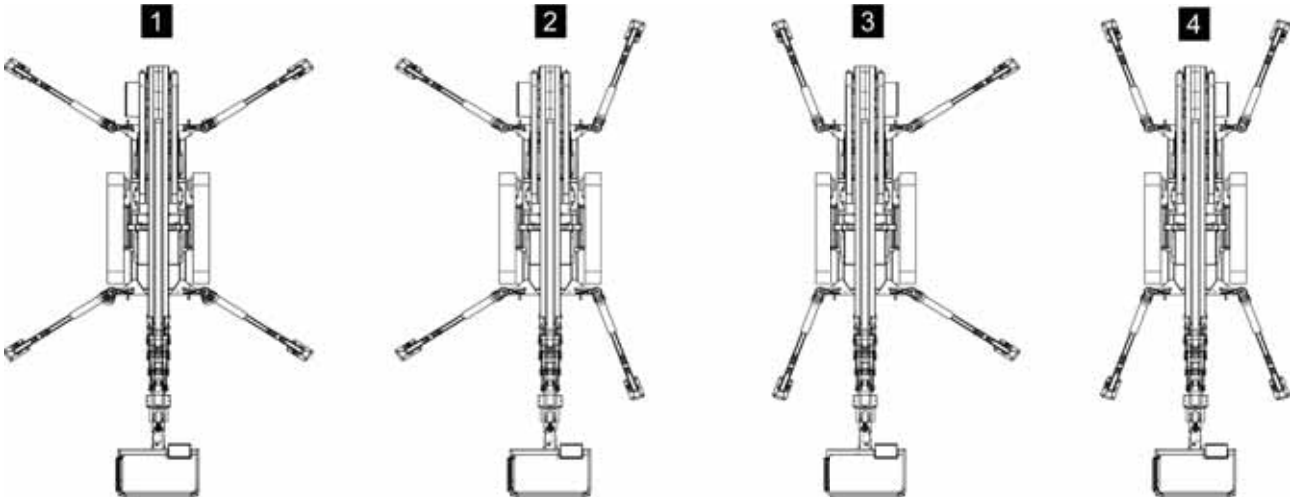


Fig. 56: Bracing variants

1 Both sides wide (working range 360°)
2 One-sided wide (working range 220°)
3 One-sided wide (working range 220°)
4 Both sides narrow (working range approx. 20°) (only possible with Leo30T)

Thanks to the narrow bracing, it is also possible to brace the machine in tight spaces.

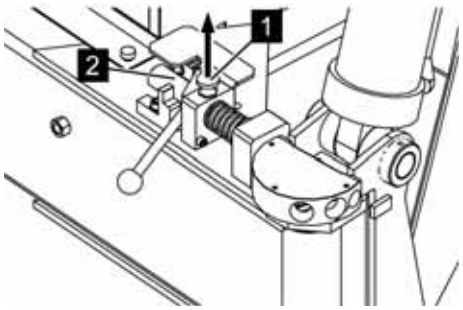


Fig. 57: Loosening the latching

1. Pull the locking pin (Fig. 57/1) upwards until the latching bolt (Fig. 57/2) turns freely.

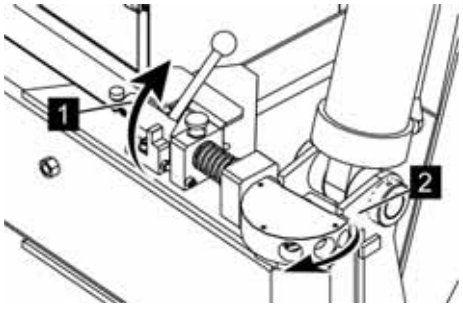


Fig. 58: Loosening the latching

2. Put the latching bolt (Fig. 58/1) into the position shown (Fig. 58) so that the outrigger (Fig. 58/2) swivels freely.

Operation

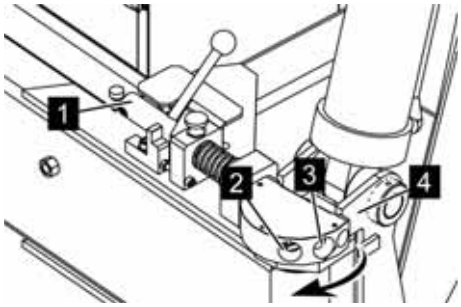


Fig. 59: Working positions

3. Swivel the outrigger (Fig. 59/4) far enough that the latching bolt (Fig. 59/1) is in front of the hole for the narrow (Fig. 59/3) or wide (Fig. 59/2) working position.

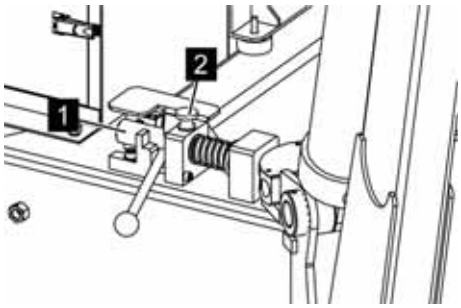


Fig. 60: Latching

4. Put the latching bolt (Fig. 60/1) into the position shown (Fig. 60) and let the locking pin (Fig. 60/2) snap in.

6.9 Putting the machine in working position

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet
- Safety harness

WARNING!

Danger of injury due to improper bracing!

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

– Always put the safety harness on when in the working basket.
– Always perform all work with at least two people.
– Ensure sufficient load capacity of the subsurface (↳ *Chapter 3 'Technical data' on page 43*).
– Heed maximum guard rail angle (↳ *Chapter 3 'Technical data' on page 43*).
– If necessary, use base plates.
– Make sure that the base plates are aligned horizontally (maximum deviation of ± 8°).
– 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 be undertaken optionally from the working basket or from the floor with the radio control.

6.9.1 Manual bracing

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Switch on the radio control (*Chapter 6.3 'Switching the radio control on/off' on page 78*).
3. Put the outriggers in the desired working position (*Chapter 6.8 'Setting the working position of the outriggers' on page 89*).

Fig. 61: Operation of outriggers

4. Press the toggle switch (Fig. 61/1) to the right into the *[Outrigger function]* (yellow) position.
5. Press the toggle switch (Fig. 61/2) to the left into the *[Manual]* position.
6. With the control levers (Fig. 61/3 to 6) select the desired outrigger(s) and extend the outrigger in question by pressing the corresponding control lever forwards.

Fig. 62: Circular level

7. Put the chassis in a horizontal position by aligning the outriggers according to the circular level (Fig. 62)(Item no. 4001/0298). The bubble (Fig. 62/1) of the circular level must be within the 1° circle (Fig. 62/2).

⇨ With proper bracing, the green control lamp on the control box and on the toolbar lights up and remains lit.

6.9.2 Automatic bracing

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Switch on the radio control (*Chapter 6.3 'Switching the radio control on/off' on page 78*).
3. Put the outriggers in the desired working position (*Chapter 6.8 'Setting the working position of the outriggers' on page 89*).

Fig. 63: Operation of outriggers

4. Press the toggle switch (Fig. 63/1) to the right into the *[Outrigger function]* (yellow) position.
5. Press the toggle switch (Fig. 63/2) to the middle into the *[Automatic]* position.
6. Use any control lever (Fig. 63/3 to 6) to telescope out all outriggers to the front by pressing.

   ⇨ The chassis aligns itself automatically.
7. Check the orientation with the circular level (Fig. 62) (item no. 4001/0280). The bubble (Fig. 62/1) of the circular level must be within the 1° circle (Fig. 62/2).

Fig. 64: Circular level

⇨ With proper bracing, the green control lamp on the control box and on the toolbar lights up and remains lit.

6.10 Operating the machine

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet
- Safety harness

WARNING!

Danger of injury due to improper operation!

Improper operation can cause severe injuries and significant property 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 place any objects on the working basket safety fence.
- Do not work on or near high-voltage lines.
- Watch out for 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.

The radio control must be in the bracket in the working basket. Otherwise the platform functions will not work.

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Switch on the radio control (*Chapter 6.3 'Switching the radio control on/off' on page 78*).

3. Put the outriggers in the desired working position (*Chapter 6.8 'Setting the working position of the outriggers' on page 89*).

Fig. 65: Platform operation

4. Press the toggle switch (Fig. 65/1) to the middle into the *[Platform function]* (blue) position.
5. With the toggle switch (Fig. 65/2), select crawl speed (snail) or fast speed (rabbit).
6. Operate the platform with the toggle switches (Fig. 65/3 and 4) and the control levers (Fig. 65/5 to 8) according to the following table.

Operating element (Fig. 65)	Symbol	Title
Toggle switch 3		Tilt working basket
Toggle switch 4		Swivel working basket
Control lever 5		Extend the telescopic arm
		Retract the telescopic arm
Control lever 6		Swivel the platform anti-clockwise (seen from above)
		Swivel the platform clockwise (seen from above)

Operating element (Fig. 65)	Symbol	Title
Control lever 7		Extend basket arm
		Retract basket arm
Control lever 8		Lift the telescopic arm
		Lower the telescopic arm

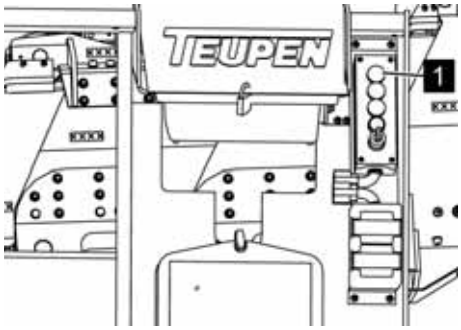


Fig. 66: Toolbar

Info load limit

If the warning lamp (Fig. 66/1) on the toolbar is blinking, only "non-critical" movements are possible. These are

- *'Lift the telescopic arm'*
- *'Retract the telescopic arm'*
- *'Swivel (only Leo30T)'*
- *'Basket arm up/down'*
- *'Swivel working basket'*

6.11 Putting the machine in transport position

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet
- Safety harness

Definition of transport position:

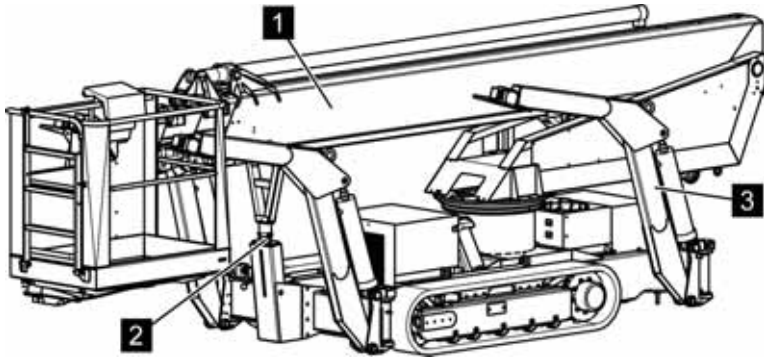


Fig. 67: Transport position

- The telescopic arm (Fig. 67/1) is on the transport attachment (Fig. 67/2).
- The outriggers (Fig. 67/3) are retracted and in transport position.

WARNING!

Danger of injury when lowering!

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

- Always put the safety harness on when in the working basket.
- Always perform all work with at least two people.
- 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 put the machine in transport position, the outriggers can be retracted manually or automatically.

6.11.1 Manual lowering

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Switch on the radio control (*Chapter 6.3 'Switching the radio control on/off' on page 78*).
3. Retract the telescopic arm (*Chapter 6.10 'Operating the machine' on page 95*).

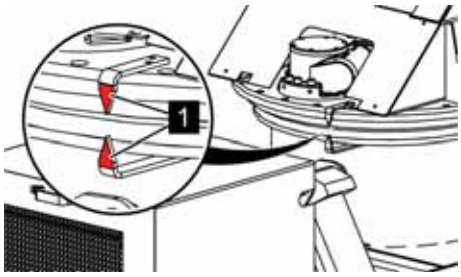


Fig. 68: Red arrows

4. Lower telescopic arm until it is slightly above the telescopic arm attachment (↯ *Chapter 6.10 'Operating the machine' on page 95*).
5. Swivel the platform in the direction of transport position (↯ *Chapter 6.10 'Operating the machine' on page 95*) until both red arrows (Fig. 68/1) meet.
6. Lower the telescopic arm into transport position (↯ *Chapter 6.10 'Operating the machine' on page 95*).

Fig. 69: Operation of outriggers

7. Press the toggle switch (Fig. 69/1) to the right into the *[Outrigger function]* (yellow) position.
8. Press the toggle switch (Fig. 69/2) to the left into the *[Manual]* position.
9. With the control levers (Fig. 69/3 to 6) select the desired outrigger(s) and extend the outrigger in question by pressing the corresponding control lever forwards.
10. When all outriggers are retracted, unlock the outriggers (↯ *Chapter 6.8 'Setting the working position of the outriggers' on page 89*) and swivel into transport position.

6.11.2 Automatic lowering

1. Switch on the machine (↯ *Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Switch on the radio control (↯ *Chapter 6.3 'Switching the radio control on/off' on page 78*).
3. Retract the telescopic arm (↯ *Chapter 6.10 'Operating the machine' on page 95*).
4. Lower telescopic arm until it is slightly above the telescopic arm attachment (↯ *Chapter 6.10 'Operating the machine' on page 95*).

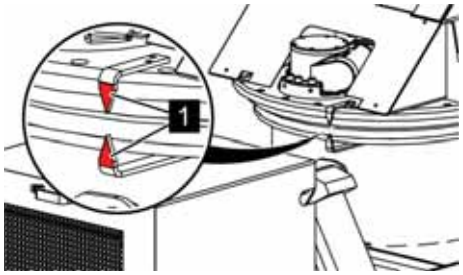


Fig. 70: Red arrows

5. Swivel the platform in the direction of transport position (↬ *Chapter 6.10 'Operating the machine' on page 95*) until both red arrows (Fig. 70/1) meet.
6. Lower the telescopic arm into transport position (↬ *Chapter 6.10 'Operating the machine' on page 95*).

Fig. 71: Operation of outriggers

7. Press the toggle switch (Fig. 71/1) to the right into the *[Outrigger function]* (yellow) position.
8. Press the toggle switch (Fig. 71/2) to the middle into the *[Automatic]* position.
9. By pulling one of the control levers (Fig. 71/3 to 6), retract all outriggers simultaneously.
10. When all outriggers are retracted, unlock the outriggers (↬ *Chapter 6.8 'Setting the working position of the outriggers' on page 89*) and swivel into transport position.

6.12 Height and width adjustment crawler chassis

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective 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 property damage.

– Only make height/width adjustment in wide working position or not in the braced state (*Chapter 6.8 'Setting the working position of the outriggers' on page 89*).

Both crawler chassis can be adjusted independently of one another in their height and thus simultaneously in their width.

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Switch on the radio control (*Chapter 6.3 'Switching the radio control on/off' on page 78*).
3. Put the outriggers in the desired working position (*Chapter 6.8 'Setting the working position of the outriggers' on page 89*).

Fig. 72: Radio control

4. Switch the toggle switch (Fig. 72/1) to the left to *[Chain function]* (red).
5. Press the toggle switch (Fig. 72/2) to the middle into the *[Fast speed]* position.
6. Adjust the chassis according to the following table:

Make sure that there are no obstacles (curb edge, etc.) beside the drive chains, since these can stop the carriage drive adjustment.

Fig. 73: Radio control

Operating element Fig. 73	Title
Press toggle switch 1 forwards	The left chassis retracts
Pull toggle switch 1 backwards	The left chassis extends
Press toggle switch 2 forwards	The right chassis retracts
Pull toggle switch 2 backwards	The right chassis extends

6.12.1 Tips and recommendations for hydraulic crawler chassis adjustment

Below are a few useful tips for crawler chassis adjustment:

- The hydraulic adjustment mechanism is designed for making the height and width adjustment of the chassis without having to lift the chassis with the outriggers.
- If an adjustment of the chassis is not possible due to an unfavourable surface, the bracing system must be used to help (↳ *Chapter 6.9 'Putting the machine in working position' on page 92*).
- To protect the machine and the chassis, the hydraulic adjustment power is limited. On a firm ground such as pavement, asphalt, hardened gravel or firm turf, a height and lateral adjustment of the individual chain side is possible on one side or both.
- On sandy ground or soft grass, it is likely that the drive chains will dig into one place depending on their adjustment and especially after repeated pulling in and out.
- With ground that is not too firm, we recommend making the desired chassis adjustment in advance on firm ground or lifting the chassis in advance with the help of the bracing (↳ *Chapter 6.9 'Putting the machine in working position' on page 92*).

6.13 Adjusting the telescopic arm attachment

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

While driving on slopes, it may be necessary to lift the working basket up a bit. So that it lies securely while driving, the height of the telescopic arm attachment can be adjusted.

CAUTION!

Danger of collision in platform operation!

When the telescopic arm attachment is extended, there is a danger of collision in platform operation.

– Make sure that the telescopic arm attachment is retracted during platform operation.

When the machine is in transport position, the telescopic arm can only be lived using the service mode (↳ Chapter 6.18 'Service operation' on page 125).

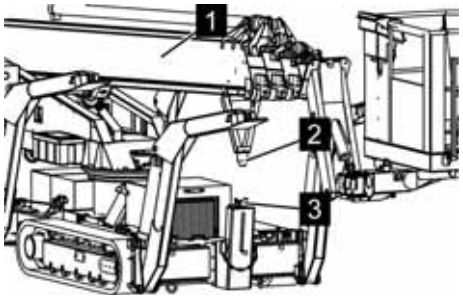


Fig. 74: Lifting the telescopic arm

1. Lift the telescopic arm (Fig. 74/1) until the attachment centring (Fig. 74/2) is about 35 to 40 cm away from the telescopic arm attachment (Fig. 74/3).

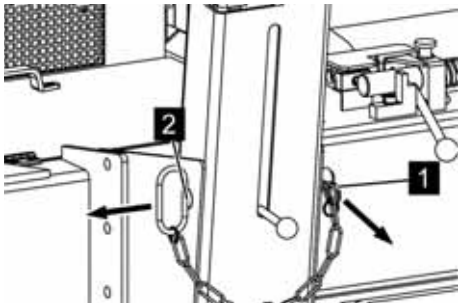


Fig. 75: Fastening bolts

2. Pull the spring cotter pin (Fig. 75/1) out of the fastening bolts (Fig. 75/2).
3. Pull out the fastening bolts (Fig. 75/2).

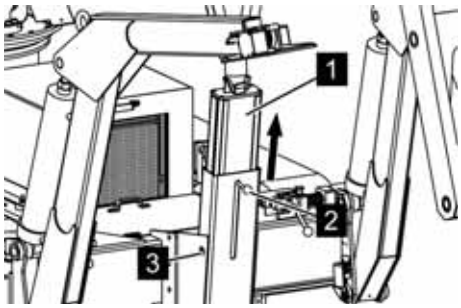


Fig. 76: Lifting the telescopic arm attachment

4. Pull the telescopic arm attachment (Fig. 76/1) upwards on the handle (Fig. 76/2) until the holes (Fig. 76/3) meet.

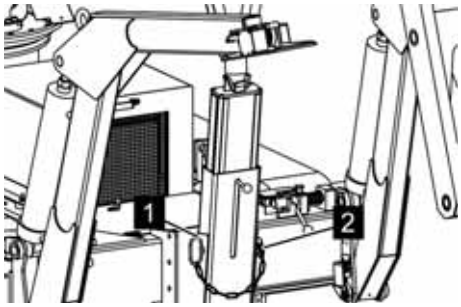


Fig. 77: Fastening bolts

5. Push the fastening bolts (Fig. 77/1) in and secure with the the spring cotter pin (Fig. 77/2).

6.14 Changing/charging the battery of the radio control

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

In the scope of delivery, there are 3 rechargeable batteries for the radio control, one in the radio control, one in the power pack and one in the charger on the lift arm holder.

The operating time of a charged battery is approximately 8 to 10 hours.

Fig. 78: Radio control

1. Switch off the radio control. To do this, turn the rotary switch (Fig. 78/1) to the *[0]* position.
2. Remove the empty battery (Fig. 79/1) on the back side of the radio control.

