

MHL 380 D



BSB50000

Mobile hydraulic loading machine **MHL380 D**

Vehicle ID no. starting

380110 / 0127 - 0171

Year of manufacture starting

2010

Version

10.12.2012 en (englisch)

Original operating instructions

Original EC Declaration of Conformity (translation)

(Machinery Directive 2006/42/EC)

Manufacturer: Terex® Deutschland GmbH
Industriestrasse 3, 76669 Bad Schönborn, Germany

Terex® Deutschland GmbH hereby declares that the machine named below

General designation: Loading machine (developed from hydraulic excavator)
Model/Type: MHL380 D
Serial number: 380110/0127 >

conforms to the relevant requirements of Machinery Directive 2006/42/EC

Person authorized to compile the documentation

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It also declares conformity to the following EC Directives:

- Directive 2004/108/EC - Electromagnetic Compatibility
- Directive 97/68/EC, version 2010/26/EC - Measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery
- Directive 2000/14/EC - Noise emission in the environment by equipment for use outdoors

Sound power level measured on representative machines: 103.1 dB(A)
Guaranteed sound power level: 104 dB(A)

Conformity assessment procedure applied: Appendix VIII

Notified body involved: ID no. 0515
DGUV Test, Prüf- und Zertifizierungsstelle
Fachbereich Bauwesen
Landsberger Strasse 309, 80687 Munich, Germany

The following technical standards have been applied:

- EN 474-1:2006+A1:2009 - Earth-moving machinery - Safety - Part 1: General requirements
- EN 474-5:2006+A2:2012 - Earth-moving machinery - Safety - Part 5: Requirements for hydraulic excavators
- EN 13309:2010 - Construction machines - Electromagnetic compatibility of machines with internal on-board electrical systems

Dealer:

The TEREX | Fuchs operating instructions consist of 10 chapters intended for different staff members:

| Chapter | Subject | Staff members |
|---------|---------------------------------|---|
| 1 | FOREWORD | Operating staff Inspection and maintenance personnel Repair staff |
| 2 | SAFETY AND ACCIDENT PREVENTION | Operating staff Inspection and maintenance personnel Repair staff |
| 3 | TECHNICAL DATA | Operating staff Inspection and maintenance personnel Repair staff |
| 4 | DISPLAY AND CONTROL ELEMENTS | Operating staff Operators must be familiar with the content of the operating instructions and the use of this or comparable machinery. |
| 5 | WORK OPERATION | Operating staff Operators must be familiar with the content of the operating instructions and the use of this or comparable machinery. |
| 6 | RECOVERY, LOADING AND TRANSPORT | Operating staff Inspection and maintenance personnel Repair staff |
| 7 | CARE AND MAINTENANCE | Operating staff Inspection and maintenance personnel Repair staff Inspection, maintenance and repair staff must have expert knowledge as well as experience of the inspection, maintenance and repair of this or comparable machinery. |
| 8 | MALFUNCTION | Operating staff Inspection and maintenance personnel Repair staff |
| 9 | APPENDIX | Operating staff Inspection and maintenance personnel Repair staff |
| 10 | SPECIAL EQUIPMENT | Operating staff Operators must be familiar with the content of the operating instructions and the use of this or comparable machinery. |

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| 1.8.2 | Description | 1.13 |
| 1.9 | Operating instructions provided by other suppliers | 1.20 |
| 1.10 | Copyright | 1.20 |

1 Foreword

1.1 General

The **Mobile Hydraulic Loading Machine MHL380 D** was thoroughly tested before it left the factory. The final inspection showed all parts to be in perfect working order and verified the machine's ability to achieve the expected level of performance.

These operating instructions have been written for the machine operator and machine maintenance personnel. They help operators to familiarize themselves with the machine and to avoid malfunctions caused by improper operation.

The operating instructions contain important information about how to use the machine safely, properly and economically. Compliance with the operating instructions will help avoid hazards, increase reliability in application and extend the service life of the machine. Repair costs and downtimes will thus be reduced.

Information about applicable national requirements for accident prevention needs to be added to the operating instructions. In addition to the operating instructions and binding regulations for accident prevention in the country and specific location where the machine is used, recognized technical rules for safe and professional working must also be followed.

1.2 Proper use

The loading machine MHL380 D is intended solely for work which is suited to the function of the machine and its work attachment. Such work involves:

- loading
- moving
- shifting

of materials such as scrap, scrap metal and chips, as well as various types of recycling material.

The appropriate work attachments for these purposes are:

- clamshell and cactus grabs
- magnets
- load hooks
- sorting grabs
- hydraulic shears

The manufacturer's specifications outlined in these operating instructions must be complied with.

Given their experience in and knowledge of working with the respective handling goods, operators and machine operators should check whether the loading machine is suitable for the task in hand. The dealer responsible should be contacted if in doubt.

Before using the machine for timber rehandling, consult the manufacturer.

When mounting work attachments (provided by outside suppliers), the proper use of such attachments as stated by their manufacturers must be observed.

Compliance with the operating instructions, the performance of maintenance work as specified and adherence to maintenance intervals are all aspects of proper use.

Attention

The operating temperature at which the machine may be used with standard fuels, lubricants and coolants is within the range from -15 °C to +45 °C.

On operating sites with lower temperatures we recommend engine oil preheating and hydraulic fluid preheating. This makes the machine ready for use within a shorter space of time and thus prolongs its service life.

