en **Service manual**

Wheel loader

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Preface

Notes for users

This service manual is designed for trained specialist staff of the Liebherr organisation and their dealers.

This service manual contains specialist knowledge for repairing Liebherr construction machines. Basic specialist knowledge on electronics, hydraulics, mechanics and engine technology is not contained in this service manual. Therefore specialized training and qualifications are necessary. Liebherr recommends participating in the Liebherr training program for construction machines.

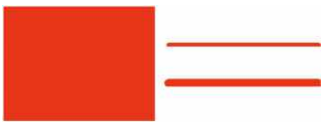
In this service manual you will find information on:
– Special tools
– Technical data
– Maintenance intervals and maintenance tasks
– Adjustment procedures
– Structure and function descriptions
– Removal and installation tasks
– Circuit diagrams, hydraulic plans and technical drawings

You will find information on controls and operation in the operator's manual. Information on spare parts are in the spare parts catalogue. Please observe the local accident prevention laws.

You can find information on repairs of machine parts in the service documentation under “Wheel loader - repair instructions”.

Technical changes are reserved.

Colour legend of hydraulic diagrams

Colour	Line thickness	Designation
	Thick or thin	High pressure
	Thick	Tank line
	Thin	Leak oil line

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Colour	Line thickness	Designation
	Thin	Replenishing pressure or pilot pressure to pilot control unit
	Thin	Control pressure or pilot pressure from pilot control unit
	Thick	Enclosed oil
	Thick	Working pressure
	Thin	Load sensing pressure

Colour legend of hydraulic diagrams

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010 Introduction

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010.1 Safety instructions

010.1.1 Information on these instructions

010.1.1.1 Representation of warning messages

Warning symbol

	Warning symbol warns of potential dangers. Obey all measures marked with this symbol to avoid injury or death.

Tab. 1: Warning symbol

Grading of warning messages

Grading of warning messages is defined by following signal words:

DANGER
WARNING
CAUTION
NOTICE

Definition of warning levels

	**DANGER**	Indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.
	**WARNING**	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	**CAUTION**	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	NOTICE	Indicates a hazardous situation which, if not avoided, could result in property damage.

Tab. 2: Warning levels

010.1.1.2 Graphic symbols in these instructions

Symbol	Meaning
	**Note** Identifies useful information and tips.
	**Precondition** Identifies conditions for subsequent action steps.
	**Action request** Identifies action steps.
	**Result** Identifies results of one or more action steps.

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Symbol	Meaning
—	**List** Identifies individual items of a list.

Tab. 3: Symbols

010.1.2 Intended use

010.1.2.1 Laws, rules, guidelines and safety regulations

To ensure safe operation:
– Ask work site manager for safety regulations at place of use.
– Adhere to safety regulations at place of use.
– Adhere to traffic regulations.
– Adhere to valid guidelines from insurers (for example employers' professional liability insurance companies, accident insurance et cetera).
– Avoid working methods that can endanger safety.
– Adhere to all intervals specified for recurrent checks and inspections in this operator's manual.

010.1.2.2 Intended use

Wheel loader is used to pick up, move and dump following materials:
– Soil
– Stones
– Broken rocks
– Bulk materials

This applies to a standard machine in normal operating conditions. Special applications are described in a separate options operator's manual.

To ensure intended use:
– Adhere to operator's manual.
– Adhere to maintenance intervals.
– Observe inspection and maintenance tasks.
– Adhere to specifications in the technical data.
– When using machine on public roads, make sure it complies with applicable national regulations.
– Only lift loads with intended working attachments (fork prongs, crane boom), which must be fitted and functioning.
– Make sure that machines used underground (mining and tunnel construction) are fitted with systems to reduce exhaust emissions (such as diesel particulate filters).
– Adhere to individual country's requirements for underground operation.
– For special uses use special working attachments and if necessary special safety equipment.
– Exclusively mount and use special working attachments with approval and as per stipulations of manufacturer of basic machine.
– Only use approved tyres.
– A suitably equipped workshop is absolutely essential for performing repair work.

Note

▶ Any other use or use beyond the stated use is improper use.

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010.1.2.3 Foreseeable misuse

Do not use machine in following cases:
– Transport of persons without mounted and functioning safety equipment
– Lifting of persons without mounted and functioning safety equipment
– Driving with attached load
– Working in explosion hazard zones
– Working in contaminated environment without corresponding and necessary equipment
– Lifting of loads without suitable working attachment
– Pulling of loads (for example, containers, wagons, trailers) without suitable towing device
– Breaking rocks
– Hammering in posts

Note

▶ The manufacturer accepts no liability for damage caused by improper use.