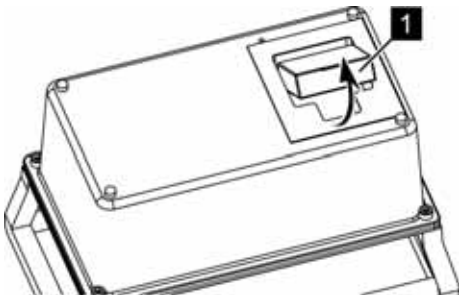


Fig. 79: Battery

3. Open the door (Fig. 80/1) in the lift arm holder. The charging station is behind this.

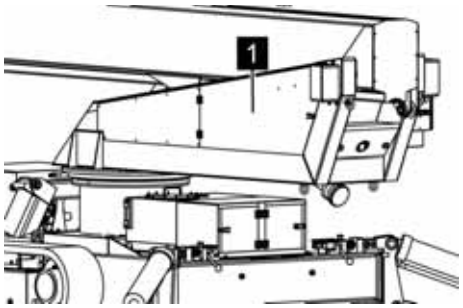


Fig. 80: Door

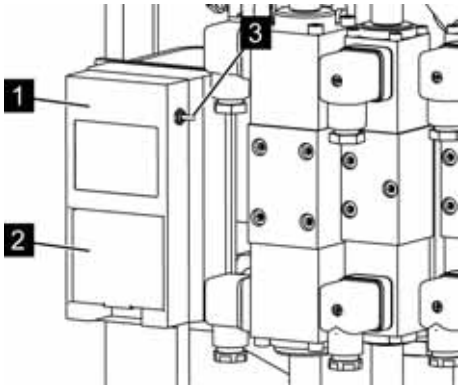


Fig. 81: Charging station

4. Remove the charged battery (Fig. 81/2) from the charging station (Fig. 81/1) and insert the empty battery. Make sure that the toggle switch (Fig. 81/3) is in the *'on'* position.

> *The charging time in normal charging mode (charge) is approximately 5 hours; in fast charge mode, approximately 2.5 hours.*

5. Insert the charged battery in the radio control.

> *In case of longer downtime, switch the charging device (toggle switch Fig. 81/3) to the 'off' position so that the machine's main battery will not discharge.*

6.15 Changing the working basket (optional)

Depending on the model, the working basket can be changed.

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

It is recommended that you change the working basket with two people.

Dismounting the working basket

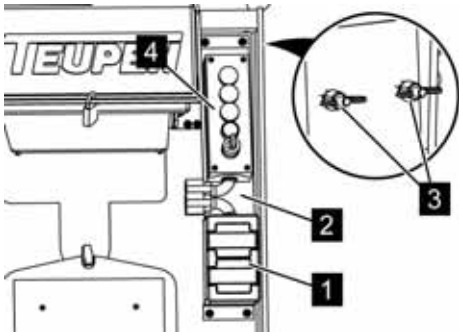


Fig. 82: Retaining plate

1. Put the machine in transport position (↳ *Chapter 6.11 'Putting the machine in transport position' on page 97*).
2. Unscrew the retaining plate (Fig. 82/2) with the toolbar (Fig. 82/4) and outlets (Fig. 82/1). To do this, loosen the wing nuts (Fig. 82/3) on the back side above and below.
3. Remove the retaining plate (Fig. 82/2) from the working basket.

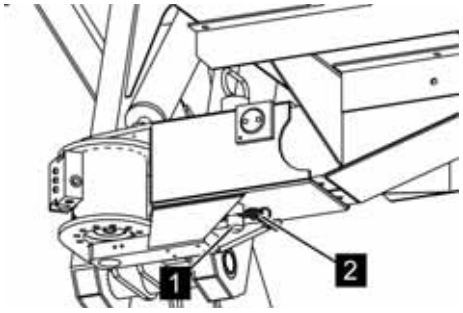


Fig. 83: Pull out the spring cotter pin

4. Pull the spring cotter pin (Fig. 83/2) out of the fastening bolts (Fig. 83/1).

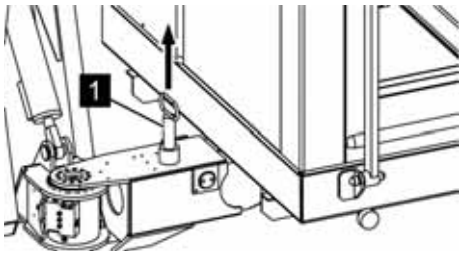


Fig. 84: Pull out the fastening bolts

5. Pull the fastening bolts (Fig. 84/1) as far upwards as possible.

The fastening bolt is secured with a link chain and cannot be pulled out completely.

Operation

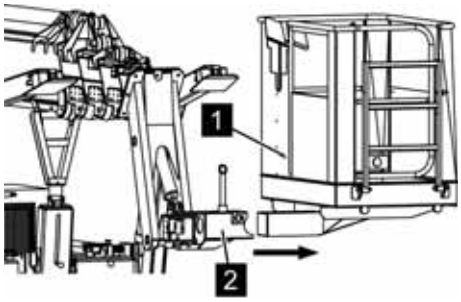


Fig. 85: Removing the working basket

6. Lift the working basket (Fig. 85/1) slightly and pull it out of the bracket (Fig. 85/2).

Inserting the working basket

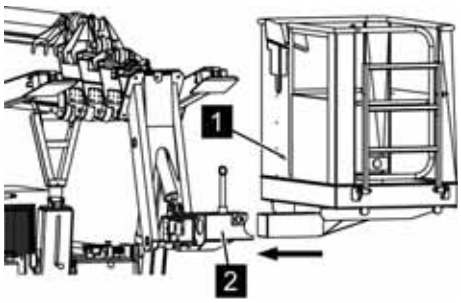


Fig. 86: Inserting the working basket

7. Push the working basket (Fig. 86/1) in up to the stop and push it into the bracket (Fig. 86/2).

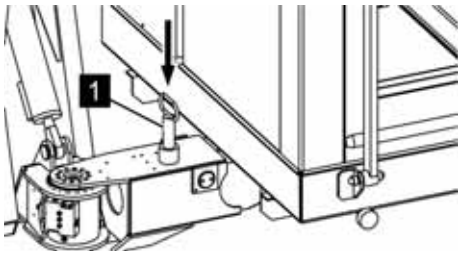


Fig. 87: Inserting the fastening bolts

8. Push the fastening bolts in (Fig. 87/1) completely. Make sure that the working basket can no longer be pulled out of the bracket.

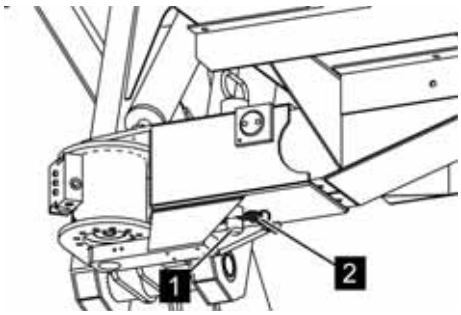


Fig. 88: Inserting the spring cotter pin

9. Secure the fastening bolts (Fig. 88/1) with the the spring cotter pin (Fig. 88/2).

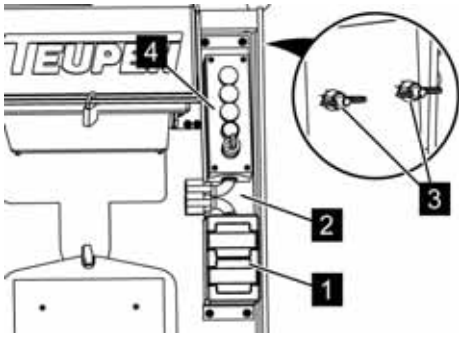


Fig. 89: Retaining plate

10. Insert the retaining plate (Fig. 89/2) with the outlets (Fig. 89/1) and the toolbar (Fig. 89/4) into the working basket and tighten the wing nuts (Fig. 89/3) on the top and bottom of the back side.

6.16 Valve settings and operation

For emergency and service operation, it is necessary to activate particular valves. The function of the valves is explained below.

6.16.1 Position of the shuttle valves

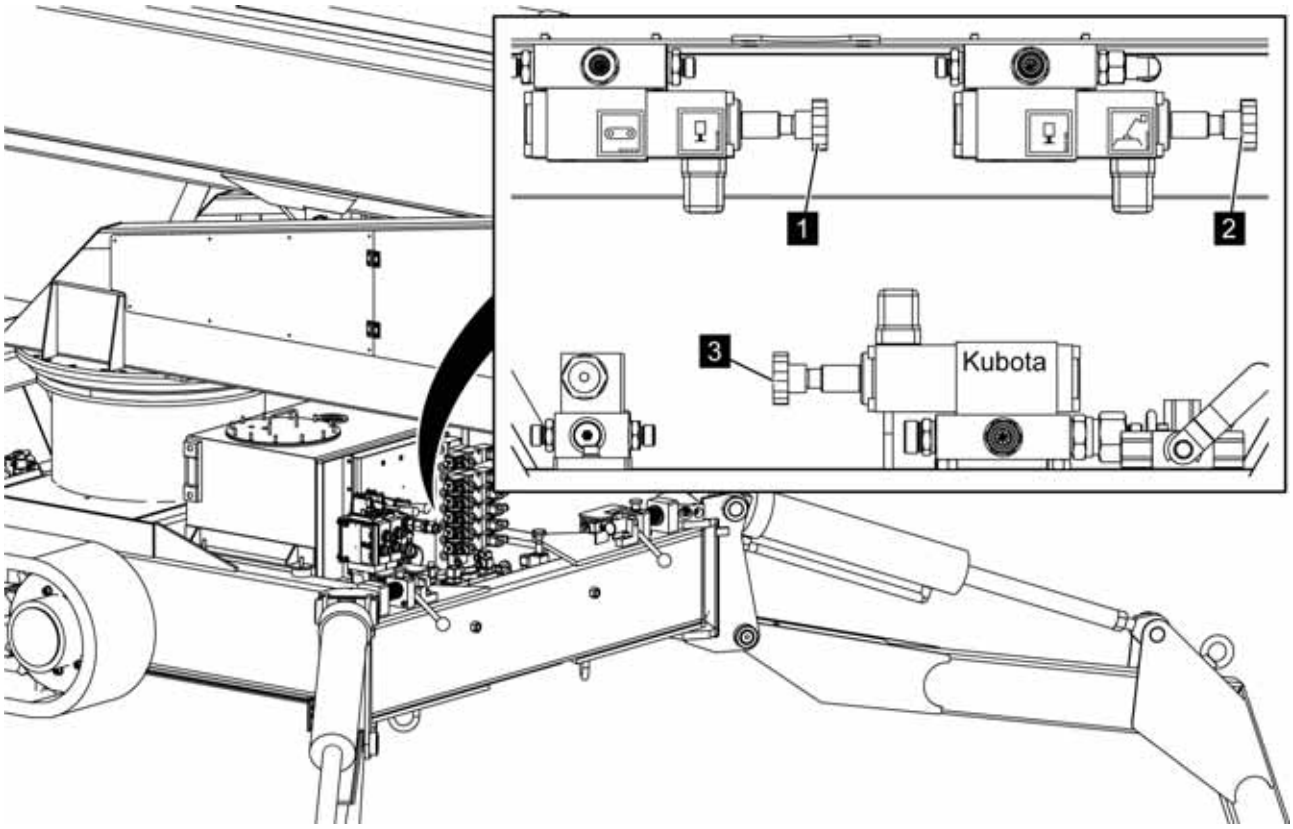


Fig. 90: Shuttle valves

Title	Valve setting Fig. 90)
For chain function	Lock valves 1 and 2
For platform function	Unlock all valves (basic setting)
For outrigger function	Lock valve 2, unlock valve 1
For Kubota operation in service mode	Lock valve 3

6.16.2 Activating shuttle valves

A shuttle valve has essentially 2 positions:

- locked
- unlocked

In normal operation, all shuttle valves are unlocked.

Depending on the valve setting (Fig. 91) a different function is activated.

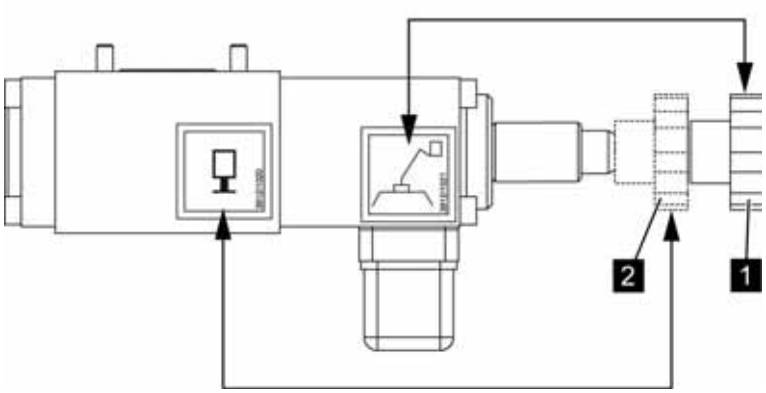
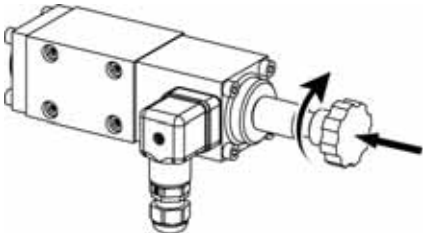


Fig. 91: Example shuttle valve

Position 1 Shuttle valve unlocked
(here: platform function activated)
Position 2 Shuttle valve locked
(here: outrigger function activated)

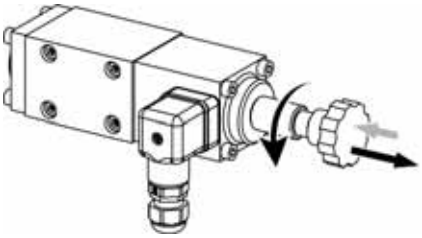
Locking shuttle valve



→ Press the shuttle valve in and lock with a slight turn clockwise.

Fig. 92: Locking shuttle valve

Unlocking shuttle valve



→ Press the shuttle valve in and unlock with a slight turn anti-clockwise.

Fig. 93: Unlocking shuttle valve

6.16.3 Valve setting for platform

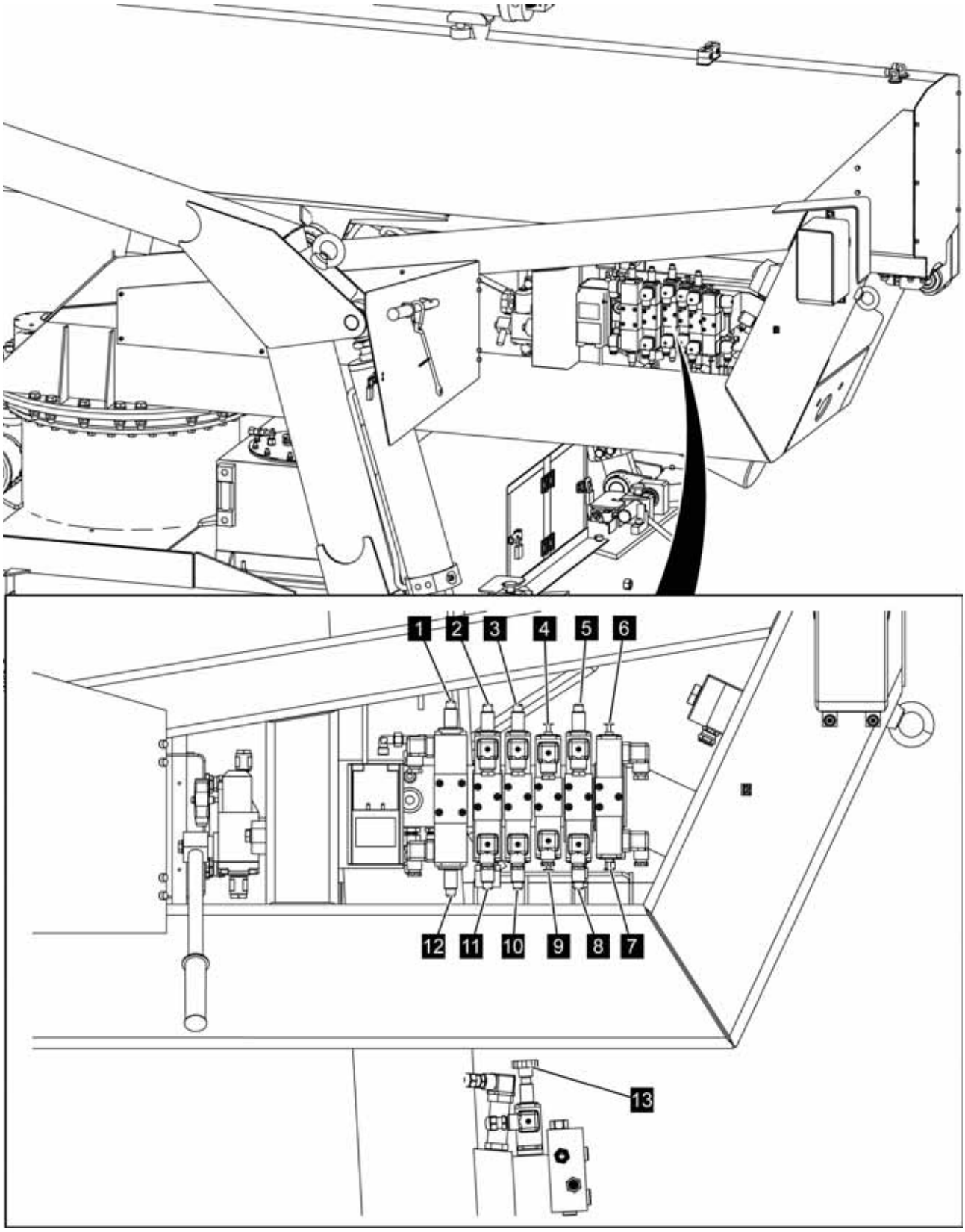


Fig. 94: Valve setting for platform

Pos.	Symbol	Title
1		Extend the telescopic arm
2		Swivel the platform clockwise (seen from above)
3		Extend basket arm
4		Swivel the working basket clockwise (seen from above)
5		Lifting the telescopic arm
6		Tip working basket forwards
7		Tip working basket backwards
8		Lower the telescopic arm
9		Swivel the working basket anti-clockwise (seen from above)
10		Retract basket arm
11		Swivel the platform anti-clockwise (seen from above)
12		Retract the telescopic arm
13		Proportional valve lower telescopic arm (only necessary in connection with Pos. 8)

6.16.4 Valve setting outriggers and height adjustment chassis

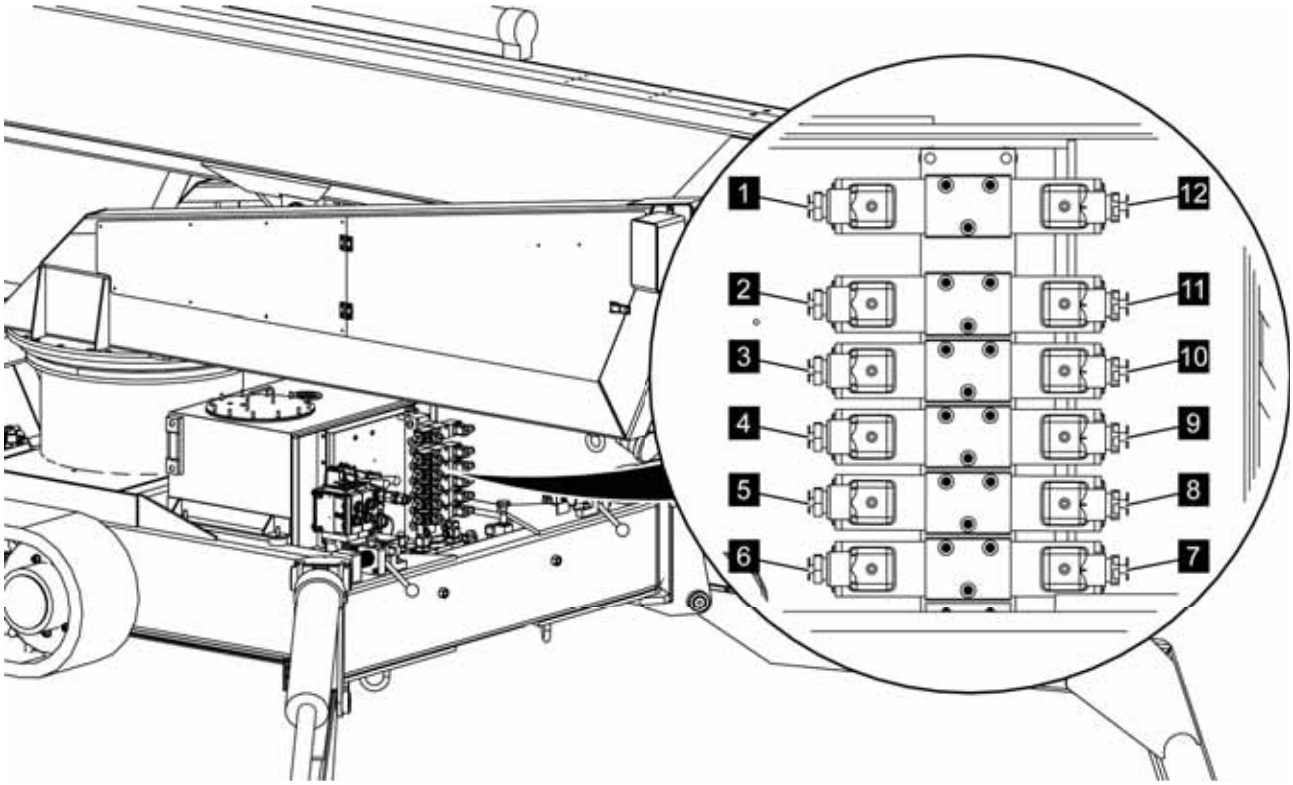
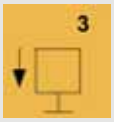
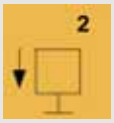
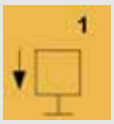
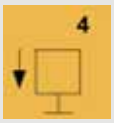