Information concerning fuels, lubricants, and coolants for temperatures below -15°C:

 *Chapter 3.15 Fuels, lubricants and coolants*

 *Chapter 4.6.10 Notes for use in winter*

1.2.1 Misuse

Any use beyond that specified here and any noncompliance with the manufacturer's specifications is regarded as improper use. The manufacturer shall not be liable for any damage resulting from such use. This risk is borne solely by the operator.

In particular, the following is prohibited:

- Loading, moving and transporting any goods other than those intended.
- Use on ships
- Use in mining
- Sites of operation with a risk of explosion
- Transporting persons

1.3 Introduction

These operating instructions assume that the machine will only be operated by authorized, trained and specially instructed personnel.

They must be kept readily accessible in the machine at all times, along with any other instructions supplied.

Points of particular importance for safe and proper use of the machine are highlighted in the operating instructions.

Errors can only be prevented and trouble-free operation assured if the user is familiar with the operating instructions. It is therefore very important that those persons who are actually responsible for operation are familiar with the operating instructions. They must be read thoroughly and their content understood, as the manufacturer will not accept liability for damages and malfunctions arising as a result of noncompliance with the operating instructions.

If you require additional information or if any of the content is unclear, please contact your dealer immediately.

We reserve the right to make improvements to the machine within the scope of technical development, without changing the operating instructions.

1.4 Warranty and maintenance

Attention

TEREX | Fuchs can provide no warranty for modifications or attachments to equipment on TEREX | Fuchs products which have not been approved by us or have not received our express written consent. In such cases, our warranty for the machine will be invalidated, as will our product liability for any resulting consequential damages.

The machine's warranty period covers 12 months, beginning with the day it is handed over or put into operation.

Efficient working requires safe working conditions and a machine in perfect working order. The loading machine will fulfill these requirements when correctly handled and when serviced and maintained as specified.

Careful observation of the machine during operation and the use of the specified fuels, lubricants and coolants will prevent malfunctions.

Trained specialist personnel are responsible for any servicing of the machine which requires expert knowledge. Inspections and repairs must therefore be carried out by your dealer's customer service department.

With regard to possible claims for damages during the warranty period, all service work outlined in the maintenance and inspection plan must be carried out at the specified intervals.

Even after the warranty period has expired, regular maintenance must be performed in order to ensure that the machine is constantly in good working order and enjoys a reasonable service life.

Insist that only **original TEREX | Fuchs spare parts** are used in the event of any repair work. This will ensure that you have a product of sustained high quality, thereby ensuring that your machine retains its original condition.

1.5 Type plate and vehicle identity number

The type plate (1/1) can be found on the undercarriage. The vehicle identity number is also stamped on the undercarriage (1/2).

Attention

Please always quote the vehicle type and vehicle ID number when making an enquiry and in all written correspondence.

The following information about the vehicle type and manufacturer can be found on the type plate (fig. 2):

- 1 Manufacturer
- 2 Type
- 3 Vehicle identity number
- 4 Minimum operating weight
- 5 Maximum operating weight
- 6 Permissible front axle load
- 7 Permissible rear axle load
- 8 Engine rating
- 9 Model year
- 10 Year of manufacture
- 11 Designation

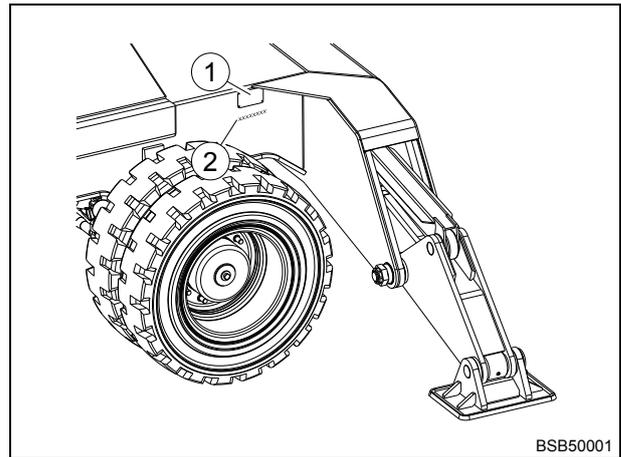


Fig. 1 Vehicle identity number

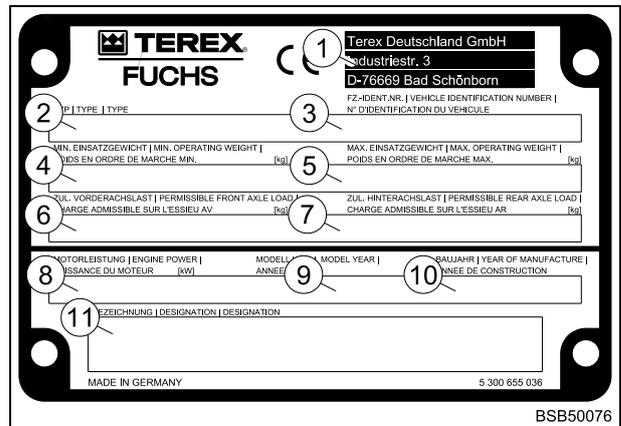


Fig. 2 Type plate

1.6 Environmental legislation

When operating or working with the machine, applicable legislation for the protection of the environment must be observed at all times.

When performing repair and maintenance work, special care must be taken to ensure that environmentally harmful substances such as

- grease and lubricating oil
- Hydraulic fluid
- fuel
- coolant
- battery acid
- liquid detergents containing solvents

do not seep into the ground or the sewerage system.