010.1.2.4 Operating conditions

– Outdoors
– Fording depth is same as maximum obstacle height.
– Operate machine in an ambient temperature of -25 °C to 45 °C.
– In case of divergent ambient temperatures, contact Liebherr customer service.

Danger to life

Operation during thunderstorms or storms

– If possible stop operation before a thunderstorm or storm.
– Put working attachment on the ground in flattest position possible.
– Secure machine correctly.
– Close window.
– Shut off diesel engine.
– Set ignition key to **0**.
– Make sure there are no persons in area around machine.

Lightning strike

– Remain in operator's cab.
– Do not leave machine until all components are voltage-free.

Contact with high voltage cable

– Do not move machine and working attachment.
– Remain in operator's cab.
– Do not leave machine until all components are voltage-free.
– Make sure that all persons stay away from the machine and the high voltage cable.
– Have voltage switched off.

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010.1.2.5 Disposal

Danger to life

Unapproved disposal of gas containers and pressure vessels

– Before disposal, completely depressurise pressure vessel.
– Before disposal, professionally empty pressure vessel.
– Adhere to safety instructions of pressure vessel manufacturer.

Unapproved disposal of refrigerant

– Have refrigerant disposed of by refrigerant recycling point.
– Adhere to safety data sheet of refrigerant during disposal.

Environmental pollution

Unapproved disposal of machine

– Make sure that the individual elements of the machine are disposed of correctly after the service life.
– Dispose of elements of machine in line with valid country-specific waste disposal guidelines and relevant valid laws.
– Remove fuels, operating fluids and lubricants from all components before disposal.
– Collect and store fuels, operating fluids and lubricants in suitable containers before disposal.
– Adhere to instructions of relevant manufacturer when disposing of fuels, operating fluids and lubricants.
– Have fuels, operating fluids and lubricants disposed of by old oil recycling point.

010.1.3 Description of staff

010.1.3.1 Personal protective equipment

Operators, assistants and maintenance staff are responsible for the following:
– Wearing personal protective equipment
– Regular cleaning and care of protective equipment
– Immediate replacement of damaged parts of protective equipment

The protective equipment consists of following elements:
– Protective helmet
– Safety glasses
– Hearing protection
– Breathing equipment
– Protective gloves
– Warning clothing (reflective, in signal colour)
– Safety boots
– Special protective clothing
  • To prevent burns
  • To prevent freezing
  • To prevent acid burns
  • To prevent stabbing and cutting injuries

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010.1.3.2 Requirements for staff

Staff meet the following requirements:
- The machine is operated, maintained and repaired exclusively by authorised and trained persons.
- All persons operating, maintaining or repairing the machine have the required minimum age.
- Staff training involves theoretical information (technology and safety) and practical training on the machine.
- Staff have read and understood the operator's manual and supplied documentation.
- Experienced staff continuously supervise following staff.
  - Staff undergoing training
  - Staff undergoing education
  - Staff undergoing instruction
  - Staff undergoing a general apprenticeship
- Staff agree to work in safety-aware and risk-aware manner.

010.1.3.3 Operating company

Responsibility

The operator is responsible for the following:
- The operator of the machine must ensure that no persons are in the operating area of the machine on the basis of a risk assessment conducted in respect of the operating site.
- If working attachments are used that deviate from the standard and result in limitations to the field of view, the operator must repeat the visual inspection.
- Make sure that exclusively trained staff operate the machine.
- Make sure that exclusively trained staff maintain the machine.
- If an electric motor is used, ensure that only a qualified and competent person connects the machine to the mains supply.
- If a machine with an “emergency actuation of parking brake” option is used, make sure that only qualified and authorised persons operate the machine.
- Check qualification of persons using the machine.
- Authorise activities of persons in handling the machine.
- Define competences and responsibilities for all persons involved in handling the machine.
- Have following staff continuously supervised by an experienced person.
  - Staff undergoing training
  - Staff undergoing education
  - Staff undergoing instruction
  - Staff undergoing a general apprenticeship
- Provide all persons tasked with handling the machine with the necessary protective equipment.
- Check safety-aware work of staff at regular intervals.
- Check danger-aware work of staff at regular intervals.
- Make sure that machine is operated in flawless, safe condition.
- If flaws affecting safety occur: Immediately decommission machine.
- Perform inspections of machine prescribed by Liebherr punctually.
- Perform nationally mandated inspections of machine punctually.
- Adhere to national legal specifications on provision of machines and tools by the employer (hazard assessment and risk assessment conducted by the operator).
- Make sure that no retrofitting is performed on machine without consultation of the manufacturer.
- Use original Liebherr spare parts wherever possible.