Fig. 95: Valve setting outriggers

Pos.	Symbol	Title
1		Left crawler chassis up
2		Right crawler chassis up
3		Lift outrigger 4
4		Lift outrigger 1
5		Lift outrigger 2

Pos.	Symbol	Title
6		Lift outrigger 3
7		Lower outrigger 3
8		Lower outrigger 2
9		Lower outrigger 1
10		Lower outrigger 4
11		Right crawler chassis down
12		Left crawler chassis down

6.16.5 Driving the crawler chassis

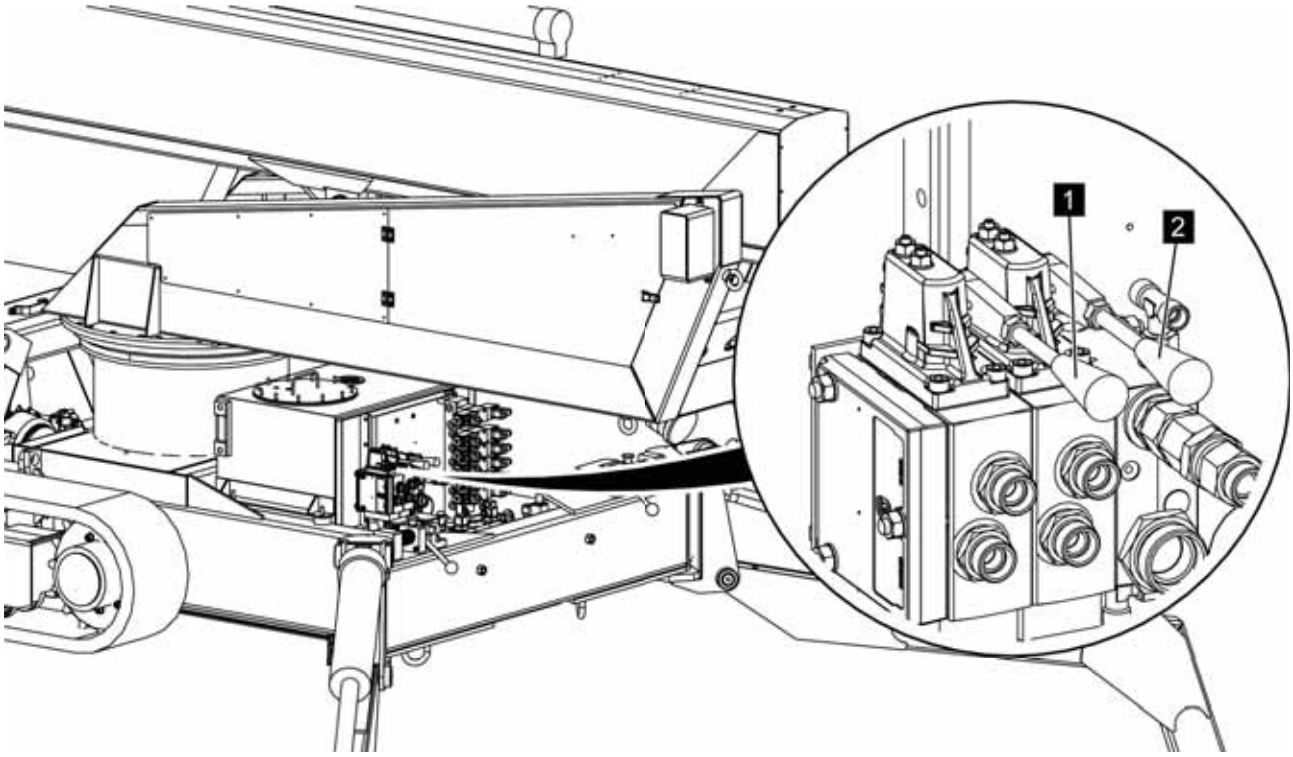
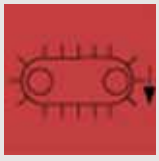


Fig. 96: Valve setting crawler chassis

Pos.	Symbol	Title	Note
1		Left crawler chassis forwards	Press lever down
		Left crawler chassis backwards	Lift lever
2		Right crawler chassis forwards	Press lever down
		Right crawler chassis backwards	Lift lever

6.17 Emergency operation

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

The aerial access platform has an emergency operation that enables operation of the aerial access platform without radio control and without power supply with the help of the hand pump. Emergency operation may only be used in order to put the machine in the direction of transport position.

Emergency operation is divided into platform and outrigger operation. Chain function is not relevant during emergency operation.

6.17.1 Platform operation in emergency operation

WARNING!

Danger of injury due to inactive safety equipment!

In emergency operation, all safety equipment (e.g. limit switches) is out of order. This can cause the machine to tip over when limit positions are exceeded (e.g. complete swivelling out with narrow bracing). This can cause severe injuries or even death.

– Execute emergency operation according to the following instructions.

1. Switch off the machine and make sure that the mains plug is disconnected (↬ *Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the door (Fig. 97/1) on the lift arm holder.

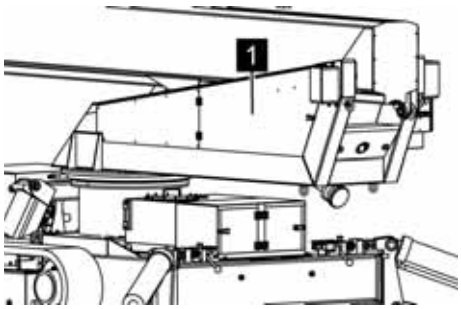


Fig. 97: Door on the lift arm holder

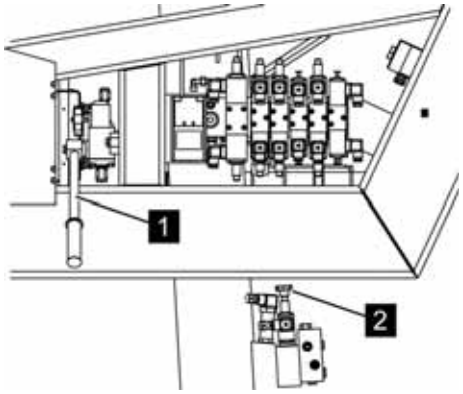


Fig. 98: Hand pump

3. Put the hand pump lever (Fig. 98/1) on the hand pump.
4. In order to be able to use the function *[Lower telescopic arm]*, lock the proportional valve (Fig. 98/2).

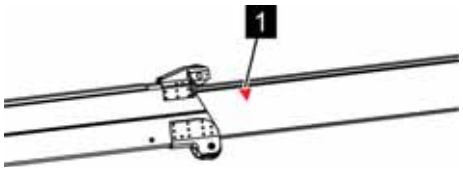


Fig. 99: Red arrows

5. **WARNING!**

Danger of injury due to improper operation!

The machine can tip or slide away due to improper operation of the platform operation. There is also a danger of collision between basket arm and working basket handrail. This can cause severe injuries and property damage.

- Keep the working basket as horizontal as possible.
- Always only retract the telescopic arm until the red arrows (Fig. 99/1) on the bearings are no longer visible.
- Swivel the platform into transport position. With (one-sided) narrow bracing, do not swivel laterally beyond the outriggers.
- Always swivel back to the same side.
- Before lowering the working basket completely, swivel out or put in transport position.

Activate the desired valve (↬ *Chapter 6.16.3 'Valve setting for platform' on page 113*) by pressing it in firmly and at the same time pumping with the hand pump (Fig. 98/1) until the selected component has reached the desired position.

6. Put the machine into transport position according to the valve setting (↬ *Chapter 6.16.3 'Valve setting for platform' on page 113*).

Note about transport position

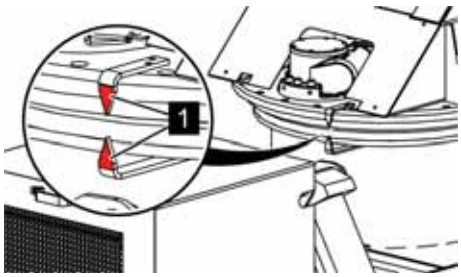


Fig. 100: Transport position

7. The platform is aligned in transport position if the red arrows (Fig. 100/1) on the rotating assembly meet.
8. After emergency operation, unlock the proportional valve (Fig. 98/2) again if necessary.

WARNING!
Danger of injury due to uncontrolled movements!
In case the valves are set incorrectly in normal operation, there is a danger of uncontrolled movements. This can cause severe injuries.
– Make sure that the proportional valve (Fig. 98/2) is completely unlocked for normal operation.

6.17.1.1 Fast emergency drain

NOTICE!
The fast emergency drain may only be done in extreme emergency (e.g. danger of a person in the working basket bleeding to death)! The machine can be damaged by the fast emergency drain.

1. Switch off the machine and make sure that the mains plug is disconnected (↬ *Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the door (Fig. 101/1).

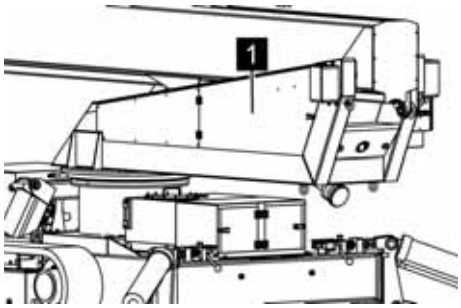


Fig. 101: Door

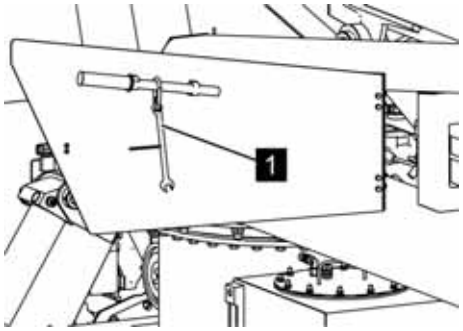


Fig. 102: Special tool

3. Remove the special tool (Fig. 102/1) (hexagon spanner with welded-on Allen wrench).

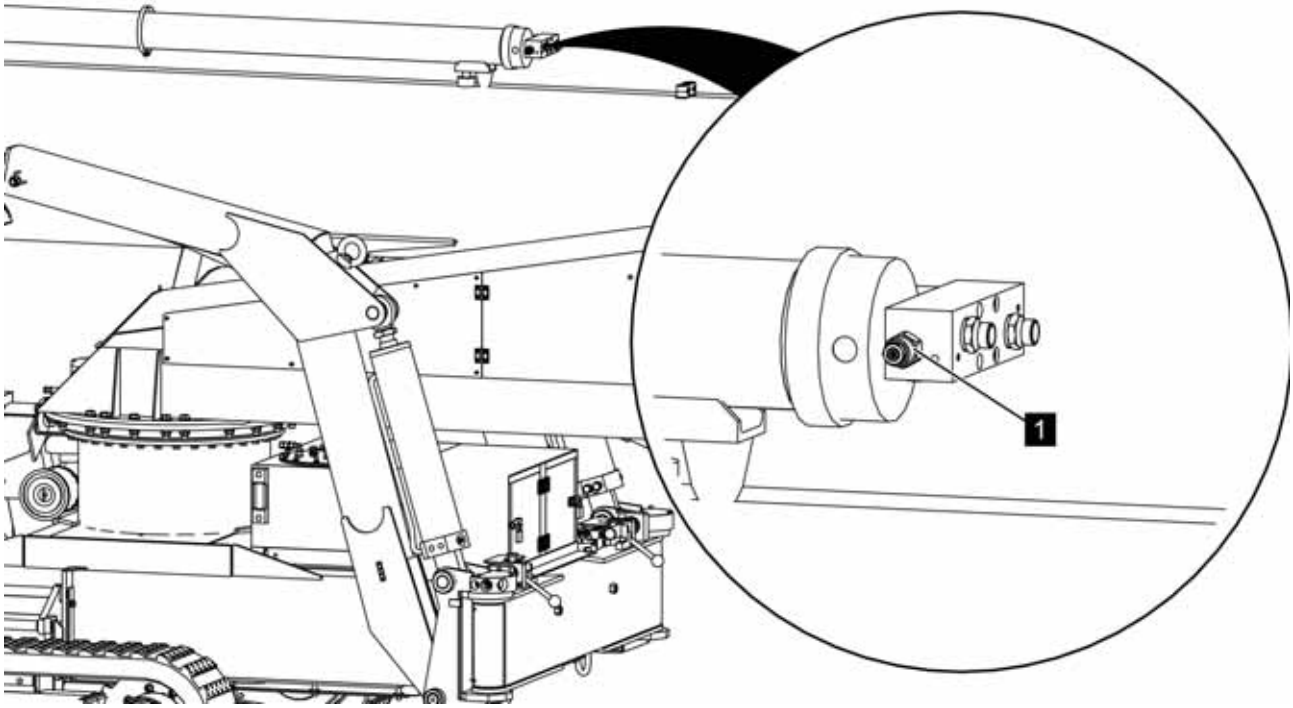


Fig. 103: Emergency drain

4. Loosen the hexagon nut (Fig. 103/1) on the valve block.

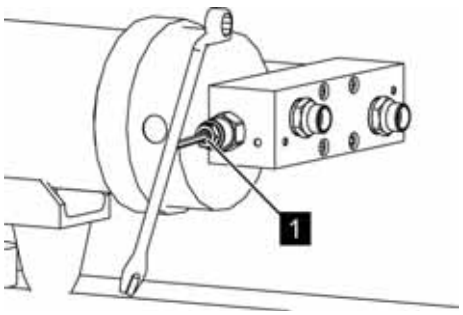


Fig. 104: Emergency drain

5. Loosen the Allen head screw (Fig. 104/1) slowly. While doing this, observe the movement of the lift arm.

6. Contact the manufacturer to check the machine. Please see page 2 for the contact data.

6.17.2 Operation of outriggers in emergency operation

WARNING!
Danger of injury due to inactive safety equipment!
In emergency operation, all safety equipment (e.g. limit switches) is out of order.

– Execute emergency operation according to the following instructions.

2 people are required for outrigger operation.

1. Switch off the machine and make sure that the mains plug is disconnected (↬ *Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the doors (Fig. 105/2 and 3) or completely remove the cover (Fig. 105/1).

NOTICE!
For platform operation, the doors (Fig. 105/2 and 3) must remain closed.

3. Open the door (Fig. 105/4).

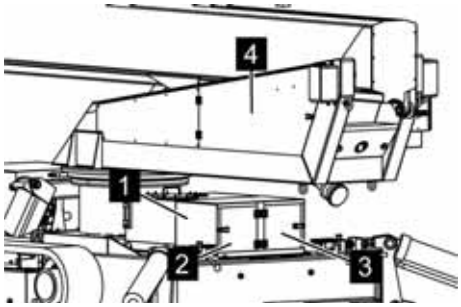


Fig. 105: Shuttle valve cover

4. For outrigger operation, lock the shuttle valve (Fig. 106/1).
5. Put the hand pump lever on the hand pump.

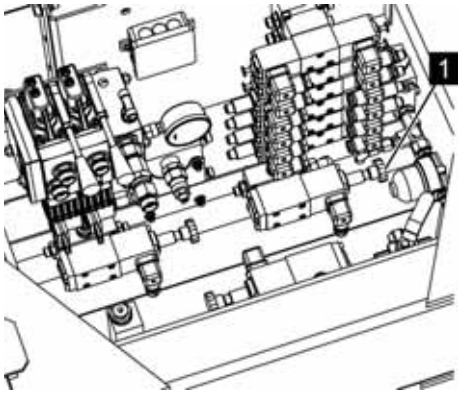


Fig. 106: Valves

6. **WARNING!**

Danger of injury due to improper operation!

The machine can tip or slide away due to improper operation of the outrigger operation. This can cause severe injuries and property damage.

– Keep the machine as horizontal as possible when lowering.

Activate the desired valve (*Chapter 6.16.4 'Valve setting outriggers and height adjustment chassis' on page 115*) by pressing it in firmly (person 1) and at the same time pumping with the hand pump (person 2) until the selected component has reached the desired position.

7. Put the machine into transport position according to the valve setting (*Chapter 6.16.4 'Valve setting outriggers and height adjustment chassis' on page 115*).

8. For emergency operation, unlock the shuttle valve (Fig. 107/1).

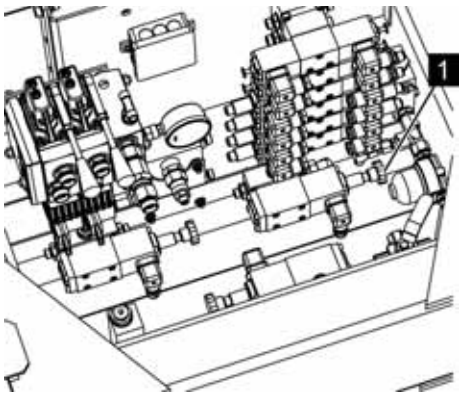


Fig. 107: Valves

WARNING!

Danger of injury due to uncontrolled movements!

In case the valves are set incorrectly in normal operation, there is a danger of uncontrolled movements. This can cause severe injuries.

– Make sure that the shuttle valve (Fig. 107/1) is completely unlocked for normal operation.

6.18 Service operation

Personnel:
- Trained people

Protective equipment:
- Protective clothing
- Safety boots
- Protective helmet

The aerial access platform has service operation which allows operation of the aerial access platform without radio control. This can be necessary, for example in case the radio control fails.

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

6.18.1 Platform operation in service operation

WARNING!
Danger of injury due to inactive safety equipment!
In service operation, all safety equipment (e.g. limit switches) is out of order.

– Execute service operation according to the following instructions.

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the door (Fig. 108/1) on the lift arm holder.

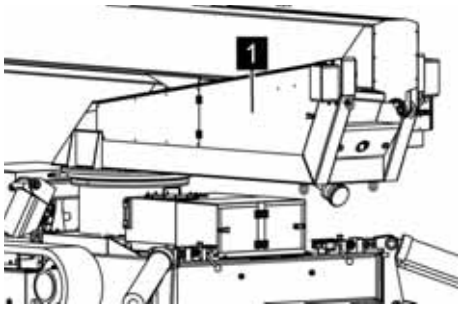


Fig. 108: Door lift arm holder

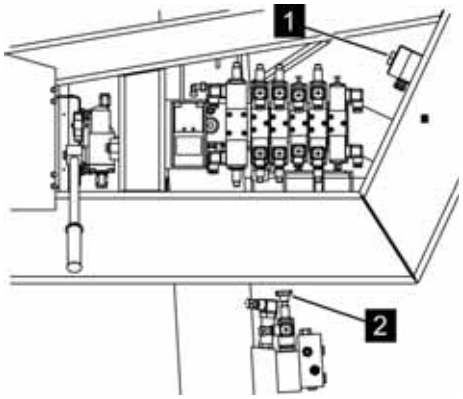


Fig. 109: Proportional valve

3. In order to be able to use the function *[Lower telescopic arm]*, lock the proportional valve (Fig. 109/2).
4. Hold the button (Fig. 109/1) for service operation down during operation.

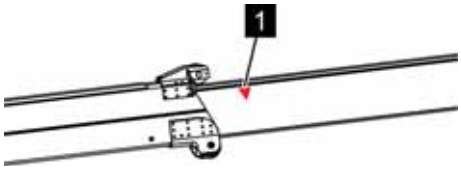


Fig. 110: Red arrows

5. **WARNING!**

Danger of injury due to improper operation!