These substances must be collected, kept, transported and disposed of in suitable containers.

If the aforementioned fluids seep into the ground, they must be immediately prevented from leaking and the fluid must be removed using suitable binding agents. It might prove necessary to excavate the area of soil affected. Binding agents and excavated soil must be disposed of properly. Compliance with applicable environmental regulations is mandatory.

1.7 Notes on using the operating instructions

1.7.1 References to images and items

The references to images and items appearing in the text, such as (14/1), mean figure 14, item 1.

1.7.2 Abbreviations and terms

An explanation of the abbreviations and terms used in these operating instructions appears below:

| | |
|-------------|--|
| MHL | M obile H ydraulic L oading M achine |
| StVO | M otor V ehicle R egulations |
| StVZO | F ederal M otor V ehicle S tandards |
| UVV | A ccident P revention R egulation |
| GLR/ LLC | G renz-last-regelung/ L oad L imit C ontrol |

1.7.3 Hazards and important notes

DANGER

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

WARNING

WARNING – indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION – indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

ATTENTION

ATTENTION – indicates important information.

ATTENTION



ATTENTION with this pictogram - indicates a situation which, if not avoided, may result in damage to property or equipment.

ATTENTION

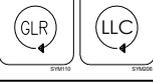


ATTENTION with this pictogram - indicates a situation harmful to the environment which, if not avoided, may result in serious and costly damage to the environment.

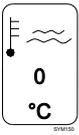
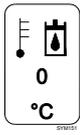
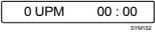
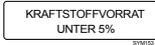
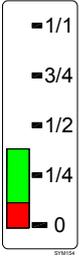
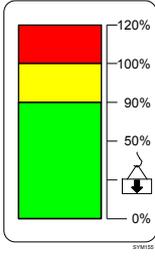
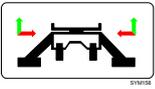
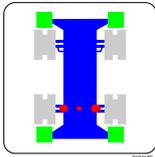
1.7.4 Pictograms

1.7.4.1 Indicators in the multifunction display

The table below explains the meaning of the indicators in the multifunction display. Functions and displays marked (*) are optional.

| Indicator | Description | Indicator | Description |
|---|--|---|---|
|  | Dual assignment: Coolant temperature Hydraulic fluid temperature |  | Close range cut-off active (dipperstick) |
|  | Charge air temperature |  | Close range cut-off bypassed (dipperstick) |
|  | Battery charge control |  | Range limiting active (dipperstick) * |
|  | Engine oil pressure |  | Range limiting bypassed (dipperstick) * |
|  | Dual assignment: Coolant level Hydraulic fluid level |  | Height limitation active * |
|  | Dual assignment: Air filter clogging Return filter logging Oil filter clogging in the bypass flow filters (optional) |  | Height limitation bypassed * |
|  | Service brake |  | Boom float function - remote range * |
|  | Parking brake |  | Boom float function - close range * |
|  | Swing brake |  | Fuel reserve indicator |
|  | Load limit control – load limit sensing control * |  | Water in fuel |
|  | Reversing fan mode * | | |
| | Not assigned | | |

| Indicator | Description | Indicator | Description |
|---|--|---|---|
|  | Windscreen wiper/ intermittent wiping (upper window section) |  | Indicator oscillating axle unlocked |
|  | Windscreen wiper (lower window section) * |  | Automatic central lubrication system – trigger additional lubrication on uppercarriage |
|  | Wiper water pump (upper window section) |  | Automatic central lubrication system – trigger additional lubrication on undercarriage * |
|  | Wiper water pump (lower window section) * |  | Magnet system ON* |
|  | Driving headlamps |  | Magnet system jog mode * |
|  | Working headlamps | | Not assigned |
|  | Flashing beacon * |  | Raise cab |
|  | Auto-idling system |  | Lower cab |
|  | Float function for dozer blade * |  | Cab forward |
| | Not assigned |  | Cab backward |

| Indicator | Description | Indicator | Description |
|--|---|---|---|
|  | Coolant temperature (diesel engine) |  | Hydraulic fluid temperature |
|  | Time/operating hours – current engine speed * |  | Text output to the indicator displays |
|  | Fuel gauge |  | Load display * |
|  | Outrigger menu * |  | Status display of the outrigger deselection * |
|  | Rear view camera | | Not assigned |