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010.1.3.4 Operator

Responsibility

Operator is responsible for following:
– Read the operator's manual.
– Read included documentation:
  • Operator's manuals for components
  • Operator's manuals from third party manufacturers
  • Additional instructions
– Wear personal protective equipment.
– Operate machine as intended.
– Avoid working methods that can endanger safety.
– Adhere to safety regulations at place of use.
– Maintain visual contact or voice contact with spotter.
– During operation, do not allow any other persons on machine.
– Report all changes to machine that affect safety to operating company.
– If it is no longer possible to work safely, stop operating the machine immediately.
– Only perform retrofittings of machine after consultation with manufacturer.
– Use original Liebherr spare parts wherever possible.

Requirement

The operator has following qualification and skills:
– Has completed the legally specified minimum age.
– Is physically and mentally capable of operating the machine safely.
  • Satisfactory eyesight
  • Satisfactory hearing ability
  • Quick reactions
  • Is able to estimate distance, height and gaps.
– Has the necessary authorisation for operation of machine.
– The operator has the necessary education (theoretical and practical) for the following:
  • Handling the machine type
  • Attaching
  • Spotting
  • Handling fire extinguishing equipment
– Knows all means of escape in an emergency.
– Is not under any physical or mental impairment that limits one of the prescribed requirements.
– Is not under the influence of alcohol.
– Is not under the influence of drugs.

010.1.3.5 Maintenance staff

Responsibility

The maintenance staff are responsible for the following:
– Read the operator's manual.
– Read included documentation:
  • Operator's manuals for components
  • Operator's manuals from third party manufacturers
  • Additional instructions
– Maintain machine for safe and reliable function.
– Execute all maintenance tasks specified for maintenance staff in the maintenance and inspection schedule.

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– Wear personal protective equipment.
– Adhere to safety regulations at place of use.
– Report all changes to machine that affect safety to operating company.
– Only perform retrofittings of machine after consultation with manufacturer.
– Use original Liebherr spare parts wherever possible.

Requirement

The maintenance staff have the following qualifications and skills:
– Are of the legally specified minimum age.
– Physically and mentally capable of servicing the machine:
  • Satisfactory eyesight
  • Satisfactory hearing ability
  • Quick reactions
  • Are able to estimate distance, height and gaps.
– Have the necessary authorisation for maintenance of the machine.
– Know the machine and the hazards.
– Know all procedures and precautions for maintenance.
– Have knowledge of handling special tools for maintenance and repair.
– Have special knowledge and experience handling hydraulic installations when working with hydraulic systems.
– Are not under any physical or mental impairment that limits one of the prescribed requirements.
– Are not under the influence of alcohol.
– Are not under the influence of drugs.

010.1.3.6 Refrigeration technician

Responsibility

The refrigeration technician is responsible for the following:
– Read the operator's manual.
– Read included documentation:
  • Operator's manuals of options
  • Operator's manuals from third party manufacturers
  • Additional instructions
– Maintain and repair machine for safe and reliable function.
– Execute all maintenance tasks and repair tasks specified for the refrigeration technician in the maintenance and inspection schedule.
– Isolate battery main switch of power supply system and secure it against switching on again.
– Clearly define and label working position.
– Wear personal protective equipment.
– Use tools suitable for the work deployment.
– Adhere to safety regulations at place of use.
– Report all changes to machine that affect safety to operating company.
– Only perform retrofittings of machine after consultation with manufacturer.
– Use original Liebherr spare parts wherever possible.

Requirement

The refrigeration technician has following qualification and skills:
– Has completed the legally specified minimum age.
– Physically and mentally capable of servicing the machine:
  • Satisfactory eyesight
  • Satisfactory hearing ability
  • Quick reactions

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    - Is able to estimate distance, height and gaps.
- The refrigeration technician has completed training that complies with the country-specific laws, standards and guidelines.
- The refrigeration technician has following skills:
    - Is able to assess work correctly.
    - Is able to recognise dangers.
    - Is able to take safety measures.
- Has knowledge and experience of the relevant field of activity.
- Knows the relevant national standards.
- Has the necessary authorisation for maintenance and repair of machine.
- Knows the machine and the hazards.
- Knows all procedures and precautions for maintenance.
- Has knowledge of handling special tools for maintenance and repair.
- Is not under any physical or mental impairment that limits one of the prescribed requirements.
- Is not under the influence of alcohol.
- Is not under the influence of drugs.