The machine can tip or slide away due to improper operation of the platform operation. This can cause severe injuries and property damage.

- If there are people or objects in the working basket, keep it as horizontal as possible.
- Always only retract the telescopic arm until the red arrows (Fig. 110/1) on the bearings are no longer visible.
- Swivel the platform into transport position.
- Always swivel back to the same side.
- Before lowering the working basket completely, swivel out or put in transport position.

Several valves can also be activated simultaneously.

Some of these are black-white valves, that is, the speed of the platform movement cannot be regulated. There are only the positions "open" or "closed".

Activate the desired valve (↬ *Chapter 6.16.3 'Valve setting for platform' on page 113*) by pressing it in firmly until the selected component has reached the desired position.

6. Continue to operate the machine according to the valve setting (↬ *Chapter 6.16.3 'Valve setting for platform' on page 113*).

Note about transport position

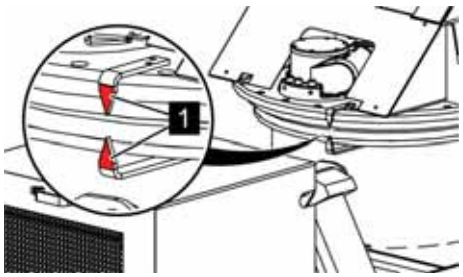


Fig. 111: Transport position

7. The platform is aligned in transport position if the red arrows (Fig. 111/1) on the rotating assembly meet.

8. For service operation, unlock the proportional valve (Fig. 109/1).

WARNING!

Danger of injury due to uncontrolled movements!

In case the valves are set incorrectly in normal operation, there is a danger of uncontrolled movements. This can cause severe injuries.

– Make sure that the proportional valve (Fig. 109/1) is completely unlocked for normal operation.

6.18.2 Outrigger operation with electric motor in service operation

WARNING!

Danger of injury due to inactive safety equipment!

In service operation, all safety equipment (e.g. limit switches) is out of order.

– Execute service operation according to the following instructions.

Operation

2 people are required for outrigger operation.

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the doors (Fig. 112/2 and 3) or completely remove the cover (Fig. 112/1).
3. Open the door (Fig. 112/4).

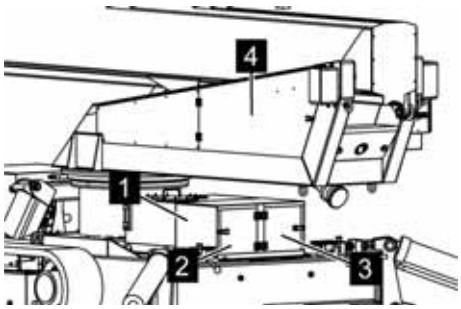


Fig. 112: Shuttle valve cover

4. For outrigger operation, lock the shuttle valve (Fig. 113/1).

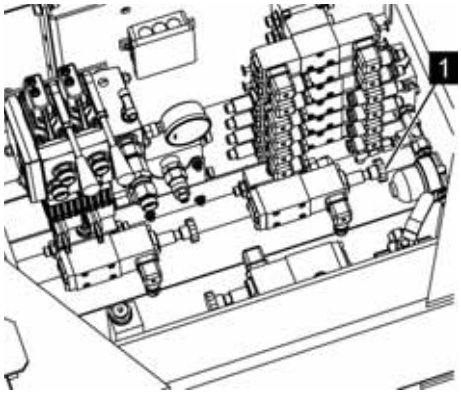


Fig. 113: Shuttle valve

5. Person 1: Hold the button (Fig. 114/1) for service operation down during operation.

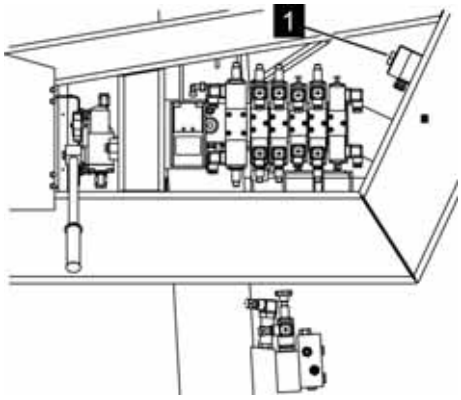


Fig. 114: Service operation button

6. **WARNING!**

Danger of injury due to improper operation!

The machine can tip or slide away due to improper operation of the outrigger operation. This can cause severe injuries and property damage.

– Keep the machine as horizontal as possible when lowering.

Person 2: Activate the desired valve (↬ *Chapter 6.16.4 'Valve setting outriggers and height adjustment chassis' on page 115*) by pressing it in firmly until the selected component has reached the desired position.

Several valves can also be activated simultaneously.

These are black-white valves, that is, the speed of the outrigger movement cannot be regulated. There are only the positions "open" or "closed".

7. Continue to operate the machine according to the valve setting (↬ *Chapter 6.16.4 'Valve setting outriggers and height adjustment chassis' on page 115*).

8. After service operation, unlock the shuttle valve (Fig. 115/1).

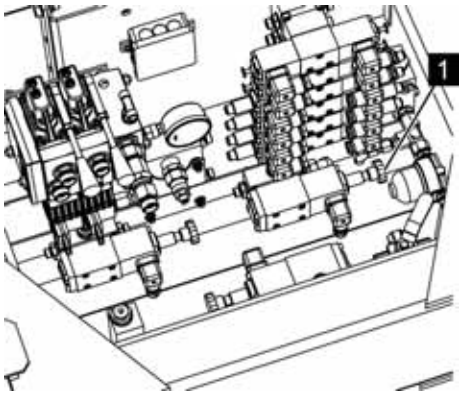


Fig. 115: Shuttle valve

WARNING!

Danger of injury due to uncontrolled movements!

In case the valves are set incorrectly in normal operation, there is a danger of uncontrolled movements. This can cause severe injuries.

– Make sure that the shuttle valve (Fig. 115/1) is completely unlocked for normal operation.

6.18.3 Outrigger operation with diesel engine in service operation

WARNING!

Danger of injury due to inactive safety equipment!

In service operation, all safety equipment (e.g. limit switches) is out of order.

– Execute service operation according to the following instructions.

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the doors (Fig. 116/2 and 3) or completely remove the cover (Fig. 116/1).
3. Open the door (Fig. 116/4).

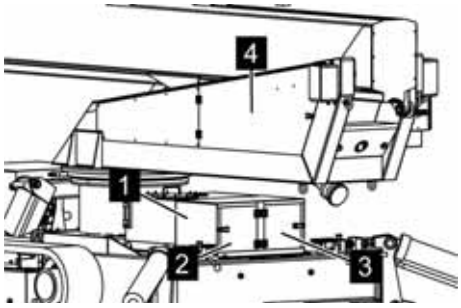


Fig. 116: Shuttle valve cover

4. For outrigger operation, lock the shuttle valves (Fig. 117/1 and 2).

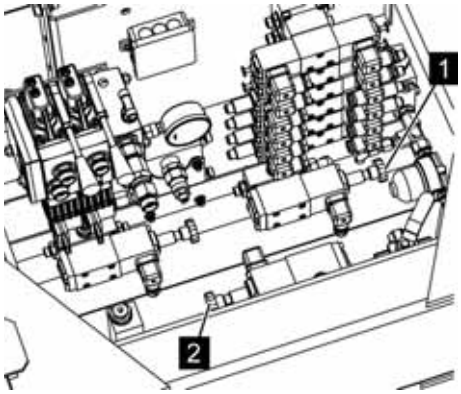


Fig. 117: Shuttle valves

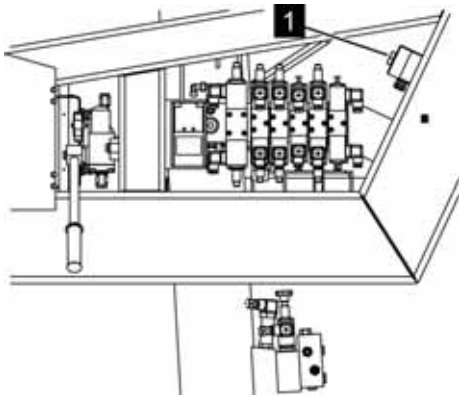


Fig. 118: Service operation button

5. *For operation by 2 people: Instead of locking the shuttle valve (Fig. 118/2), the service button can be pressed by the second person.*

WARNING!

Danger of injury due to improper operation!

The machine can tip or slide away due to improper operation of the outrigger operation. This can cause severe injuries and property damage.

– Keep the machine as horizontal as possible when lowering.

Activate the desired valve (↯ *Chapter 6.16.4 'Valve setting outriggers and height adjustment chassis' on page 115*) by pressing it in firmly until the selected component has reached the desired position.

Several valves can also be activated simultaneously.

These are black-white valves, that is, the speed of the outrigger movement cannot be regulated. There are only the positions "open" or "closed".

6. Continue to operate the machine according to the valve setting (↯ *Chapter 6.16.4 'Valve setting outriggers and height adjustment chassis' on page 115*).

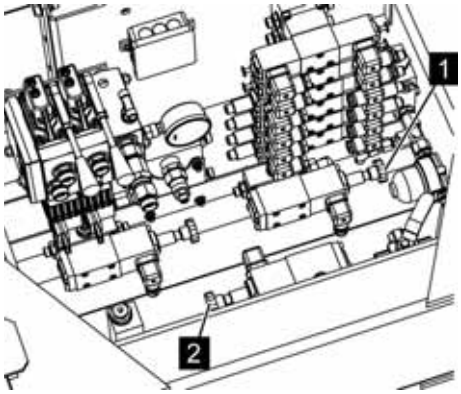


Fig. 119: Shuttle valve

7. After service operation, unlock the shuttle valves (Fig. 119/1 and 2).

WARNING!

Danger of injury due to uncontrolled movements!

In case the valves are set incorrectly in normal operation, there is a danger of uncontrolled movements. This can cause severe injuries.

– Make sure that for normal operation, the shuttle valves (Fig. 119/1 and 2) are completely unlocked.

6.18.4 Outrigger operation with electric motor in service operation

WARNING!

Danger of injury due to inactive safety equipment!

In service operation, all safety equipment (e.g. limit switches) is out of order.

– Execute service operation according to the following instructions.

1. Switch on the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the doors (Fig. 120/2 and 3) or completely remove the cover (Fig. 120/1).
3. Open the door (Fig. 120/4).

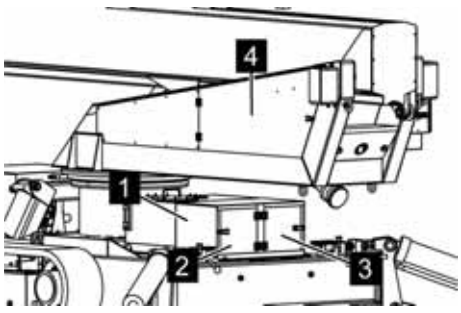


Fig. 120: Shuttle valves door

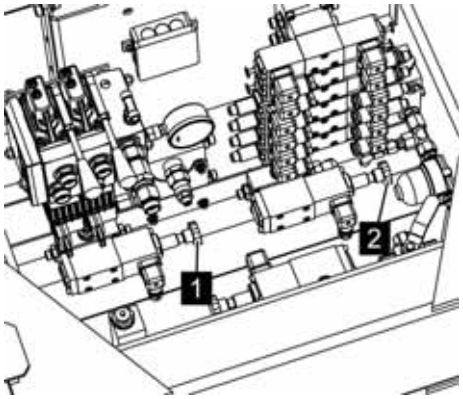


Fig. 121: Shuttle valves

4. For chain operation, lock the shuttle valves (Fig. 121/1 and 2).

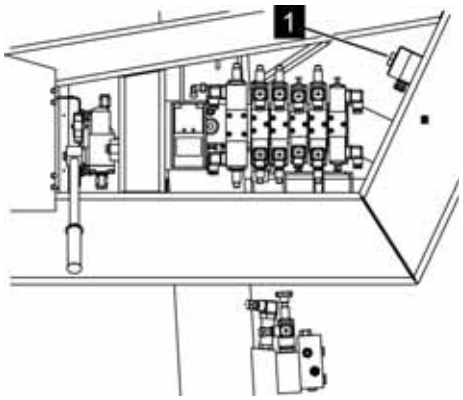


Fig. 122: Service operation button

5. Hold the button (Fig. 122/1) for service operation down during operation.
6. Activate the desired valves (*Chapter 6.16.4 'Valve setting outriggers and height adjustment chassis' on page 115*).
7. After service operation, unlock the shuttle valves (Fig. 121/1 and 2).

WARNING!

Danger of injury due to uncontrolled movements!

In case the valves are set incorrectly in normal operation, there is a danger of uncontrolled movements. This can cause severe injuries.

– Make sure that for normal operation, the shuttle valves (Fig. 121/1 and 2) are completely unlocked.

7 Maintenance

7.1 Safety instructions for maintenance

Secure against restarting

WARNING!

Danger to life due to unauthorised restarting!

Due to unauthorised restarting of the power supply during maintenance work, there is danger of severe injuries or even death for people in the danger zone.

– Before starting work, switch off the power supply and secure against restarting.

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.

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.

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.

7.2 Maintenance plan

The next sections describe the maintenance work that is required for optimal and fault-free operation of the machine.

Insofar as increased wear can be detected during regular checks, the required maintenance intervals must be abbreviated according to the actual signs of wear. In case of questions about maintenance work and intervals, contact the manufacturer. See contact data on page 2.

7.2.1 Maintenance plan combustion engine

To conduct maintenance work, see the manufacturer's operating instructions (↬ Appendix C ‘Kubota diesel engine’ on page 183).

Interval	Maintenance work	Personnel
After the first 50 hours of operation	Motor oil change	Qualified personnel
	Change oil filter insert	Qualified personnel
Every 100 hours of operation	Clean air filter element	Qualified personnel
	Clean fuel filter	Qualified personnel
	Check battery acid level	Qualified personnel
	Check ventilator belt tension	Qualified personnel
Every 200 hours of operation	Check coolant hose and hose clamps to ensure they are seated firmly and do not leak	Trained people
	Change oil filter insert	Qualified personnel
	Check intake air line for leaks and tight fit	Trained people
Every 400 hours of operation	Change fuel filter element	Qualified personnel
Every 500 hours of operation	Remove accumulations from the fuel tank	Qualified personnel
	Clean water jacket (inside cooler)	Trained people
	Change ventilator belt	Qualified personnel
monthly or every other month	Charge battery	Trained people
annually or every 6 cleanings of the air filter element	Change air filter element	Qualified personnel
Every 800 hours of operation	Check valve play	Qualified personnel
Every 1500 hours of operation	Check injection pressure on the fuel injection nozzle	Kubota qualified personnel
Every 3000 hours of operation	Check turbocharger	Kubota qualified personnel
	Check fuel injection pump	Kubota qualified personnel

Maintenance

Interval	Maintenance work	Personnel
	Check fuel injection timer	Kubota qualified personnel
Every 2 years	Change battery	Qualified personnel
	Change coolant hose and hose clamps	Qualified personnel
	Change firing tubes and hose clamps	Kubota qualified personnel
	Change coolant	Qualified personnel
	Change intake air line	Qualified personnel
Every 50 hours of operation	Motor oil change	Qualified personnel
	Check hose clamps and fuel pipe to ensure they are seated firmly and do not leak	Trained people

7.2.2 General maintenance plan

Interval	Maintenance work	Personnel
As necessary	Charge battery (↯ *Appendix C 'Kubota diesel engine' on page 183*)	Trained people
	Tension chain (↯ *Chapter 7.3.2 'Tensioning the chain' on page 142*)	Qualified personnel
	Clean machine (↯ *Chapter 7.3.1 'Clean machine' on page 141*)	Trained people
After the first 50 hours of operation	Tighten fastening screws on the rotating assembly (↯ *Chapter 7.3.10 'Rotating assembly tightening torques' on page 154*)	Qualified personnel
Every 50 hours of operation	Grease grease nipple on the rotating assembly, rotating drive and on the work basket levelling device (↯ *Chapter 7.3.4 'Lubricating the rotating assembly' on page 146* and ↯ *Chapter 7.3.9 'Lubrication plan' on page 153*).	Qualified personnel
	Lubricate the bolts (↯ *Chapter 7.3.9 'Lubrication plan' on page 153*)	Qualified personnel
	Check rollers to make sure they move (↯ *Chapter 7.3.3 'Checking the rollers' on page 145*)	Qualified personnel
	Check the hydraulic oil level (↯ *Chapter 7.3.6 'Checking the hydraulic oil level' on page 148*)	Qualified personnel
Every 150 hours of operation	Lubricate transport guide slide bearing (↯ *Chapter 7.3.5 'Greasing the telescopic arm' on page 146*)	Qualified personnel
	Check hydraulic hoses for damage and leaks	Qualified personnel
	Check energy supply chains for wear and damage	Qualified personnel
Every 800 hours of operation or annually	Tighten fastening screws on the rotating assembly (↯ *Chapter 7.3.10 'Rotating assembly tightening torques' on page 154*)	Qualified personnel
	Replace hydraulic filter (↯ *Chapter 7.3.8 'Replacing the hydraulic filter' on page 151*)	Qualified personnel
	Carry out annual maintenance according to "Checklist - Leo Maintenance -" (see Annex of Machine Record)	Expert
	Check the gearbox oil level (↯ *Chapter 7.3.7 'Checking the gearbox oil level of the crawler chassis' on page 149*)	Qualified personnel

Interval	Maintenance work	Personnel
	Replace hydraulic filter insert (↳ *Chapter 7.3.8 'Replacing the hydraulic filter' on page 151*)	Qualified personnel
Every 2000 hours of operation or every 2 years	Change battery (↳ *Appendix C 'Kubota diesel engine' on page 183*)	Qualified personnel
Every 6 years	Replace all hydraulic hoses	Hydraulics Specialist

7.3 Maintenance work

7.3.1 Clean machine

Personnel:
- Qualified personnel

Protective equipment:
- Protective clothing
- Safety boots
- Safety goggles

NOTICE!

Property damage due to improper cleaning!

Improper cleaning can cause damage to the machine.

– Do not use any acidic or aggressive cleaning agents.
– Remove all cleaning agents thoroughly with clear water.

General cleaning

1. Switch off the machine (↳ *Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Make sure that all covers are mounted properly.
3. Loosen coarse dirt with the high-pressure cleaner. Do not clean the appropriately-marked components (Fig. 123) with the high-pressure cleaner.
4. Clean machine with a sponge, acid-free household cleanser and a water hose.
5. After cleaning the machine, lubricate it according to ↳ *Chapter 7.3.9 'Lubrication plan' on page 153*.

Fig. 123: Cleaning forbidden

Service flap

Especially during tree cutting work, dirt (little pieces of wood) can accumulate inside the telescopic arm. To remove these, proceed as follows.

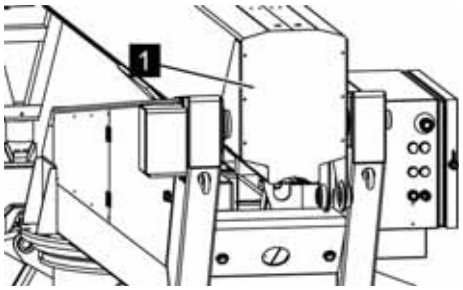


Fig. 124: Service flap

1. Switch off the machine (↯ *Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Unscrew the service flap (Fig. 124/1).

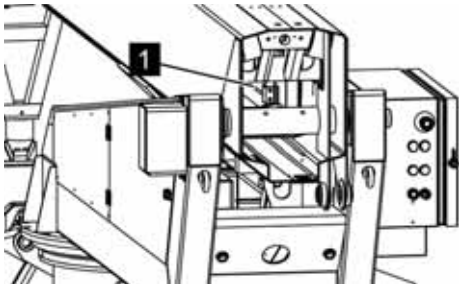


Fig. 125: Clean the inside

3. Remove accumulations from the inside of the telescopic arm (Fig. 125/1) by hand or with compressed air.
4. After cleaning, screw the service flap (Fig. 124/1) back on.

7.3.2 Tensioning the chain

Personnel:	■ Qualified personnel
Protective equipment:	■ Protective clothing ■ Safety boots
Special tool:	■ Grease gun
Materials:	■ Multi-purpose lubricant (Item no. 3917/0095)

1. Put the machine in working position (↯ *Chapter 6.9 'Putting the machine in working position' on page 92*). The machine must be braced completely and the chains may no longer touch the floor.