1.7.4.2 Pictograms in the control panel

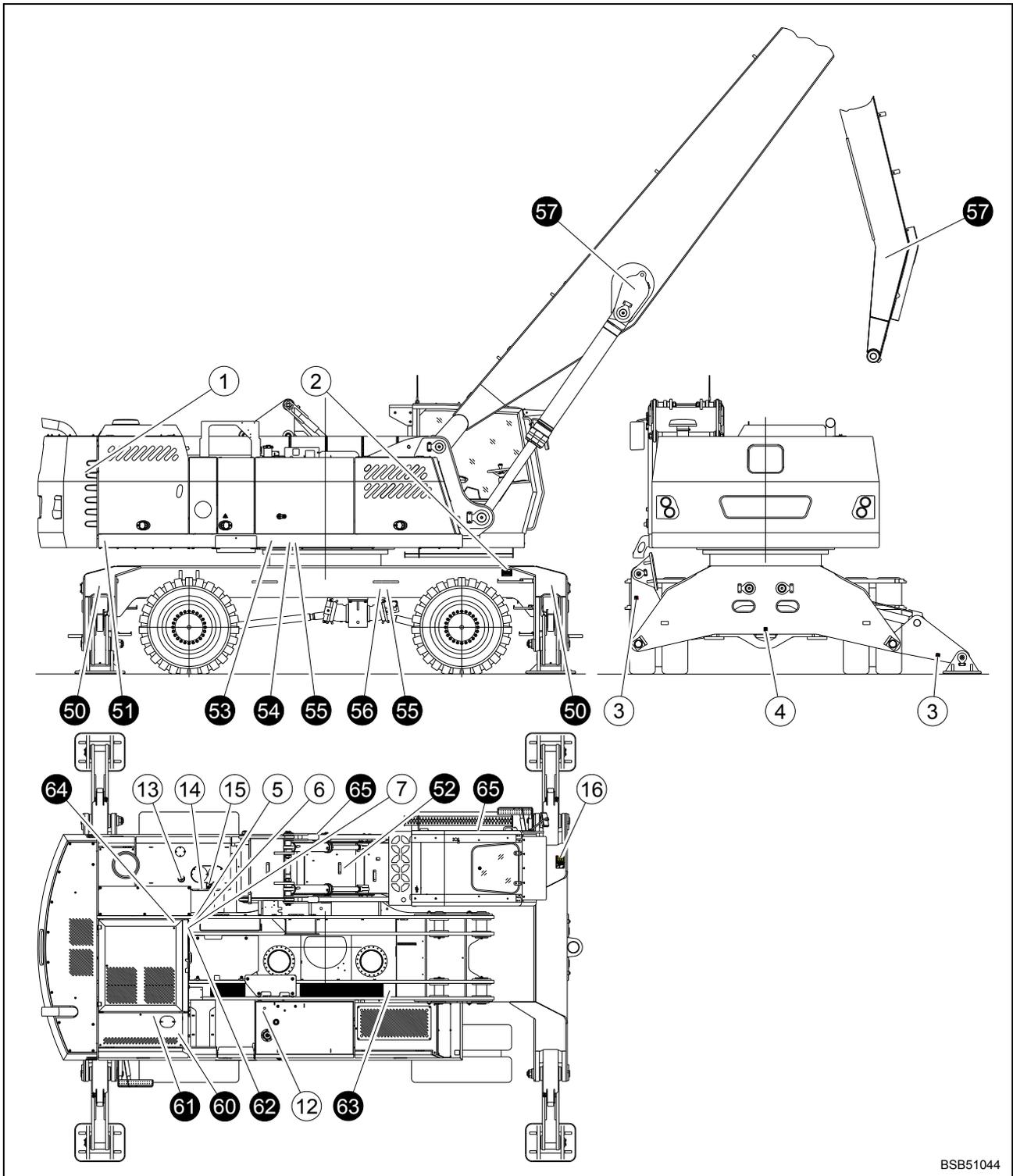
The table below explains the meaning of the pictograms in the control panel. Functions and displays marked (*) are optional.

| Symbol | Description | Symbol | Description |
|---|---|---|---|
|  | Parking brake |  | Flashing control indicator (left) |
|  | Swing brake |  | Flashing control indicator (right) |
|  | Oscillating axle lock release |  | Error display for engine control system (Electronic Engine Control III) |
|  | Working hydraulic ON In case of emergency: Bypass automatic cut-off of work functions if the hydraulic oil level is too low, or the coolant or charge air temperature is too high. |  | Preheat display |
|  | Deactivate close range cut-off (dipperstick) |  | General warning/emergency operation active |
|  | Hazard warning lights |  | Clogged particulate filter indicator * |
|  | Side lights/headlamps | | Not assigned |
|  | Raise cab |  | Cab forward |
|  | Lower cab |  | Cab backward |

1.8 Symbols

Various symbols are used on the machine. These should be visible and legible at all times.