010.1.3.7 Slinger

Responsibility

Slinger is responsible for following:
- Wear personal protective equipment.
- Choose correct and undamaged slinging gear.
- Correctly attach slinging gear to load or lifting accessory.
- Correctly remove slinging gear from load or lifting accessory.
- Grant approval for movement or accompaniment.

Requirement

The slinger has following qualification and skills:
- Has completed the legally specified minimum age.
- Physically and mentally capable of slinging loads:
    - Satisfactory eyesight
    - Satisfactory hearing ability
    - Quick reactions
    - Is able to estimate distance, height and gaps.
- The slinger has following skills:
    - Is able to estimate mass distribution and load distribution.
    - Is able to operate radio units.
    - Is able to give clear instructions on radio units.
    - Is able to guide a load.
- Has the necessary authorisation for attaching loads.
- The slinger has the necessary education (theoretical and practical) for the following:
    - Selecting the suitable slinging gear
    - Attaching slinging gear
    - Securing to prevent unintended disengaging of slinging gear
    - Avoiding damage to slinging gear
    - Spotting
    - Applying all necessary signal signs
- Is not under any physical or mental impairment that limits one of the prescribed requirements.
- Is not under the influence of alcohol.
- Is not under the influence of drugs.

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010.1.3.8 Spotter

Responsibility

The spotter is responsible for the following:
– Wear personal protective equipment.
– Forward signals from slinger to operator.
– If the spotter is the only person for this purpose: Give instructions to operator.
– The spotter must be in the field of view of operator or have voice contact with the operator.

Requirement

The spotter has following qualification and skills:
– Has completed the legally specified minimum age.
– Physically and mentally capable of spotting and providing signals:
  • Satisfactory eyesight
  • Satisfactory hearing ability
  • Quick reactions
  • Is able to estimate distance, height and gaps.
– The spotter has following skills:
  • Is able to operate radio units.
  • Is able to give clear instructions on radio units.
  • Is able to guide a load.
  • Is able to ensure safe movement of load and machine.
– Has the necessary authorisation for giving signal signs.
– The spotter has the necessary education (theoretical and practical) for the following:
  • Spotting
  • Applying all necessary signal signs
– Is not under any physical or mental impairment that limits one of the prescribed requirements.
– Is not under the influence of alcohol.
– Is not under the influence of drugs.

010.1.4 Protective devices on the machine

010.1.4.1 Operator's cab

Danger to life

Unapproved working method

– Put on safety belt before starting work.
– Make sure that changes in the operator's cab (for example installation of accessories) do not restrict the operator's workspace.

Injuries

Objects in the operator's cab

– Remove objects that are not necessary for the work from the operator's cab.
– Stow and fasten objects that are necessary for the work before starting.
– Make sure that objects carried do not protrude into the operator’s workspace.

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010.1.4.2 Roll over protective structure (ROPS)

Danger to life

Damaged falling object protective structures

- Do not put machine into service with damaged falling object protective structures.
- Do not put machine into service with deformed falling object protective structures.
- Do not use falling object protective structures with structural changes.
- Do not use repaired falling object protective structures.
- Do not perform welding on falling object protective structures.
- Do not cut or saw falling object protective structures.
- Do not drill falling object protective structures.

Exceeding of total weight

- Make sure that total weight of machine (see identification plate) is not exceeded.
- Make sure that the machine does not exceed the total weight with heavy working tools.
- Make sure that the machine does not exceed the total weight after changing the working attachment.
- Make sure that the machine does not exceed the total weight with add-ons or after retrofitting.

010.1.4.3 Falling object protective structures (FOPS)

Danger to life

Damaged falling object protective structures

- Do not put machine into service with damaged falling object protective structures.
- Do not put machine into service with deformed falling object protective structures.
- Do not use falling object protective structures with structural changes.
- Do not use repaired falling object protective structures.
- Do not perform welding on falling object protective structures.
- Do not cut or saw falling object protective structures.
- Do not drill falling object protective structures.

010.1.5 Emergency equipment on the machine

010.1.5.1 Emergency exit (standard)

Danger to life

Incorrect labelling

- Make sure that all information signs are present.
- Make sure that all information signs are legible.

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Incorrect equipment

– Make sure that emergency hammer (option) is present.
– Make sure that position of emergency hammer (option) is known.