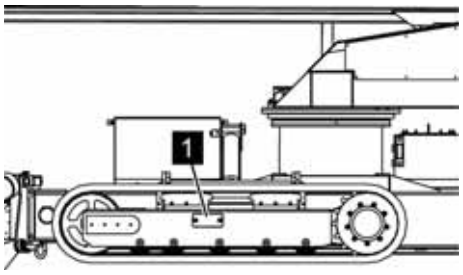


Fig. 126: Unscrewing the lid

2. Unscrew the lid (Fig. 126/1).

Maintenance

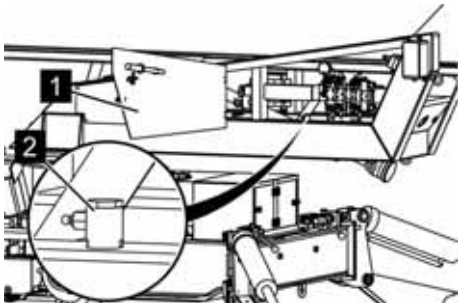


Fig. 127: Slide coupling

3. Remove the door (Fig. 127/1) and remove the slide coupling (Fig. 127/2).

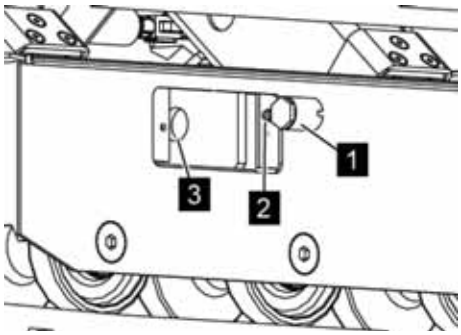


Fig. 128: Put back the slide coupling

4. Push the slide coupling (Fig. 128/1) with the grease nipple (Fig. 128/2) in front onto the grease tension cylinder (Fig. 128/3).

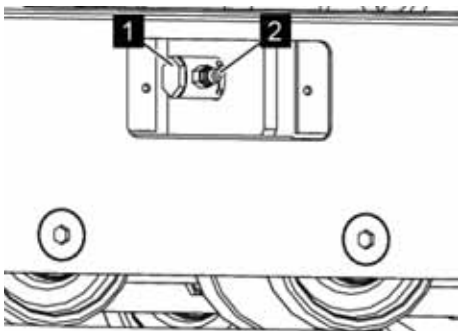


Fig. 129: Turning the slide coupling

5. Turn the slide coupling (Fig. 129/1) by 180° clockwise until the grease nipple (Fig. 129/2) points outward.
6. With a grease gun on the grease nipple (Fig. 129/2), insert sufficient multi-purpose lubricant (Item no. 3917/0095) that the chain has slack (Fig. 130/X) of 10–15 mm.

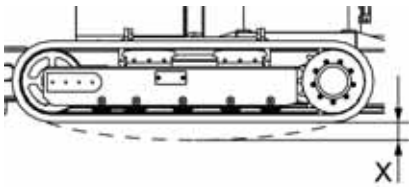


Fig. 130: Slack X

7. Make sure that no lubricant escapes on the grease nipple (Fig. 129/2).

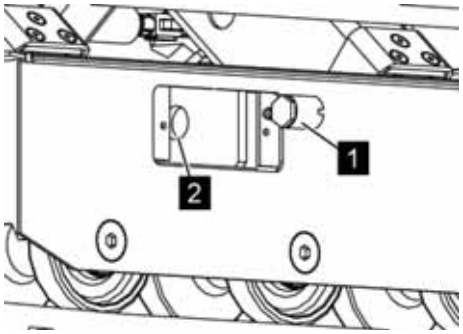


Fig. 131: Pulling out the slide coupling

8. Turn the slide coupling (Fig. 131/1) back by 180° anti-clockwise and pull it out of the grease tension cylinder (Fig. 131/2).

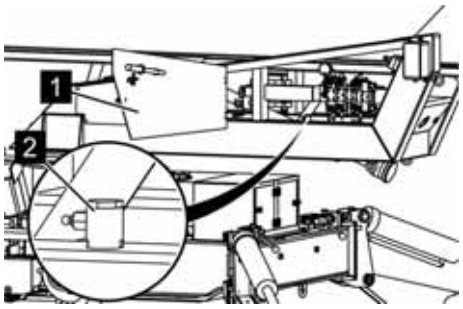


Fig. 132: Slide coupling

9. Put the slide coupling (Fig. 132/2) back onto the attachment and close the door (Fig. 132/1).

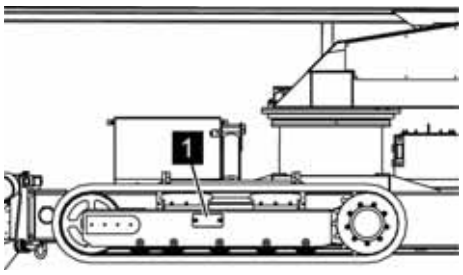


Fig. 133: Lid and cover

10. Put the lid (Fig. 133/1) back on.

7.3.3 Checking the rollers

Personnel:
- Qualified personnel

Protective equipment:
- Protective clothing
- Safety boots

1. Put the machine in working position (*Chapter 6.9 'Putting the machine in working position' on page 92*). The machine must be braced completely and the chains may no longer touch the floor.

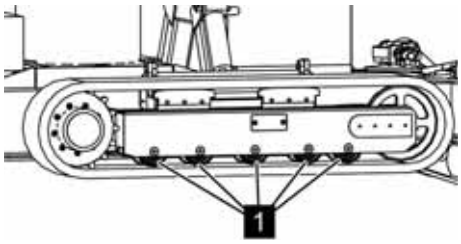


Fig. 134: Lid and cover

2. The rollers (Fig. 134/1) must turn by hand.

CAUTION!
Do not grease the rollers!

If the rollers do not turn by hand, they must be changed. If necessary, contact the manufacturer. Please see page 2 for the contact data.

7.3.4 Lubricating the rotating assembly

Personnel:	■ Qualified personnel
Protective equipment:	■ Protective clothing ■ Safety boots
Special tool:	■ Grease gun
Materials:	■ High-performance lubricant (Item no. 3917/0130)

1. Put the machine in working position (↬ *Chapter 6.9 'Putting the machine in working position' on page 92*).

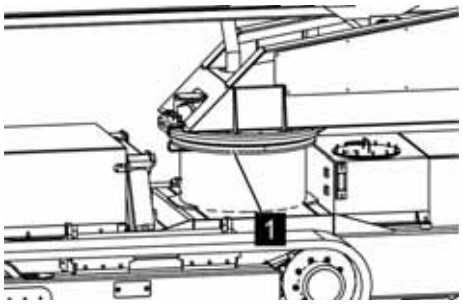


Fig. 135: Lubricating the rotating assembly

2. Use the grease gun on the grease nipples (Fig. 135/1) of the rotating assembly to insert high-performance lubricant (Item no. 3917/0130).
3. Remove the excess lubricant and dispose of it properly.

7.3.5 Greasing the telescopic arm

Personnel:	■ Qualified personnel
Protective equipment:	■ Protective clothing ■ Safety boots
Materials:	■ White paste spray (Art No 3917 / 0037) ■ Thinner EPI Biosol special (art no 3910 / 0168)

1. Put the machine in wide working position (↬ *Chapter 6.9 'Putting the machine in working position' on page 92*).

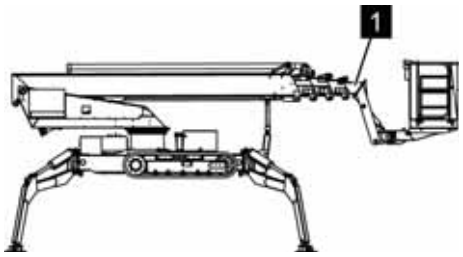


Fig. 136: Securing the boom

2. Extend the telescopic arm so far that the front boom (Fig. 136/1) can be secured with a belt slip or a trolley.
3. Secure the front boom with a belt slip or a trolley.

Fig. 137: Extend the telescopic arm

WARNING!

Danger of injury due to deactivated safety equipment!

The further operation of the platform can only take place in service operation (↯ *Chapter 6.18 'Service operation' on page 125*). In service operation, all safety equipment does not function.

– Follow the operating sequence below and follow the instructions precisely.

4. Change to service operation (↯ *Chapter 6.18 'Service operation' on page 125*).
5. Extend the telescopic arm (Fig. 137/1) completely (↯ *Chapter 6.18 'Service operation' on page 125*).
6. Clean the sliding surfaces of the booms on all side with thinned EPI Biosol spezial (Item no. 3910/0168) and then grease on all sides with white paste spray (Item no. 3917/0037).
7. Extend the telescopic arm (Fig. 137/1) completely (↯ *Chapter 6.18 'Service operation' on page 125*).
8. Remove the belt slip or rolling cart.
9. Leave service operation (↯ *Chapter 6.18 'Service operation' on page 125*).

The following step can be carried out in normal mode.

10. Operate the machine (↯ *Chapter 6.10 'Operating the machine' on page 95*) or if necessary, put it in transport position (↯ *Chapter 6.11 'Putting the machine in transport position' on page 97*).

7.3.6 Checking the hydraulic oil level

Personnel:	■ Qualified personnel
Protective equipment:	■ Protective clothing ■ Safety boots
Materials:	■ Hydraulic oil (Item no. 3917/0066)

NOTICE!

Property damage due to improper filling!

An incorrect oil level or incorrect hydraulic oil can cause failure of and damage to the hydraulic system.

- Check the oil level regularly.
- Only use prescribed oils (↯ *Chapter 3 'Technical data' on page 43*).
- Do not mix types of oil.

1. Put the aerial access platform in transport position (↯ *Chapter 6.11 'Putting the machine in transport position' on page 97*).
2. Retract the crawler chassis completely (↯ *Chapter 6.12 'Height and width adjustment crawler chassis' on page 101*).
3. Make sure that the aerial access platform is aligned horizontally.
4. Switch off the machine (↯ *Chapter 6.2 'Switching the machine on/off' on page 74*).
5. Check the oil level on the inspection glass (Fig. 138/1).

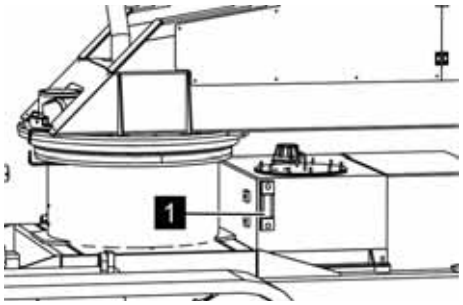


Fig. 138: Hydraulic oil inspection glass

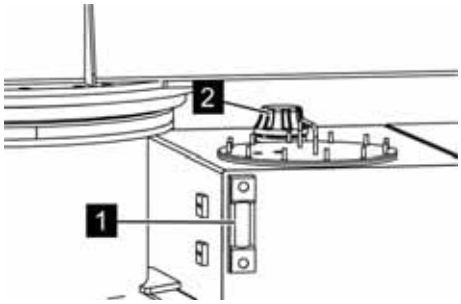


Fig. 139: Unscrewing the lid

6. If necessary, top up hydraulic oil (Item no. 3917/0066)(*Chapter 3 'Technical data' on page 43*). Open the padlock of the lid (Fig. 139/1) with the corresponding spanner and remove it (*Chapter 4.6.1 'Keys' on page 66*).
7. Unscrew the lid (Fig. 139/2) from the hydraulic oil tank.
8. Fill up the hydraulic oil up to the maximum marking on the inspection glass (Fig. 139/1).
9. Screw the lid (Fig. 139/2) back on and secure with the padlock.

7.3.7 Checking the gearbox oil level of the crawler chassis

Personnel:	■ Qualified personnel
Protective equipment:	■ Protective clothing ■ Safety boots
Materials:	■ Gearbox oil (Item no. 3917/0130)

NOTICE!

Property damage due to improper filling!

An incorrect oil level or incorrect gearbox oil can cause failure of and damage to the gearbox.

– Check the oil level regularly.
– Only use prescribed oils (*Chapter 3 'Technical data' on page 43*).

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

1. Put the machine in transport position (*Chapter 6.11 'Putting the machine in transport position' on page 97*).
2. Align the machine so that the lower edge of the screw connection (Fig. 140/1) is on the middle axis (Fig. 140/2) of the gearbox unit (Fig. 140/3).
3. Make sure that the machine is aligned horizontally.
4. Switch off the machine (*Chapter 6.2 'Switching the machine on/off' on page 74*).

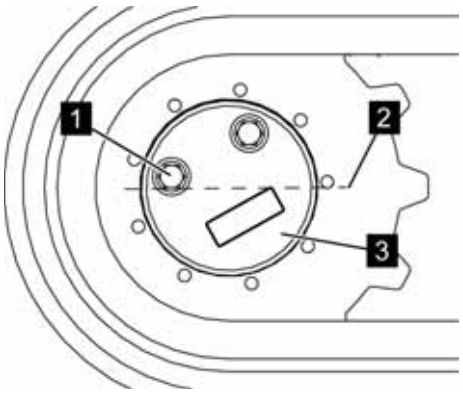


Fig. 140: Aligning the aerial access platform

5. Unscrew the screw connections (Fig. 141/1 and 2).

> *If necessary, catch escaping gearbox oil and dispose of it properly.*

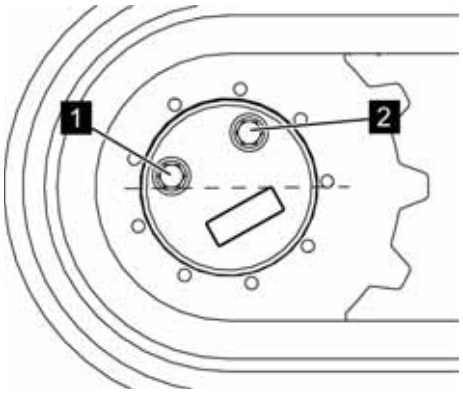


Fig. 141: Unscrewing the screw connections

6. Check the oil level visually. The gearbox must be filled with oil up to the lower edge of the threaded hole (Fig. 142/1).
7. If necessary, top up gearbox oil (Item no. 3917/0122)(*Chapter 3 'Technical data' on page 43*). To do this, tip oil slowly through the hole (Fig. 142/2) until it reaches the lower edge of the threaded hole (Fig. 142/1).
8. Make sure that the seals and copper washers of the screw connections are present and undamaged.

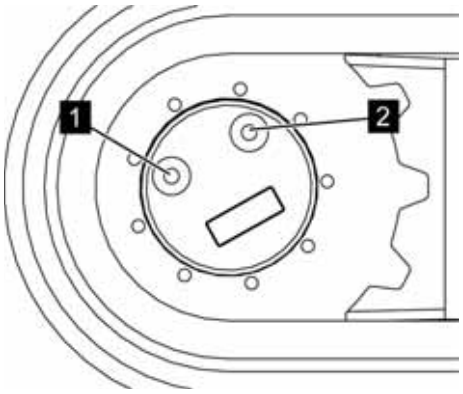


Fig. 142: Checking the oil level

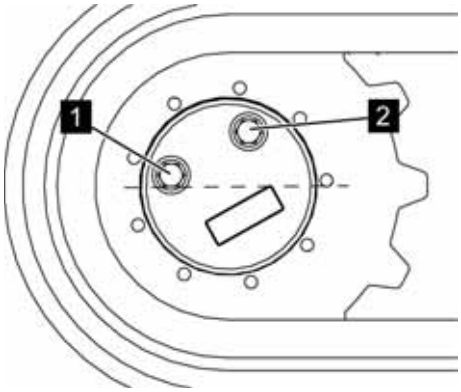


Fig. 143: Tightening the screw connections

9. Re-tighten the screw connections (Fig. 143/1 and 2) with the seals or copper washers.

7.3.8 Replacing the hydraulic filter

Personnel:	■ Qualified personnel
Protective equipment:	■ Protective clothing ■ Safety boots
Materials:	■ Filter insert (Item no. 3162/0019)

1. Put the aerial access platform in transport position (↬ *Chapter 6.11 'Putting the machine in transport position' on page 97*).
2. Switch off the the machine, if necessary pull the mains plug (↬ *Chapter 6.2 'Switching the machine on/off' on page 74*).
3. Unscrew the bottom plate (Fig. 144/1).

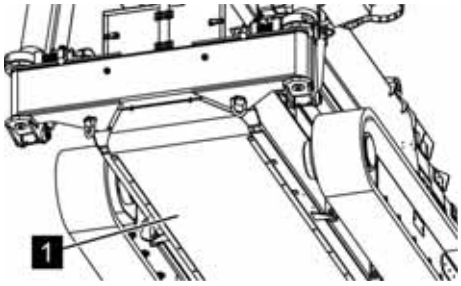


Fig. 144: Loosening the bottom plate

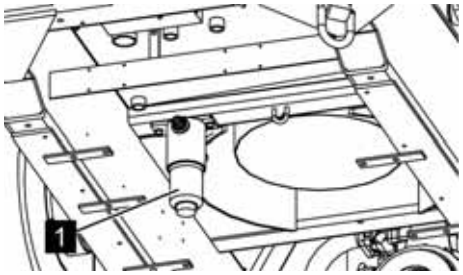


Fig. 145: Unscrewing the filter bowl

4. Place a suitable container for hydraulic oil under the hydraulic filter.
5. Carefully unscrew the filter bowl (Fig. 145/1).
6. Catch escaping hydraulic oil and dispose of it properly.

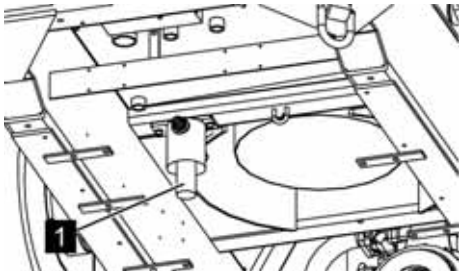


Fig. 146: Filter insert

7. Remove the filter insert (Fig. 146/1) and insert a new filter insert.

> *The filter insert (Item no. 3162/0019) can be ordered from the manufacturer. Please see page 2 for the contact data.*

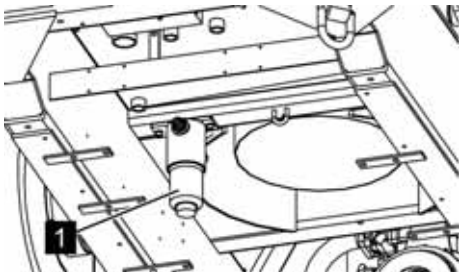


Fig. 147: Hydraulic filters

8. Screw the filter bowl (Fig. 147/1) back in.

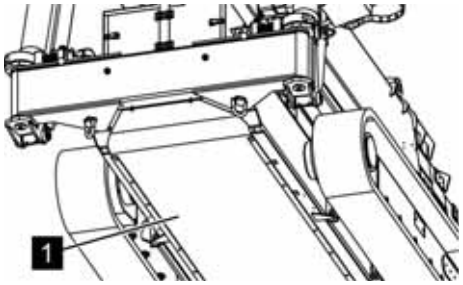


Fig. 148: Fastening the bottom plate

9. Screw the bottom plate (Fig. 148/1) tight.
10. Check the hydraulic oil level (↬ *Chapter 7.3.6 'Checking the hydraulic oil level' on page 148*).

7.3.9 Lubrication plan

When handling lubricants, always heed the manufacturer's safety data sheet. With specification of the item number, the lubricants can be ordered from the manufacturer. Please see page 2 for the contact data.

The interval details relate to normal soiling. In case of heavier soiling, it may be necessary to adapt the intervals.