1.8.1 Locations on the machine

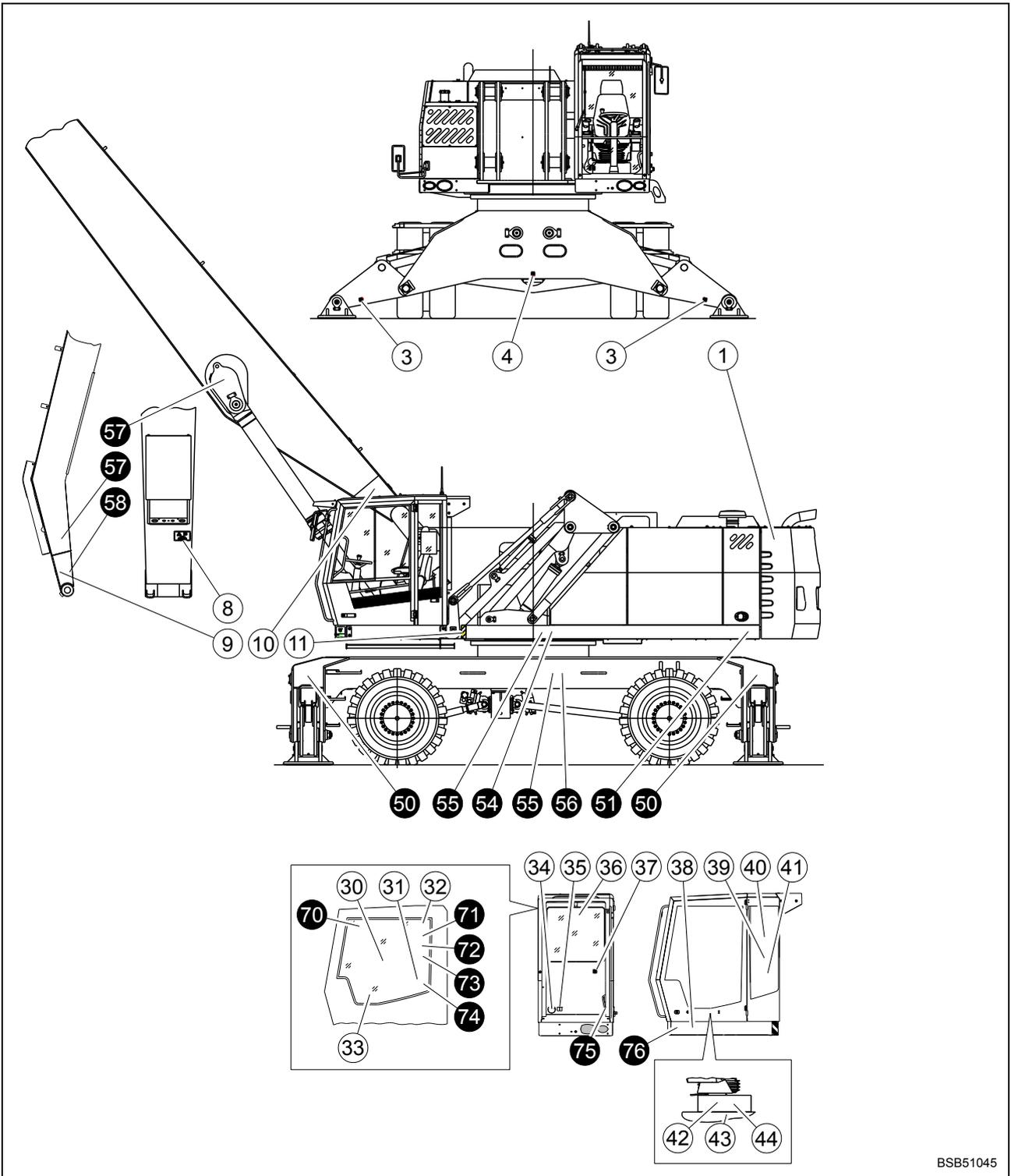


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Fig. 3 Overview

64 Decals under the engine hood

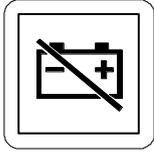
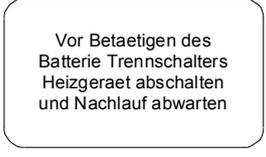
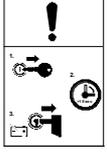
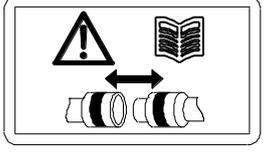
65 Decals in the pressure accumulator area (under the cab lift mechanism and under the bottom plate of the cab)

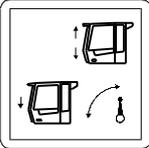
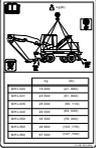
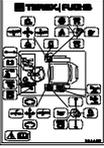
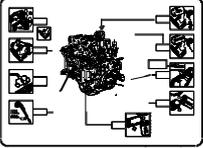


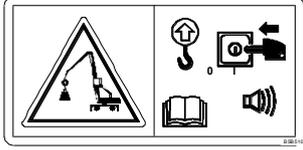
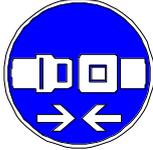
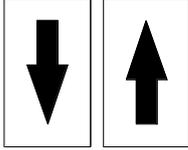
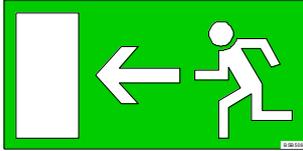
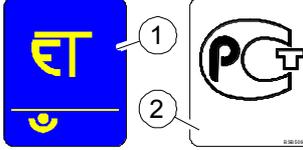
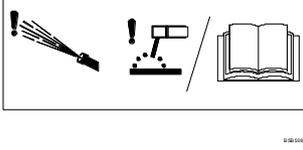
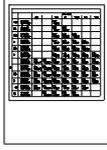
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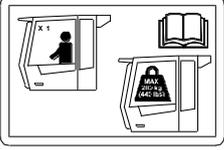
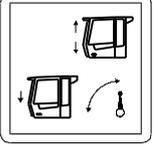
Fig. 4 Overview