010.1.5.2 Fire extinguisher (option)

Danger to life

Incorrect behaviour

– Make sure that all fastening points of fire extinguishers on the machine are known.
– Make sure that everyone is able to operate the fire extinguishers.
– Make sure that everyone knows local fire alarm options.
– Make sure that everyone knows the local fire-fighting possibilities.
– Before starting machine, unlock all locks of hoods and doors of machine.

010.1.6 Safe operation

010.1.6.1 Intoxicants

Danger to life

Physical and mental impairment

– Make sure that no persons working on or with the machine are under the influence of drugs.
– Make sure that no persons working on or with the machine are under the influence of alcohol.
– Make sure that no persons working on or with the machine are under the influence of medication.
– Make sure that no persons working on or with the machine are overtired.
– Make sure that no persons working on or with the machine are exhausted.

010.1.6.2 Dangerous fuels and operating fluids

Injury

Incorrect handling

– Adhere to safety instructions on handling oils, greases and chemical substances.
– In case of hot lubricants and fuels put on personal protective equipment.

Environmental damage

Incorrect disposal

– Dispose of lubricants and fuels safely and in eco-friendly manner.
– Adhere to guidelines applicable to disposal.

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010.1.6.3 Transporting machine

Danger to life

Machine tipping

- Make sure that the transport vehicle is authorised for the machine weight and machine size.
- Do not manoeuvre while driving on ramps.
- Before driving on ramps, clean mud, snow and ice off tyres or travel gear.
- Make sure that a spotter is available if necessary.
- To load and unload machine, use only sturdy, stable loading ramps.
- Make sure that width and angle of ramps match the gauge and climbing ability of machine.

Incorrect transport

- Park machine on level ground during preparation for transport (disassembly, cleaning).
- Secure machine against rolling away.
- Apply parking brake.
- Pull out ignition key.
- Leave operator's cab.
- All doors, windows and service access points are closed.
- Make sure that nobody is on the machine during transport.
- If necessary, dismantle a portion of working attachment from machine for duration of transport.
- Make sure that the road to be travelled is known.
- Make sure that all applicable limitations for width, height and weight are known.
- Drive carefully under electric cables and bridges.
- Drive carefully through tunnels.

010.1.6.4 Access to machine

Injury

Incorrect entry and exit

- Clean dirt, oil, ice and snow from steps, ladders, anti-slip mats, handrails and handles.
- Enter and exit carefully on muddy roads, ice, snow, traffic on access roads and in narrow conditions.
- Regularly check steps, ladders, anti-slip mats, handrails and handles and have them repaired if necessary.
- Before entering machine, clean mud, grease, ice and snow from shoes and climbing aids.
- Put on gloves for secure grip.
- Do not climb up or down using tyres, wheel hubs or rims.
- When exterior influences (for example wind) make opening and closing the door more difficult: Always guide door with your hand.
- Make sure that the opened or closed door has engaged properly.
- If the machine is still moving: Do not stand up from the operator's seat.
- Never jump off machine.
- Enter and leave the machine exclusively using the access system.
- Do not use control elements as handles.
- Keep your face towards machine during entry and exit.

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– Make sure you always have two hands and a foot or two feet and one hand in contact with the access system.
– After entering the operator's cab, find out about emergency exit.

If the machine has a cab elevation:
– Climb until the door is reached.
– When you reach door handle with your free hand: Open door.
– Continue climbing.

010.1.6.5 Machine danger zone

The area in the immediate vicinity of the machine is considered to be the danger area and must be adapted according to the application for which the machine is used.

Following factors influence size of danger area:
– The travel speed and movement of the machine
– Working attachment installed
– Type of loading material
– Risk of loading material falling

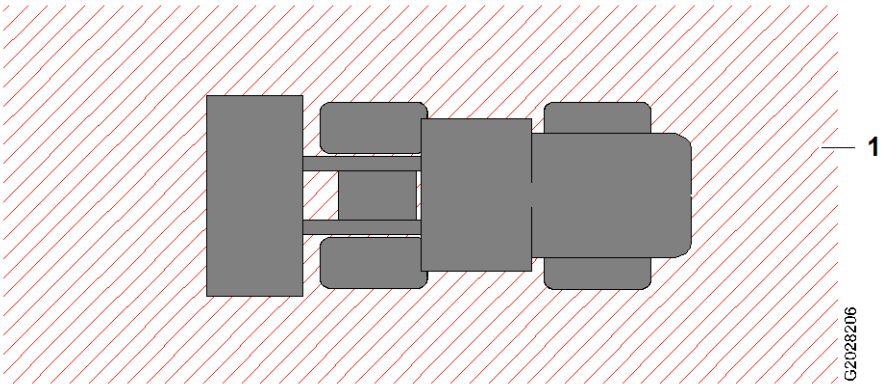

Fig. 10: Machine danger zone (view from above)

1 Danger zone

Danger to life

Unapproved presence in danger zone

– Make sure there is nobody in the danger area.