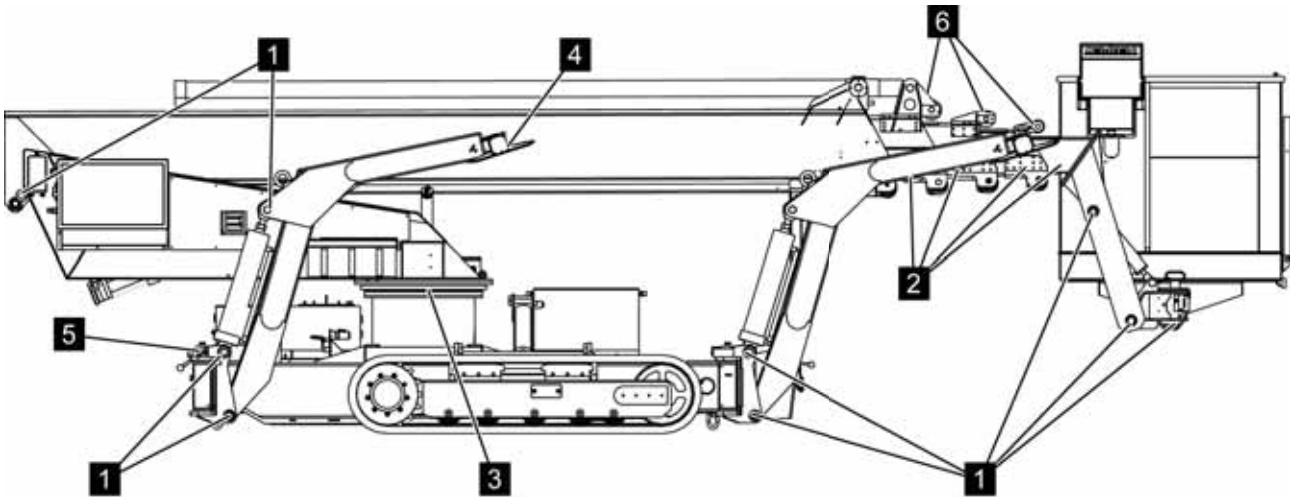


Fig. 149: Lubrication plan

No.	Designation	Lubricant	TEUPEN item number	Interval
1	Bolts	Lubricant spray	3917/0005	every 50 hours of operation
2	Transport guides slide bearing	White paste spray	3917/0037	every 150 hours of operation
3	Rotating drive (3 grease nipples)	Grease	3917/0095	every 50 hours of operation
4	Bracing pads (ball pins) 4x	Grease	3917/0095	every 50 hours of operation
5	locking bolts	White paste spray	3917/0037	every 50 hours of operation
6	Telescopic arm chains	KL 300 chain lubricant	3917/0036	every 50 hours of operation

Bh = hours of operation

7.3.10 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
M 12	10.9	110 Nm
M16	10.9	270 Nm

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 repair

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.

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.

Behaviour in the event of faults

The following applies in principle:

1. Immediately initiate an emergency stop in the event of faults posing an immediate danger to people or property.
2. Ascertain the cause of the fault.
3. If fault rectification requires work in the danger zone, shut down the machine and secure to prevent restarting.

   Immediately notify those responsible at the place of use about the fault.
4. Depending on the nature of the fault, have it rectified by authorised specialised personnel or rectify it yourself.

The fault table below provides information about who is authorised to rectify the fault.

8.2 Fault table

In addition to the following table, follow the operating instructions for the combustion engine (↬ Appendix C 'Kubota diesel engine' on page 183).

If the fault is not included in the table below or if it cannot be repaired with the measures described, make contact with the manufacturer (see page 2 for the contact data).

Fault description	Cause	Remedy	Personnel
No function of the combustion engine	Fuel tank empty	Fill fuel tank	Trained people
	Starter battery discharged	Charge starter battery (↳ *Appendix C 'Kubota diesel engine' on page 183*).	Trained people
	Emergency Stop button activated	Unlock Emergency Stop button (↳ *'Emergency Stop button' on page 30*)	Trained people
No function for power supply via construction-side feed	Safety equipment has been triggered (fuse, FI circuit breaker)	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
	Extension cable faulty	Replace extension cable	Trained people
	Incorrect cable cross-section or incorrect cable length	Adhere to permissible cable length and cable cross-section (↳ *Chapter 3 'Technical data' on page 43*)	Trained people
	Emergency Stop button activated	Unlock Emergency Stop button (↳ *'Emergency Stop button' on page 30*)	Trained people
Chain does not move	Switch position on the control panel incorrect	Move toggle switch to "*[Chain function]* (↳ *Chapter 6.7 'Moving the machine' on page 85*).	Trained people
	Safety equipment has been triggered (fuse, FI circuit breaker)	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
Bracing not possible	Switch position on the control panel incorrect	Move toggle switch to *[Outrigger function]* (↳ *Chapter 6.9 'Putting the machine in working position' on page 92*).	Trained people

Faults

Fault description	Cause	Remedy	Personnel
	Machine not in transport position	Put the machine in transport position (↳ *Chapter 6.11 'Putting the machine in transport position' on page 97*)	Trained people
	Safety equipment has been triggered (fuse, FI circuit breaker)	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
No platform function possible	Emergency Stop button activated	Unlock Emergency Stop button (↳ *'Emergency Stop button' on page 30*)	Trained people
	Bracing not correct	Brace machine correctly (↳ *Chapter 6.9 'Putting the machine in working position' on page 92*).	Trained people
	Switch position on the control panel incorrect	Move toggle switch to *[Platform function]* (↳ *Chapter 6.10 'Operating the machine' on page 95*).	Trained people
	No or insufficient voltage supply	Check voltage supply	Qualified Electrician
	Safety equipment has been triggered (fuse, FI circuit breaker)	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
Extension of upper boom not possible	Safety equipment has been triggered (fuse, FI circuit breaker)	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
Swivelling not possible	Upper and lower boom still in the transport attachment	Lift lower boom out of the transport attachment (↳ *Chapter 6.10 'Operating the machine' on page 95*)	Trained people

Fault description	Cause	Remedy	Per-sonnel
	Safety equipment has been triggered (fuse, FI circuit breaker)	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
Green light on the control panel is blinking	Bracing not correct	Check bracing (↳ *Chapter 6.9 'Putting the machine in working position' on page 92*)	Trained people
Red light on the control panel is always lit	Operating lever moved during the start process	Activate Emergency Stop and re-start control (unlock Emergency Stop button)	Trained people
	System error	Call service	Trained people
Red light on the control panel is blinking	Basket level is tilted more than ± 5°	Align basket using valve control (emergency operation)(↳ *Chapter 6.17 'Emergency operation' on page 118*)	Trained people
Red and green lamps never light up	Safety equipment has been triggered (fuse, FI circuit breaker)	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
Motor pump runs and stalls	Hydraulic hose kinked	Check the hydraulic hoses	Qualified personnel
	Hydraulic filter soiled	Replace filter insert (↳ *Chapter 7.3.8 'Replacing the hydraulic filter' on page 151*)	Qualified personnel
Cylinder lowers by itself	Hydraulic system defective	Take machine out of service immediately and call service	Trained people
Loud motor pump noise and move-ments get slower and then stop	Too little hydraulic oil in the tank	Check hydraulic oil level and top up if necessary (↳ *Chapter 7.3.6 'Checking the hydraulic oil level' on page 148*)	Trained people
	Hydraulic system is leaking	Call service	Trained people
Outlet in the working basket has no voltage	Power supply inter-rupted	Check power supply	Qualified Electrician

Faults

Fault description	Cause	Remedy	Per-sonnel
	Plug not in the outlet	Plug in plug (↳ *Chapter 6.2 'Switching the machine on/off' on page 74*)	Trained people
	Safety equipment has triggered	Check safety equipment and switch on or replace if necessary (↳ *Chapter 8.5.1 'Changing fuses' on page 166* or ↳ *Chapter 8.5.2 'Switching the circuit breaker on/ off' on page 167*)	Trained people
Great wear on the crawler track	Drive ring severely worn	Call service	Trained people
Steel wires of the rubber tracks broken	Excessive tension on the chain bands due to stones caught, abrupt swerving on rough floor, defective spring set, frozen material between the rollers	Call service	Trained people

8.3 Error code list

The error codes are shown on the display of the bottom control.

Table of possible error messages

Code	Text on the display	Cause/remedy
33	error: angle sensor	Angle sensor of the respective control could not be read correctly.
35	error angle adjust	Stored value in EEPROM is incorrect.
36	error CAN: bus off	Check CAN bus.
37	error CAN: communication	Check CAN bus.
38	error CAN: stuff	Check CAN bus.
39	error CAN: format	Check CAN bus.
40	error CAN: no acknowledge	Check CAN bus.
41	error CAN: recessive level	Check CAN bus.

Code	Text on the display	Cause/remedy
42	error CAN: dominant level	Check CAN bus.
43	error CAN: transmit	Check CAN bus.
45+48	error number:	error only specified by error code: usually system error.
57	EEPROM not write-protected!	Jumper WC may not be set.
76	hardware error CRC check	Hardware error.
77	hardware error RAM check	Hardware error.
78	timeout error	Check CAN bus.
81	timeout error communication	Check CAN bus.
82	error: EEPROM angle offset	Hardware error occurred in EEPROM.
83	error: pressure sensor 1	Check pressure sensor for reliable values.
84	error: pressure sensor 2	Check pressure sensor for reliable values.
85	pressure sensor not equal	Check pressure sensors.
86	angle 1 not possible	Currently measured angle not in the allowed range. The shaft may be misplaced.
87	angle 2 not possible	Currently measured angle not in the allowed range. The axis may be misplaced.
88	angle sensors not equal	Check position of the angle sensors. Possibly reset to zero or set.
90	error: load table	Error in the load curve. Software error.
91	error: voltage	Supply voltage has dropped below 13 V.
92	error: stack overflow	Software error.
93	error: stack underflow	Software error.
94	code error	Hardware error.
95	error: protect instruction	System error
96	error: illegal operand	Software error/hardware error.
97	error: illegal instruction	Hardware error.
98	error: illegal bus access	Hardware error.
99	error: trap class B	Software error/hardware error.
100	error: timer 0 interrupt	Software error.
101	error: K7.0 U1 ON	Check safety relay monitoring contact
102	error: K7.0 U1 OFF	Check safety relay monitoring contact

Faults

Code	Text on the display	Cause/remedy
103	error: K7.0 U2 ON	Check safety relay monitoring contact
104	error: K7.0 U2 OFF	Check safety relay monitoring contact
105	error: locking of outriggers unequal	Difference between input U1 and input U2 for the outrigger locking (only sb14).
106	error: monitoring contact S.relay	In the switch-on moment, no voltage was measured on the monitoring contacts of the safety relay.
107	error: release contact	In the switch-on moment, there is a dead man signal present.
108	error: joystick left	In the switch-on moment, a joystick was moved.
109	error: joystick right	In the switch-on moment, a joystick was moved.
120	error: angle not zero	With a fitted telescopic arm, the measured angle may not exceed a particular value. It is possible that the on/off switch gets jammed in the mounting.
123	error: pressure <-> angle	The telescopic arm is not fitted. The pressure measured for this situation is too low.
124	error: cycle time too slow	The cycle time is too slow.
127	error: not critical input	In the switch-on moment, the supply voltage for uncritical movements was measured.
128	compare error U1:E10-U2:E10	Check inputs E10. Inputs must always be the same. Also check on the display.
129	compare error pressure U1 U2	Check pressure sensors.
130	compare error dead man	Check dead man inputs.
131	different load tables	The load curves in U1 and U2 are not the same. Incorrect programs were selected.
135	error: load table	The load curve was programmed incorrectly.
150	Pressure error with lifted arm	The pressure may not drop below a particular value if the telescopic arm is lifted.
176	fault on relay: function lower	The contacts of the safety relay are not read back correctly. For example, due to a defective NC contact, pulled plug, defective digital input.
192	fault on height limiter!	Fault on height limiter, e.g. for the Leo 23. The limit switches must be activated in a specified sequence one after another when moving out the telescopic arm.

Code	Text on the display	Cause/remedy
211	error: angle <-> support	With one-sided wide bracing, the angle e.g. for Leo 23 may not exceed a particular value.
212	error: tolerance of cage level > 10°	Emergency limit switch of the automatic basket levelling activated (stop of all platform functions).
219	angle xy not possible	Xy sensor value outside of the tolerance.
221	error swivel safety relay	The contacts of the safety relay are not read back correctly. For example, due to a defective NC contact, pulled plug, defective digital input.
223	error lower telescope	Error safety relay lower boom.

8.4 Notes about the crawler track

Damage

During operation, the crawler 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	■ 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	■ Hard use in the field. ■ Crossing sharp-edged or high hurdles.	No compromise of operation.
Cracks on the inside by the metal core	■ Various causes.	No compromise of operation.

Faults

Damage	Possible cause	Note
Wear of the metal core	■ 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	■ 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

- Daily visual check
- 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 crawler chassis 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.

8.5 Work for fault repair

8.5.1 Changing fuses

Personnel:
- Qualified personnel

Protective equipment:
- Protective clothing
- Safety boots

DANGER!

Danger to life due to electric power!

In case of contact with live components, there is danger to life. Switched-on electric components can make uncontrolled movements and cause extremely severe injuries.

– Before starting work, switch off the power supply and secure against switching on again.
– When changing fuses, adhere to the correct amperage.

1. Switch off the the machine, if necessary pull the mains plug (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open the door (Fig. 150/1) of the bottom control with the included double bit key (*Chapter 4.6.1 'Keys' on page 66*).

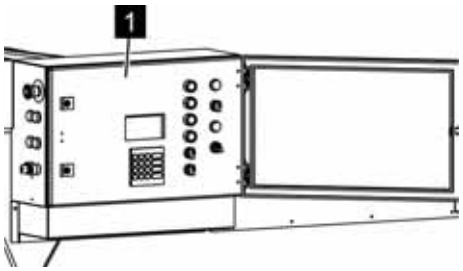


Fig. 150: Opening the door

3. The fuses are on the fuzzy control card (Fig. 151/1 and 2). Replace defective fuse with a new fuse of equal amperage (*Chapter 8.6 'Fuses' on page 168*).

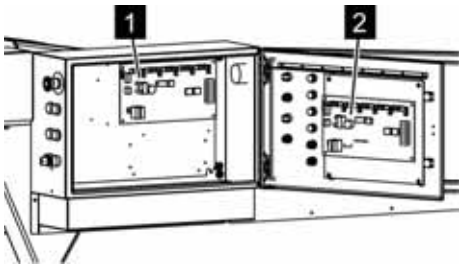


Fig. 151: Fuzzy control card

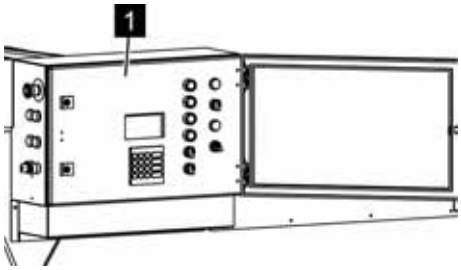


Fig. 152: Closing the door

4. Close the door (Fig. 152/1) of the bottom control and lock it with the included double bit key.

8.5.2 Switching the circuit breaker on/off

Personnel:
- Qualified personnel

Protective equipment:
- Protective clothing
- Safety boots

DANGER!

Danger to life due to electric power!

In case of contact with live components, there is danger to life. Switched-on electric components can make uncontrolled movements and cause extremely severe injuries.

– Before starting work, switch off the power supply and secure against switching on again.
– When changing fuses, adhere to the correct amperage.

1. Switch off the the machine, if necessary pull the mains plug (*Chapter 6.2 'Switching the machine on/off' on page 74*).
2. Open cover of the FI box (Fig. 153/1).
3. Switch the FI circuit breaker or fuse for outlet on the working basket (*Chapter 8.6 'Fuses' on page 168*) on or off.
4. Close cover of the FI box (Fig. 153/1).

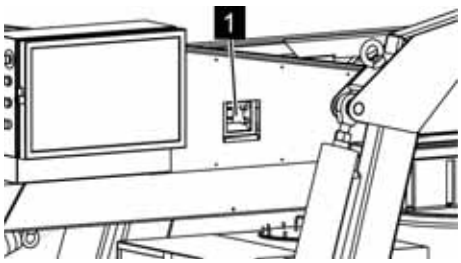


Fig. 153: Circuit breaker

8.6 Fuses

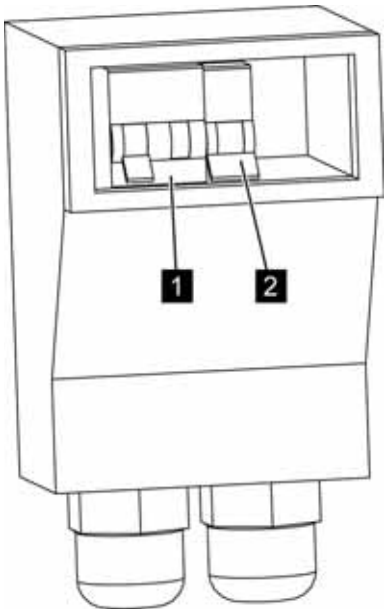
8.6.1 Fuzzy control card

For the precise assignment, consult the circuit diagram (↳ Appendix A 'Circuit diagram' on page 179).

Fig. 154: Fuzzy control card

No.	Position	Type
1	-	Glass fuse M 1.25 A
2	A2.8	Glass fuse FF 4 A
	A2.9	
	A2.10	
	A2.11	
3	A2.4	Glass fuse FF 4 A
	A2.5	
	A2.6	
	A2.7	
4	A2.0	Glass fuse FF 4 A
	A2.1	
	A2.2	
	A2.3	
5	A8.4	Glass fuse FF 4 A
	A8.5	
	A8.6	
	A8.7	
6	A8.0	Glass fuse FF 4 A
	A8.1	
	A8.2	
	A8.3	

8.6.2 Working basket fuse and FI circuit breaker



1 FI circuit breaker
2 Fuse for outlet on working basket

Fig. 155: Example fuses

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.

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.

Disposal

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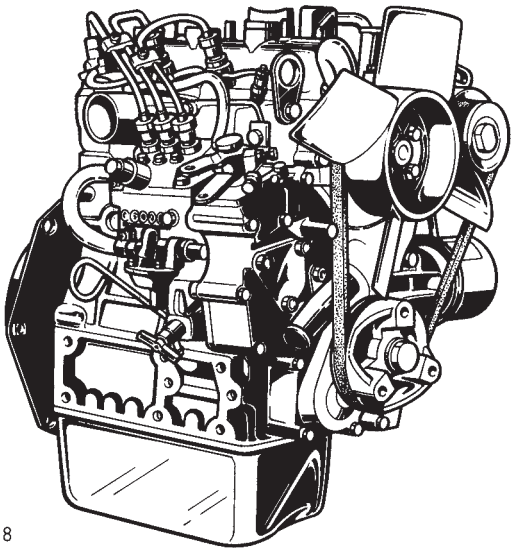
Kubota diesel engine

ENGLISH

OPERATOR'S MANUAL

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.

ENGLISH

CONTENTS

ENGLISH

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.

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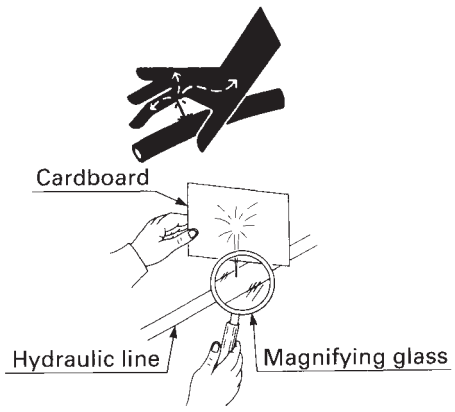
6. EXHAUST GASES & FIRE PREVENTION

- 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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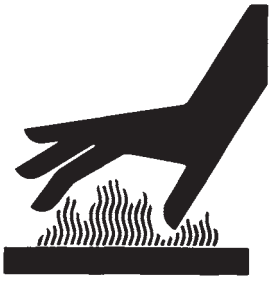
8. CAUTIONS AGAINST BURNS & BATTERY EXPLOSION

- 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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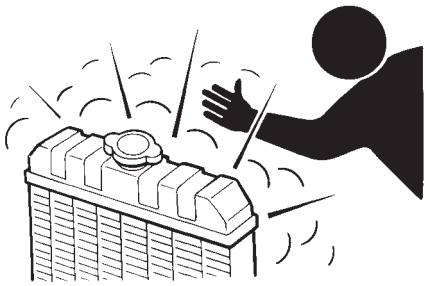

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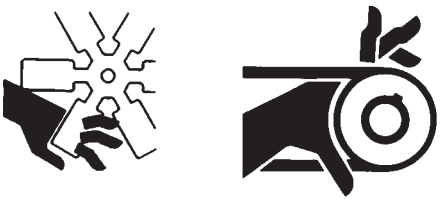
9. KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

- 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.



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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.

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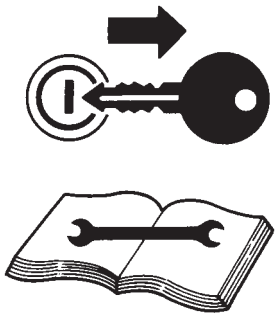
1BJABAAAP0180

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.