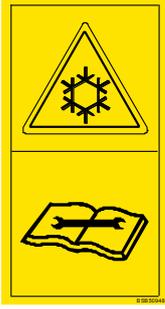
1.8.2 Description

| Item | View | Description |
|------|---|--|
| 1 |  | <p>Danger symbol Indicates the counterweight as a danger area when the uppercarriage is turning (only for Russia).</p> |
| 2 |  | <p>Type plate Contains selected information to identify the machine and its technical data. <i>i</i> Chapter 1.5 Type plate and vehicle identity number</p> |
| 3 |  | <p>Information sign for loading by crane Indicates the lifting points on the outrigger feet for lifting the machine to load by crane. <i>i</i> Chapter 6 Recovery, Loading, and Transporting</p> |
| 4 |  | <p>Information sign for lashing Indicates the lashing points for transport on the front and rear. <i>i</i> Chapter 6 Recovery, Loading, and Transporting</p> |
| 5 |  | <p>Information sign for battery cut-off Indicates the battery isolator switch. Note information in the operating instructions. <i>i</i> Chapter 4.6.1 Battery isolator switch</p> |
| 6 |  | <p>Warning plate for supplementary heating (optional) Information on the relationship between the supplementary heating and the battery: "Before operating the battery isolator switch, switch off the heater and wait for the overrun period to end". <i>i</i> Chapter 4.9.2 Supplementary heating (optional)</p> |
| 7 |  | <p>Risk of machine damage If the battery isolator switch is switched off while the machine is running, this can cause damage to the machine. 1. Run down and then switch off the diesel engine. Remove ignition key. 2. Wait at least 15 seconds. 3. Switch off the battery isolator</p> |
| 8 |  | <p>Warning plate for quick couplings Release hydraulic pressure before disconnecting. Note information in the operating instructions. <i>i</i> Chapter 7.3 Discharging residual pressure in the hydraulic circuit Tool manufacturer's documentation</p> |
| 9 |  | <p>Carrying capacity sign (only for Italy) Information about the maximum right and left carrying capacity on the dipperstick. <i>i</i> Chapter 3.13 Working range of the machine</p> |

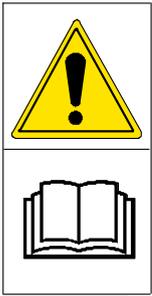
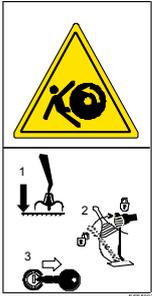
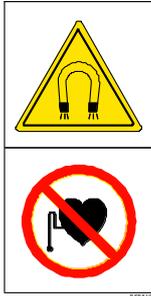
| Item | View | Description |
|------|---|---|
| 10 |  | <p>Carrying capacity sign (only for Italy and FQC) Indication of the maximum right and left carrying capacity on the boom. ⓘ Additional operating instructions</p> |
| 11 |  | <p>Danger symbol Indicates the cab - cab lift mechanism - uppercarriage danger area. ⓘ Chapter 4.11 Cab which can be raised and moved forward hydraulically</p> |
| 12 | | <p>Not available.</p> |
| 13 |  | <p>Information sign for hydraulic oil Indicates the filler opening for the hydraulic oil. ⓘ Chapter 7.9.13 Hydraulic system</p> |
| 14 |  | <p>Information sign for emergency lowering Indicates effect of emergency lowering valve lever on cab movement. ⓘ Chapter 4.11 Cab which can be raised and moved forward hydraulically</p> |
| 15 |  | <p>Emergency lowering valve on uppercarriage Indicates the emergency lowering valve's adjustment handle with red paint. ⓘ Chapter 4.11 Cab which can be raised and moved forward hydraulically</p> |
| 16 |  | <p>Information sign for loading by crane Using symbols, shows the crane loading and lists the weight of loading machines by type. Indicates details in the operating instructions.</p> |
| 30 |  | <p>Information sign for control unit Indicates the most important control elements in the cab. ⓘ Chapter 4 Display and control elements Chapter 5 Work operation</p> |
| 31 |  | <p>Information sign for diesel engine Lists the key maintenance work specified by the engine manufacturer. ⓘ Chapter 7 Care and Maintenance</p> |

| Item | View | Description |
|------|---|--|
| 32 |  | Information sign for sound power level Indicates the machine's sound power level. i Chapter 3.12 Noise level values |
| 33 |  | Information sign for the overload warning device Refers to the black key switch. Position 0: Overload warning device deactivated Position I: Overload warning device activated i Chapter 5.1.14 Overload warning device for hoisting (optional) |
| 34 |  | Mandatory sign for safety belt Indicates that the safety belt must be worn in the cab. i Chapter 4.8 Operator's stand |
| 35 |  | Information sign for accelerator pedal Indicates the direction of travel for the accelerator pedals. Note the effect on the position of the uppercarriage! i Chapter 4.1 Overview of the display and control elements |
| 36 |  | Escape sign for emergency exit Indicates the rear window as the emergency exit. i Chapter 4.10.9 Emergency hammer |
| 37 |  | Location of operating instructions Indicates the storage location of the operating instructions. |
| 38 |  | Certification labels 1 All loading machines except Russia 2 For Russia only |
| 39 |  | Risk of machine damage Cleaning using high-pressure water, or welding on the machine, may lead to damage of the electrical components. i Chapter 2.3.5 Welding on the machine Chapter 7.10 Care and cleaning |
| 40 |  | Information sign for carrying capacity table (depending on order) Lists the SWLs (safe working loads). The sign may or may not be present depending on the country of delivery. i Chapter 3.13 Working range of the machine |

| Item | View | Description |
|------|---|---|
| 41 | | Not available. |
| 42 |  | <p>Information sign for the maximum carrying capacity of the cab Maximum carrying capacity of the cabin with operator and load.</p> |
| 43 |  | <p>Emergency lowering valve in the cab Indicates the emergency lowering valve's adjustment handle with red paint. This enables the cab to be lowered manually if the hydraulics fail.</p> <p> Chapter 4.11 Cab which can be raised and moved forward hydrau-</p> |
| 44 |  | <p>Information sign for emergency lowering Indicates effect of emergency lowering valve lever on cab movement.</p> <p> Chapter 4.10.9 Emergency hammer</p> |