010.1.6.6 Visibility

Danger to life

Insufficient visibility

– If equipment is installed that deviates from the standard, the operator must re-evaluate the field of view and, if necessary, take measures.
– Make sure that persons approach the machine from the front and within operator's field of vision.
– Make sure that persons contact the operator before approaching the machine.
– Make sure that no obstacles impair visibility in the working area.
– Use viewing devices to observe environment of machine if necessary.

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– Use viewing devices if necessary to observe areas around the machine that cannot be seen directly.
– Position working attachment so that sufficient visibility is ensured.
– Work with spotter if visibility is restricted.
– Agree on which hand signs to use.
– If necessary communicate via radio.
– Make sure that spotter is outside danger zone.
– In conditions of poor visibility use illumination in accordance with the applicable regulations.
– Work with extra care and attention in poor visibility and changing weather.
– Only use sun visors if field of vision is not restricted.

Incorrect operation

– Comply with national regulations regarding sufficient visibility in the operator's cab.
– Before operation, check viewing devices for function, cleanliness and correct setting.
– Adjust mirrors so that the best possible all-round visibility is guaranteed.
– Immediately repair defective viewing devices or have them replaced.
– Clean dirty cab windows.
– Avoid covering of visual aids by working attachment.

Damage

Incorrect changes

– Make sure that modifications to the machine do not impair visibility.
– Perform risk analysis again.
– Test machine according to current standards.
– Test machine according to regulations applicable at place of use.
– Depending on the test result, take appropriate measures.
– Inform operator about modifications.

010.1.6.7 Protection against vibration

Injuries

Incorrect working method

– Use machine, working attachment and working tool adapted to the task.
– Check condition of machine (tyre pressure, brakes, steering, mechanical connections, ...).
– Ensure that operator's seat is functional and complies with national regulations.
– Adjust operator's seat to weight and size of operator.
– Adjust shock absorption to weight and size of operator.
– Do not use jerky movements to steer, brake, accelerate and shift gears.
– Do not use jerky movements to move and load working attachment.

Incorrect travel

– Adapt speed to route.
– Travel slowly on rough terrain.
– Travel around obstacles and very rough terrain.
– Travel over longer distances (for example, on public roads) at a suitable (medium) speed.

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Incorrect path of machine

– Remove large rocks and obstacles.
– Fill up channels and holes.
– Keep machines to hand for creating and maintaining suitable terrain conditions and calculate sufficient time.

Damage

Increased travel mode

– If machine is driven a lot: Stipulate use of special auxiliary systems for travel mode.
– Regulate speed to prevent swaying.

010.1.6.8 Operation of machine

Danger to life

Incorrect place of use

– Make sure that load capacity value of ground is sufficient.
– Do not exceed maximum inclination angle of machine while working.
– Do not exceed maximum inclination angle of machine when driving on ramps (side inclination).
– Make sure that ground offers sufficient grip.
– Assessment of subsoil conditions before starting work
– Adhere to safety gap from live overhead cables.
– Every line must be considered live.
– Keep a safe distance from overhangs, drops, slopes and unsafe terrain.

Incorrect use

– When working in following areas, adhere to the laws, regulations and rules applicable at the place of use.
  • Explosive area
  • Flammable area
  • Areas with underground lines (gas, electricity)
– Ensure that machines in enclosed spaces (for example, tunnels, hangars) are equipped with exhaust reduction components.
– Make sure that adequate ventilation and fresh air supply is ensured when operating in enclosed spaces.
– Never leave operator's seat while machine is still in motion.
– Never leave machine unattended with engine running.
– Clean machine regularly to remove flammable residues (for example dust, wood scraps).

Incorrect handling of electrical system

– Make sure there are no persons with a pacemaker in the vicinity of the running diesel engine.
– Before working on electrical system, make sure that affected parts are voltage-free.
– Before working on electrical system, make sure that neighbouring parts are isolated.
– Have work on electrical systems performed exclusively by a qualified electrician.

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