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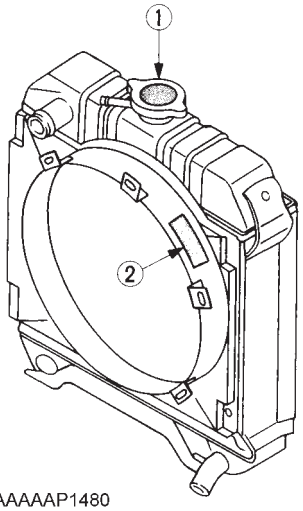
12. WARNING AND CAUTION LABELS



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

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② Part No.TA040-4957-1
Stay clear of engine
fan and fan belt


1ABAAAAAP1500

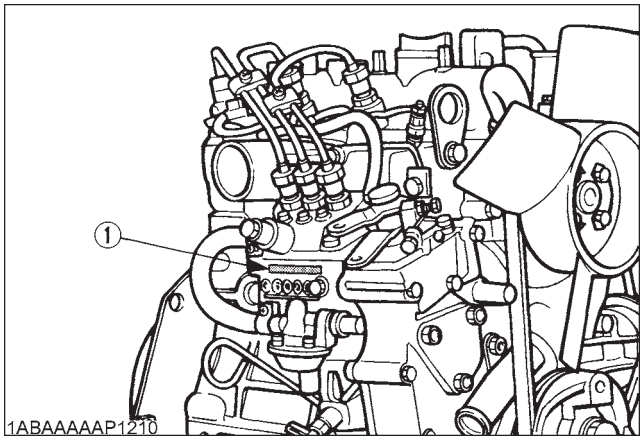
13. CARE OF WARNING AND CAUTION LABELS

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.

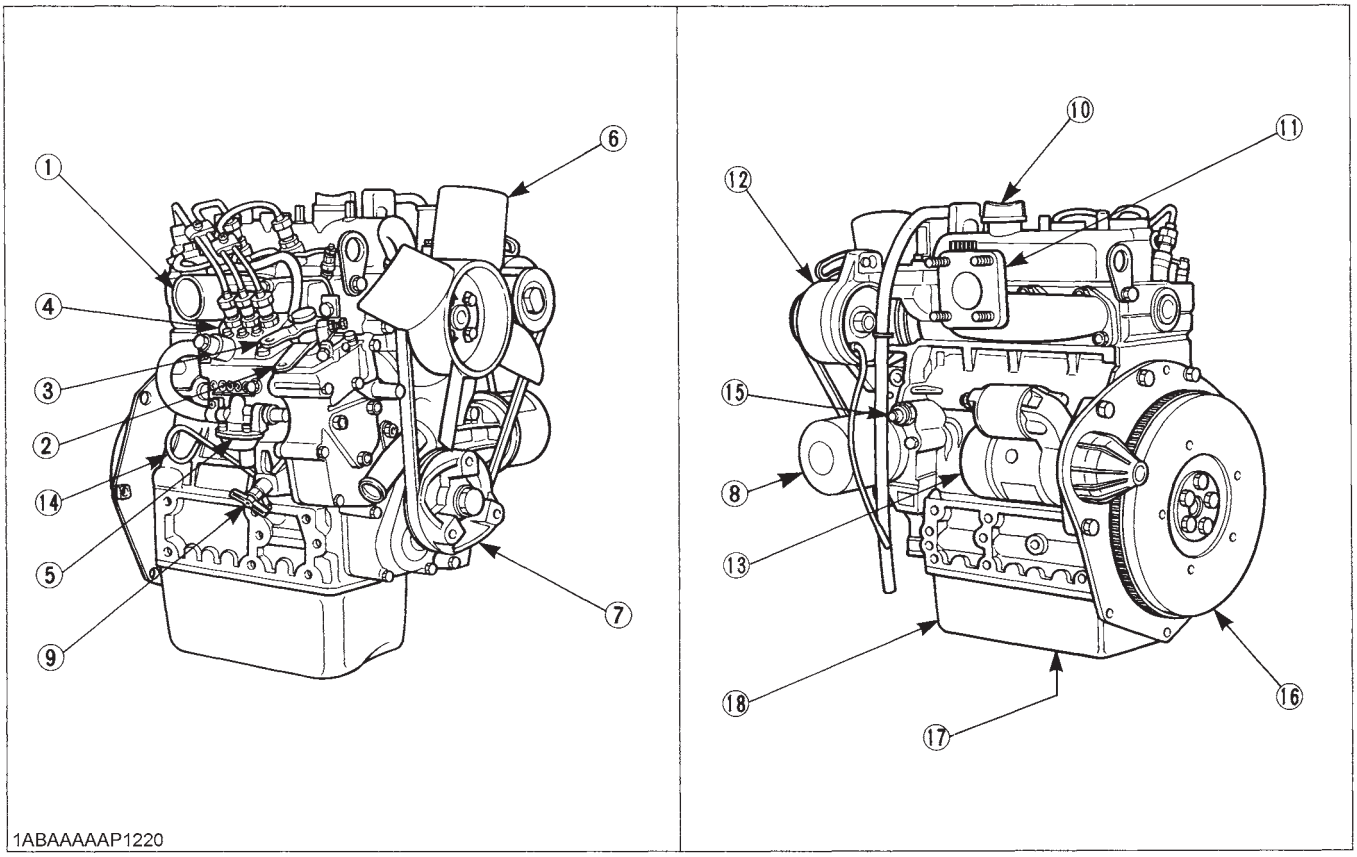
	Type	Serial No.
Engine		
Date of Purchase		
Name of Dealer		
(To be filled in by purchaser)		



(1) Engine serial number

ENGLISH

NAMES OF PARTS



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(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

ENGLISH

OPERATING THE ENGINE

STARTING THE ENGINE(NORMAL)

CAUTION

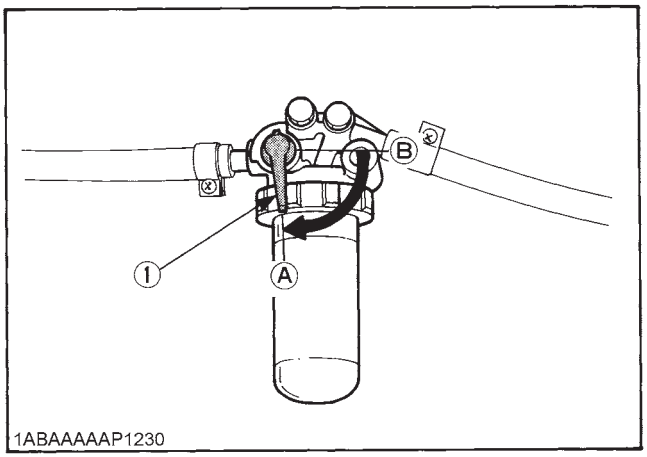
To avoid personal injury:

- **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.

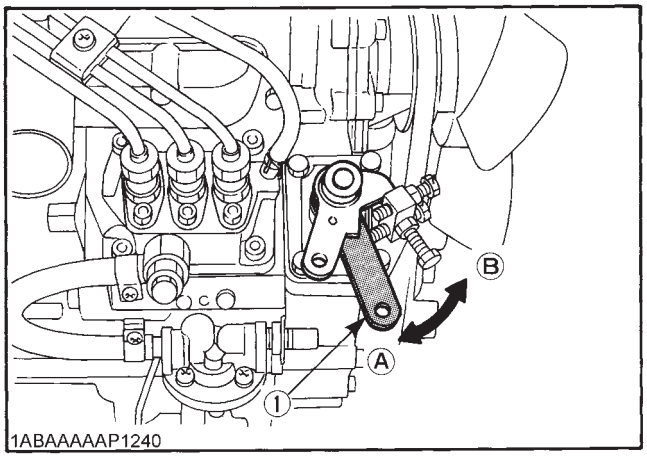
1. Set the fuel lever to "ON".



(1) Fuel lever (A) "ON" (B) "OFF"

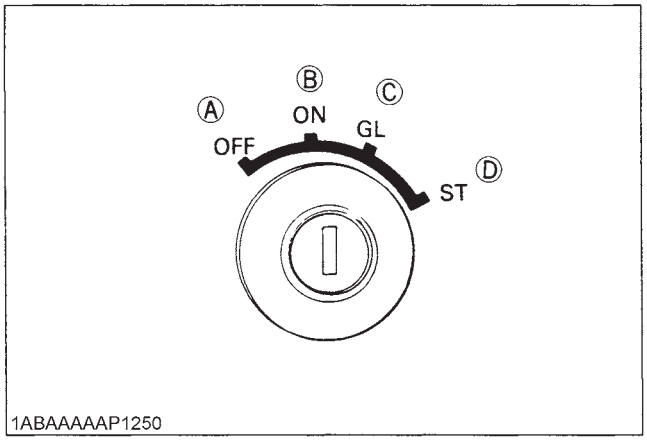
2. Place the engine stop lever in the "START" position.

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	

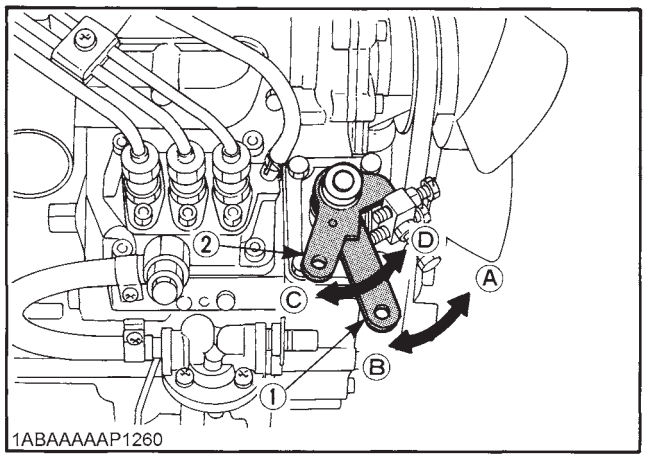
NOTE :
- In case of installing standard glow lamp, glow lamp goes off after about 6 seconds, when the starter switch key is turned to the "PREHEATING" position. However if necessary, keep the starter switch key at the "PREHEATING" position for longer time, according to the left recommendation.

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
(2) Engine stop lever
(A) "IDLING"
(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

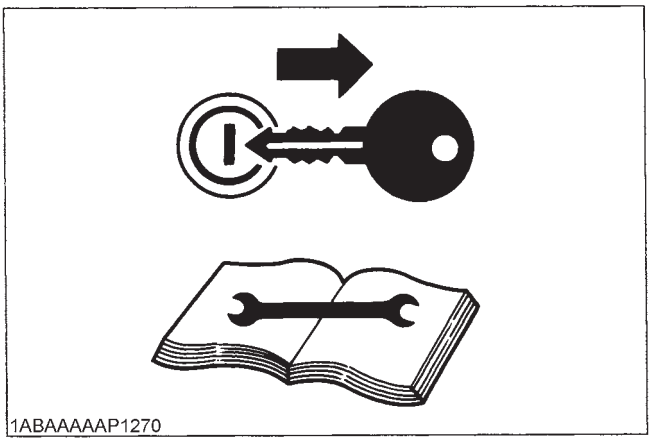
1. Immediately set the engine stop lever to "STOP" position to stop the engine.
2. After stopping the engine, check the air cleaner, intake rubber tube and other parts and replace parts as needed.

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;

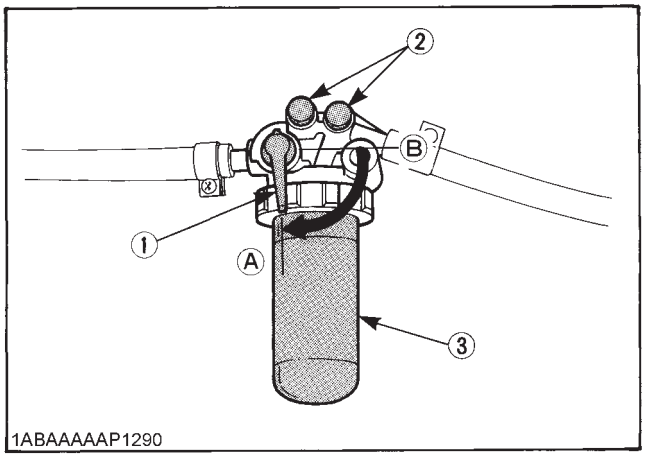
- **Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.**

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.



1ABAAAAAP1290

(1) Fuel filter lever
(2) Air vent plug
(3) Fuel filter pot
(A) "ON"
(B) "OFF"

■Checking the fuel pipes

CAUTION

To avoid personal injury;

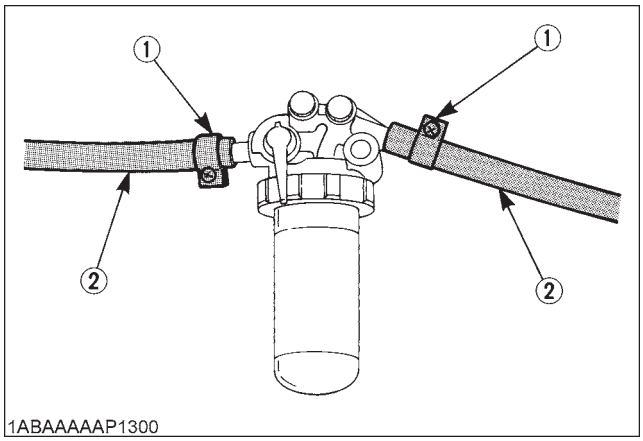
- **Check or replace the fuel pipes after stopping the engine. Broken fuel pipes can cause fires.**

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.



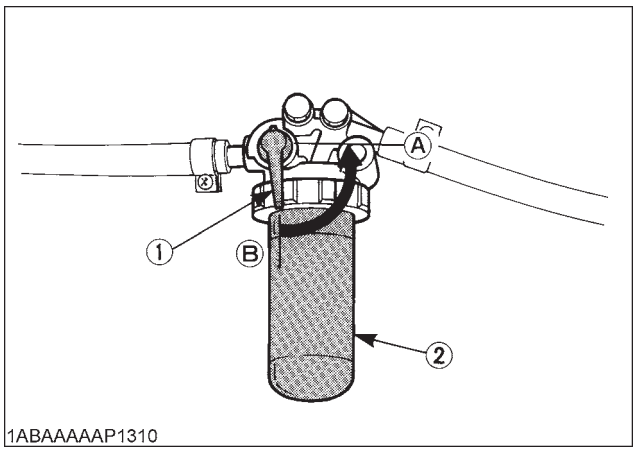
1ABAAAAAP1300

(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.



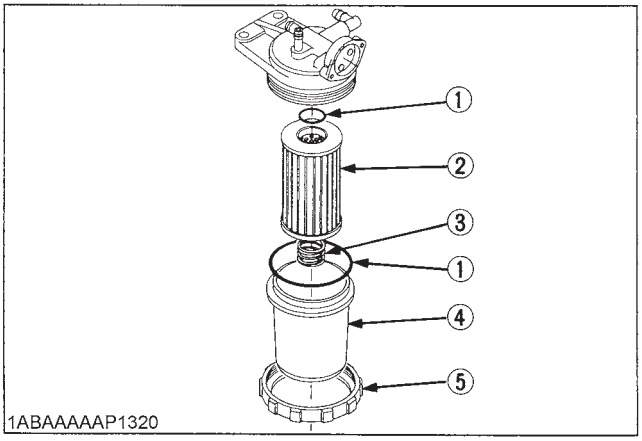
1ABAAAAAP1310

(1) Fuel filter lever
(2) Fuel filter pot
(A) "OFF"
(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.



(1) O ring
(2) Filter element
(3) Spring
(4) Filter bowl
(5) Screw ring

ENGINE OIL

CAUTION

To avoid personal injury:

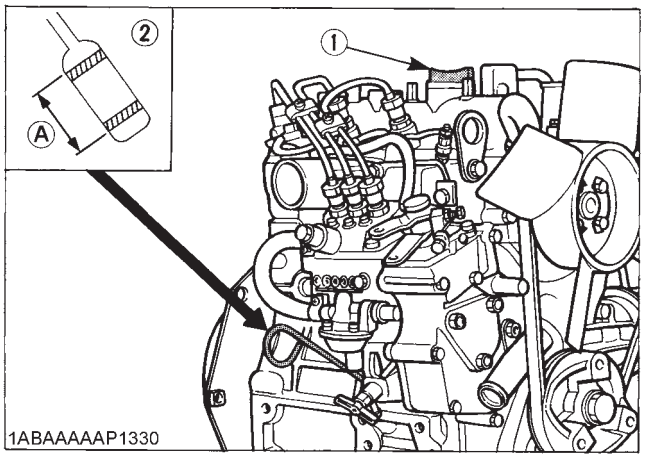
- **Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.**
- **Do not touch muffler or exhaust pipes while they are hot; Severe burns could result. Always stop the engine and allow it to cool before conducting inspections, maintenance, or for a cleaning 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.



(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.

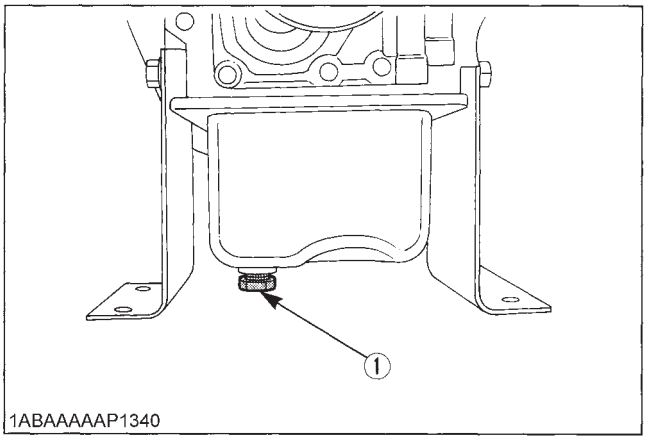
■Changing engine oil

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.



(1) Oil drain plug

3. Add new engine oil up to the upper limit of the oil level gauge.

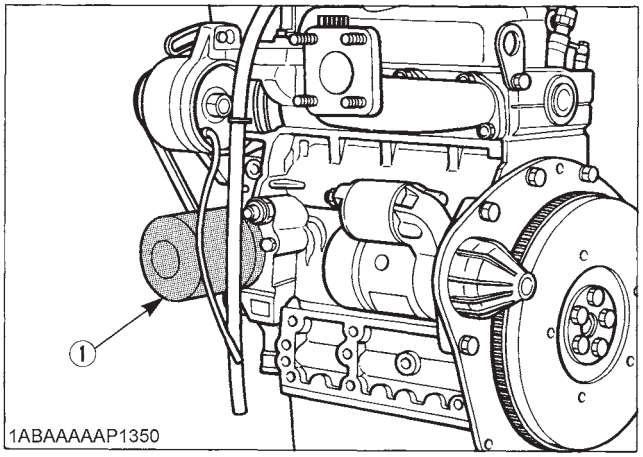
■Replacing the oil filter cartridge

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.

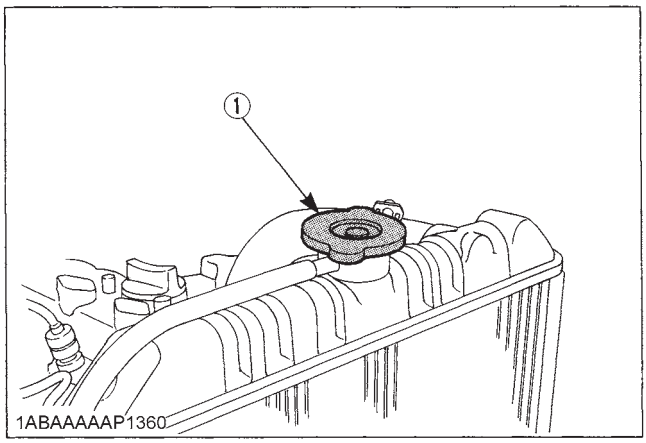
WARNING

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.