| Item | View | Description | Item | View | Description |
|------|---|---|------|--|--|
| 50 |  | Danger of crushing Coming into contact with the moving outrigger can lead to death or serious injury. Maintain a sufficient distance from the moving outrigger. | 51 |  | Danger of crushing Coming into contact with the moving machine can lead to death or serious injury. Maintain a sufficient distance from the moving machine. |
| 52 |  | Danger of poisoning Contact with refrigerants can lead to death or serious injury. Ensure that you read and understand the instructions before servicing the air conditioning system. | 53 |  | Danger of falling Falling can lead to death or serious injury. Use the ascending and descending aids provided. |
| 54 |  | Danger of crushing Coming into contact with the moving machine can lead to death or serious injury. Maintain a sufficient distance from the moving machine. | 55 |  | Danger of electric shock Coming into contact with power supply lines can lead to death or serious injury. Maintain a safe distance. |
| 56 |  | Danger of being drawn in Coming into contact with the rotating drive train will lead to death or serious injury. Maintain sufficient distance from the rotating drive train. Switch off the diesel engine before performing any maintenance work. | 57 |  | Danger of crushing Coming into contact with the moving loading equipment or grab can lead to death or serious injury. Maintain a sufficient distance from the moving loading equipment and grab. |

| Item | View | Description | Item | View | Description |
|------|---|--|------|--|--|
| 58 |  | Danger due to magnetic field (only with optional magnet system) Standing close to a strong magnetic field may affect the function of a heart pacemaker. This may be fatal or lead to serious injury in those wearing heart pacemakers. | 60 |  | Danger of burns The release of hot, pressurized fluids can lead to death or serious injury. Do not open the sealing cover until the fluid has cooled. |
| 61 |  | Warning plate for engine compartment Coming into contact with rotating parts can lead to death or serious injury. Maintain a sufficient distance from belts and fans when the diesel engine is running. Switch off the diesel engine before performing any maintenance work. | 62 |  | Danger of explosion/chemical burns An exploding battery or contact with caustic acid can lead to death or serious injury. Keep open flames and sparks away. Wear personal protective equipment, especially gloves, face protection, and long-sleeved overalls. |
| 63 |  | Danger of penetration Fluid escaping under pressure may penetrate the skin and lead to death or serious injury. | 64 |  | Danger of burns Coming into contact with hot surfaces may lead to death or serious injury. Maintain a sufficient distance from hot surfaces. Allow the machine to cool down before performing any maintenance work. |
| 65 |  | Danger of explosion The quick release of pressurized fluids or gas may lead to death or serious injury. Depressurize the system before servicing hydroaccumulators. No welding, attachment, or soldering work is permitted on hydroaccumulators. Keep flames or other sources of heat at a sufficient distance from the hydroaccumulator. | 70 |  | Danger of impact A falling window can lead to death or serious injury. Use the locking device to latch an open window. |

| Item | View | Description | Item | View | Description |
|------|---|--|------|--|---|
| 71 |  | <p>Improper operation or maintenance can lead to death or serious injury. Ensure that you read and understand the operating instructions and safety signs before operating or servicing the equipment. If the information in the instructions is not clear, ask a supervisor, the operator, or the manufacturer.</p> | 72 |  | <p>Danger of electric shock Coming into contact with power supply lines can lead to death or serious injury. Maintain a safe distance. Before operating the machine, ask the owner of the power supply lines to disconnect, move, or isolate them.</p> |
| 73 |  | <p>Danger of crushing Sudden or unexpected movements of the machine can lead to death or serious injury. Before leaving the operator's seat, ensure that: 1. The loading equipment is on the floor 2. The parking brake is engaged 3. The diesel engine is switched off and the key has been removed from the ignition.</p> | 74 |  | <p>As (58), but transparent.</p> |
| 75 |  | <p>Danger of falling Falling can lead to death or serious injury. Always use the safety belt. Only operate the machine with the cab door closed.</p> | 76 |  | <p>Danger of falling Falling can lead to death or serious injury. 1. Completely lower the cab. 2. Use the ascending and descending aids provided when entering and leaving the cab.</p> |

1.9 Operating instructions provided by other suppliers

The operator must also comply with the operating instructions listed below covering components from outside suppliers. Reference is made to these operating instructions in the TEREX | Fuchs operating instructions.

| Operating instructions | Manufacturer |
|----------------------------|--------------|
| Diesel engine | Deutz |
| Central lubrication system | Lincoln |
| Optional: | |
| Supplementary heating | Eberspächer |
| Tank filling pump | Johnson Pump |

 Supplied CD

1.10 Copyright

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2 Safety and accident prevention

Working with the machine can expose owners, operators or maintenance specialists to hidden dangers. Dangers and accidents can be prevented by reading, then continuously and thoroughly rereading and complying with the various safety instructions. This applies particularly to persons who only work with the machine occasionally - during maintenance work, for example.

Following the safety requirements outlined below conscientiously will ensure your safety and that of others, and will prevent damage to the machine.

Compliance with these requirements does not absolve you of the responsibility to adhere to the safety requirements and regulations issued by legislators or employer's liability insurance associations which are applicable at the installation location.

Safety instructions have been included in these operating instructions for jobs and activities that might be dangerous. These safety instructions describe various dangers that are emphasized by the terms **DANGER**, **WARNING**, **CAUTION**, and **ATTENTION**.

2.1 Declaration of conformity



The machine meets the basic requirements of applicable European regulations.

Conformity is hereby confirmed. An original copy of the declaration of conformity is included in the sales documentation. The contents can be found on the inside page of the cover.

A copy of the declaration of conformity is kept on file by the manufacturer.