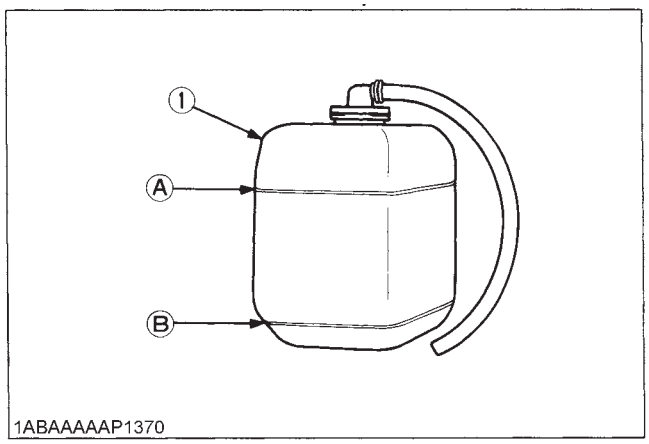
■Checking coolant level, adding coolant

1. Remove the radiator cap after the engine has completely cooled, and check to see that coolant reaches the supply port.



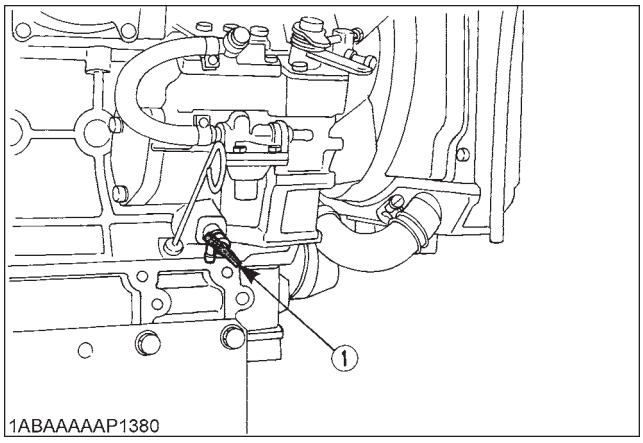
(1) Radiator pressure cap

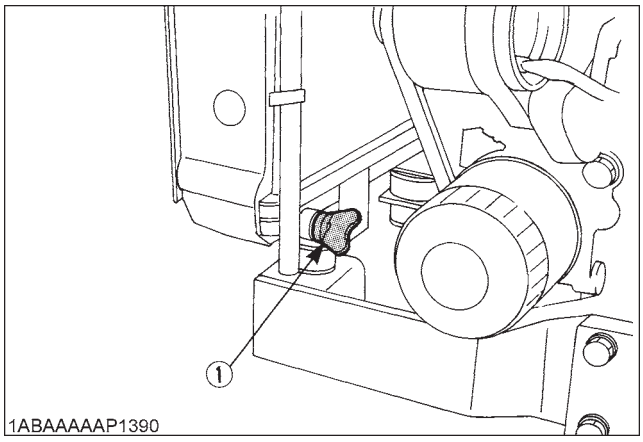
2. If the radiator is provided with a reserve tank, check the coolant level of the reserve tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.



(1) Reserve tank (A) "FULL"
(B) "LOW"

3. When the coolant level drops due to evaporation, add water only up to the full level.
4. 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

1. 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.
2. Remove the overflow pipe of the radiator pressure cap to drain the reserve tank.
3. 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.

4. An improperly tightened radiator cap or a gap between the cap and the seat quickens loss of coolant.
5. 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 *	
	℃	℉	℃	℉
40	-24	-12	106	222
50	-37	-34	108	226

*At 1.013 x 10^5Pa (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.)

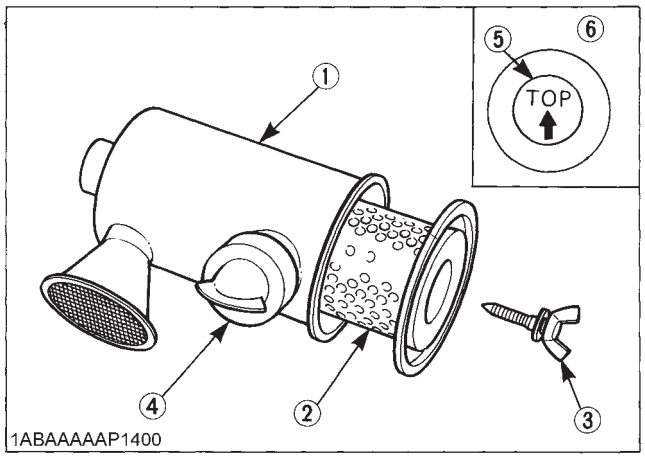
■Radiator cement

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/cm^2, 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

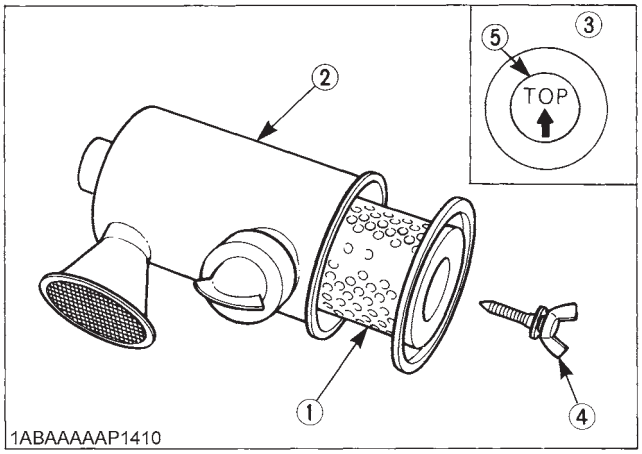
IMPORTANT :

- 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.

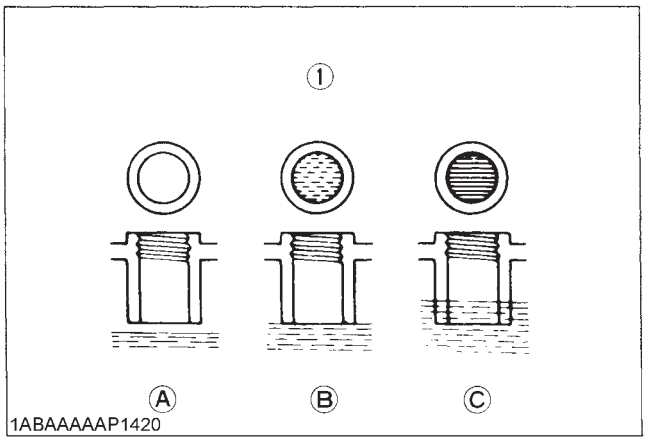
- **For using the refillable type battery, follow the instructions below.**
  Do not use or charge the battery if its fluid level stands below the LOWER (lower limit level) mark.
  Otherwise, the battery component parts may deteriorate earlier than expected, which may shorten the battery's service life 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.**

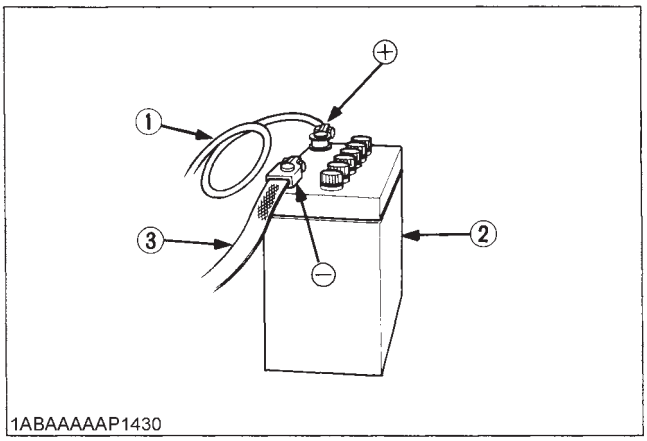
1. Make sure each electrolyte level is to the bottom of vent wells, if necessary, add only distilled water in a well-ventilated place.



1ABAAAAAP1420

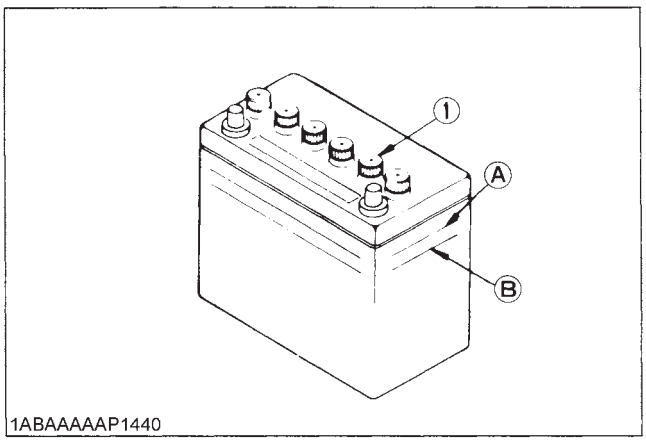
(1) Battery electrolyte level
(A) "TOO LOW"
(B) "PROPER"
(C) "TOO HIGH"

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.

ENGLISH

■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℃ (167℉).
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:

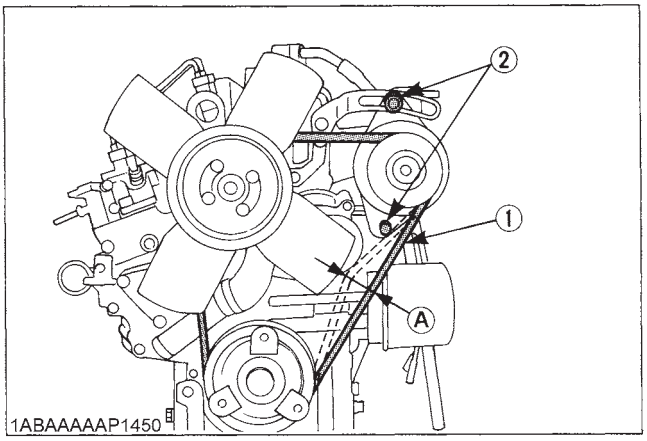
- **Be sure to stop the engine and remove the key before checking the belt tension.**
- **Be sure to reinstall the detached safety shield after maintenance or checking.**

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.

ENGLISH

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.	*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	*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.	*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.	*Adjust valve clearance to 0.145-0.185mm(0.0057-0.0072in) when the engine is cold.
Leaking valves	*Grind valve.
Fuel injection timing is wrong.	*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.	*Change grade of oil according to the weather (temperature.)
Low compression	*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.	*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	*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	*Bad valve and excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts. *Grind valves.
Fuel is insufficient.	*Check fuel system.
Overheating of moving parts	*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.	*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	*Clean the element every 100 hours of operation.
Fuel injection pressure is wrong.	*Adjust to proper pressure. 13.7Mpa (140 kgf/cm²; 1991 psi)
Injection pump wear	*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

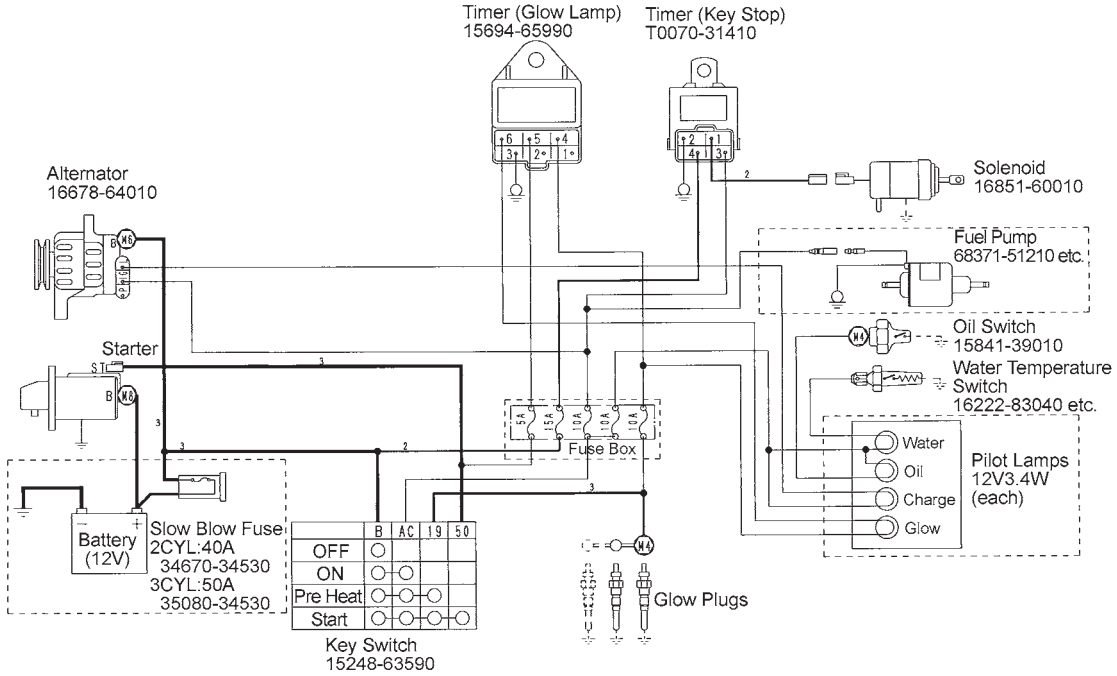
Model	Z482-E	Z602-E	D662-E	D722-E	D782-E	D902-E
Type	Vertical, water-cooled, 4-cycle diesel engine					
Number of cylinders	2		3			
Bore and stroke mm (in.)	67 x 68 (2.64 x 2.68)	72 x 73.6 (2.83 x 2.90)	64 x 68 (2.52 x 2.68)	67 x 68 (2.64 x 2.68)	67 x 73.6 (2.64 x 2.90)	72 x 73.6 (2.83 x 2.90)
Total 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/cm²)					
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 plut)					
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 equiped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm^2 with no mark.

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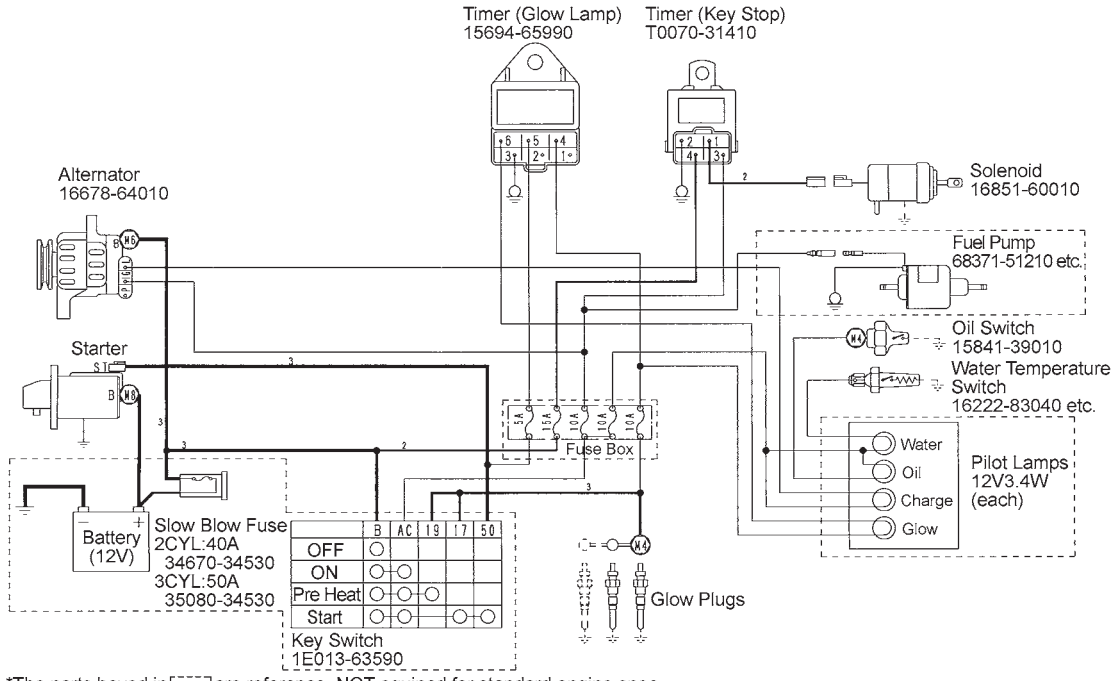
KEA standard for Alternator (Energize to stop)



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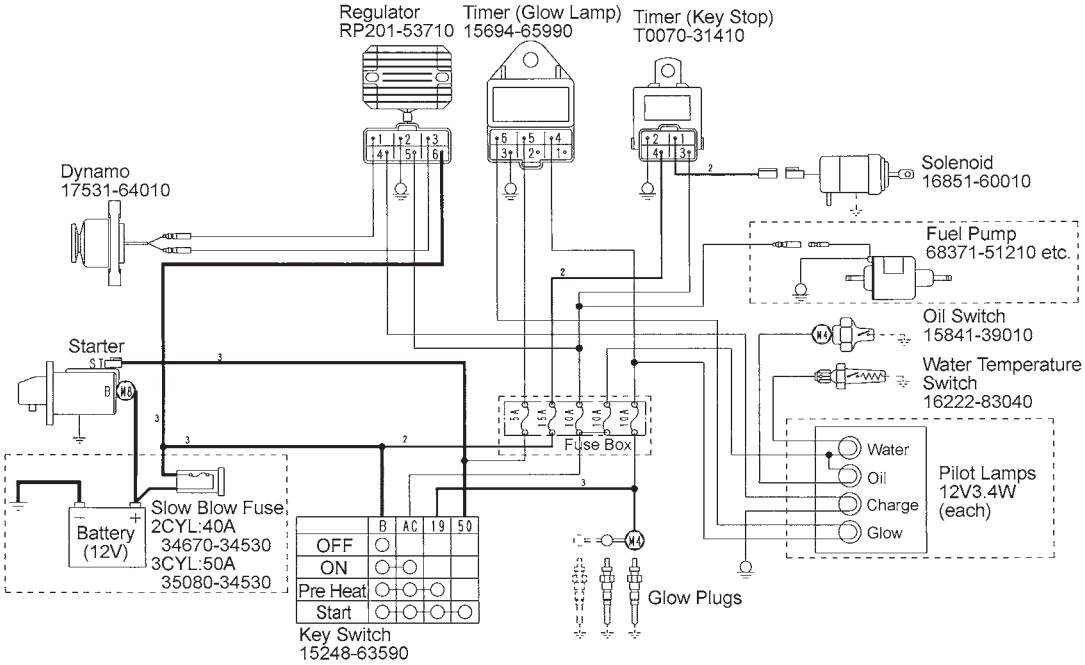
EU standard for Dynamo (Energize to stop)



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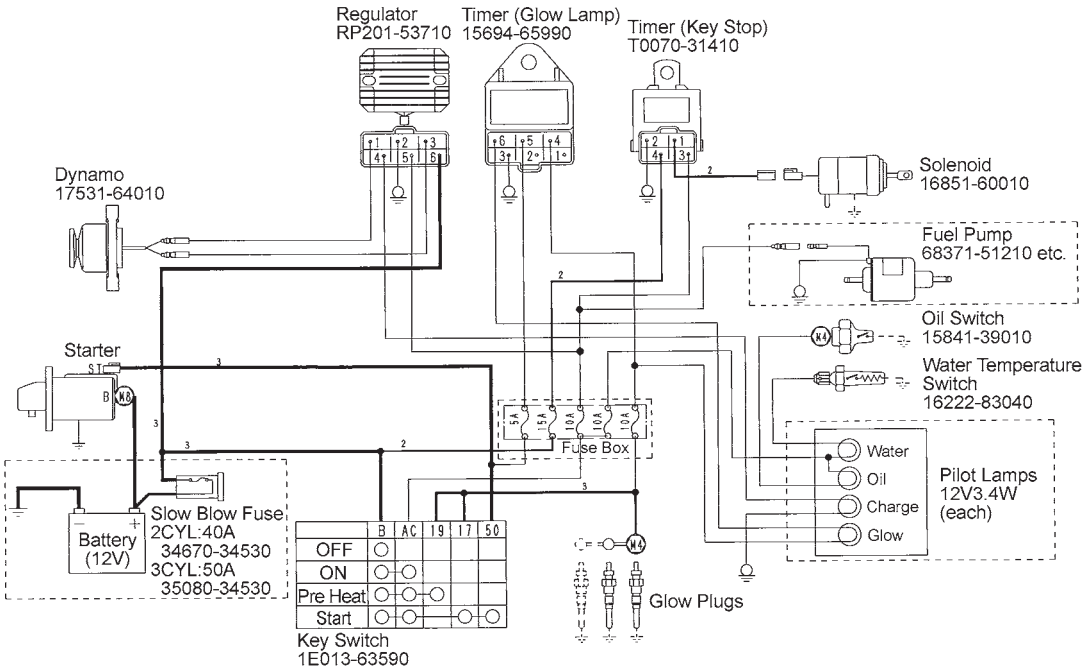
KEA standard for Dynamo (Energize to stop)



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