2.2 General safety notes

- Familiarize yourself with the operating instructions before the machine is put into operation for the first time. Make sure that you have any additional manuals in your possession and have read and understood them (these may be related to special equipment on your machine).
- Only persons explicitly authorized to do so may operate, maintain or repair the machine. All such persons must be of the legal minimum age.
- Only trained personnel or those who have undergone proper instruction may be deployed. Personnel responsibilities for operating, fitting, maintaining and repairing the machine must be clearly defined. Authorize your personnel to ignore third-party instructions that contravene health and safety. This also applies with regard to instructions contravening traffic regulations.
- Personnel who are being trained, instructed or are involved in a general training program must only be allowed to work with the machine under the supervision of an experienced person.
- Make checks at regular intervals to ensure personnel are working in a safety-conscious manner in compliance with the operating instructions.
- Wear protective work clothing when you are working on or with the machine. Rings, wristwatches, ties, shawls, open jackets or any other loose clothing should not be worn. Otherwise there is a danger that clothing may become stuck or caught in the machine. Protective goggles, protective boots, helmets, gloves, reflective jackets, ear protection, etc. may be required for certain tasks.
- Ask the site supervisor about special safety requirements.
- Always fold up the left armrest before getting out of the operator's seat.
- When getting in and out, do not hold onto the steering column, the operator control panel or the operating levers. This could cause inadvertent movements that could result in accidents.
- Never jump off the machine. Instead use the steps, ladders, and hand grips designed for mounting and descending. Grab on with both hands and face the machine.
- The rear windshield acts as an emergency exit.
- For maintenance and repair jobs, observe the following points as described in these operating instructions:
 - park the machine only on a solid and level surface,
 - set down the open work attachment carefully on the ground,
 - release the pressure in the hydraulic system,
 Chapter 7.3 Discharging residual pressure in the hydraulic circuit
 - move all operating levers to the neutral position and fold up the left armrest,
 - turn off the diesel engine and remove the ignition key.
- Before any work takes place on the hydraulic circuit, the pressure in the hydraulic system and inside the tank must also be released as described in these operating instructions.
- Secure all loose parts on the machine.
- Never put the machine into operation without having first performed a thorough walk-around inspection and checking whether any safety signs are missing or illegible.
- The manufacturer's approval must be obtained before making any changes, additions or conversions to the machine that could impair safety. This also applies to the installation and adjustment of safety devices and safety relief valves, as well as to any welding work on load-bearing elements.

2.2.1 Avoiding crushing and burns

- Do not work under the loading equipment unless it is resting safely on the ground or is fully supported.
 - Do not work underneath the cab or underneath the lift frame when the cab is raised and not secured by a support sleeve.
 - Do not use any restraining devices such as cables or chains that are damaged or do not have sufficient carrying capacity. Wear safety gloves when working with wire cables.
 - Never use your fingers to align the holes when working on the equipment. Use a suitable mandrel instead.
 - Check that there are no hands or objects that could be pulled into the fan when the diesel engine is running. The fan can cause severe injuries, eject or destroy objects, or be damaged itself by these objects.
 - Close to the operating temperature, the entire engine cooling system is hot and pressurized. Avoid touching parts that carry coolant. There is a risk of burns.
 - Only check the coolant level if the cap of the expansion container has cooled off enough for you to hold it. Then turn the cover carefully to first release the excess pressure.
 - Close to the operating temperature, the engine oil and hydraulic fluid are hot. Avoid touching hot oil or parts carrying oil.
 - Wear protective goggles and protective gloves when you are working on the battery. Avoid sparks and naked flames.
 - Never allow a helper to guide the grab manually.
- Before performing any work in the engine compartment, always use the supports provided to prevent the engine cover closing unintentionally.
 - There is a risk of being crushed by the lift frame due to the movement of the cab, since the operator in the cab cannot see all areas fully. The same kind of risk applies when lowering the elevating cab in an emergency using the ball valves provided.
 - ❗ Chapter 4.11.6 Emergency lowering of cab

2.2.2 Avoiding fire and explosion

- Turn the diesel engine off when refueling.
- Check the electrical system regularly.
- Have all faults such as loose connections, blown fuses and bulbs, or singed or worn away wiring repaired by specialist personnel immediately.
- When refueling or charging the batteries, avoid smoking and naked flames.
- Always start the diesel engine according to the directions in the operating instructions.
- Do not take any flammable liquids on the machine, except in tanks provided for that purpose.
- Check all lines, hoses and screw couplings regularly for leaks and damage. Repair all leaks immediately and replace any defective parts. Oil spraying out of leaks can easily lead to fire.
- Check that all supports and protective signs have been installed properly so as to withstand vibrations, abrasion and heat build-up.
- Do not use jump starters containing ether to start diesel engines with preglow or flame-glow systems! Otherwise there is a DANGER OF EXPLOSION!
- You should familiarize yourself with where the (optional) fire extinguishers are located on the machine and how to use them, as well as with on-site options for reporting and fighting fires.

2.2.3 Safe operation despite obscured view

Depending on the position of the cab lift and loading equipment as well as the area behind the counterweight, the driver may have a restricted field of vision. He or she will not therefore always be able to see people and obstacles in the close vicinity of the machine.

To avoid injuring persons and machine collisions, the driver must take the following actions before starting and when operating the machine:

- Set the outside mirror to optimum visibility.
- Rear view camera function test.
 -  Chapter 4.13.1 Rear view camera (optional)
- Vehicle reversing alarm function test (optional). A pulsed alarm must sound during travel.
- Mark the machine's work zone using barrier tape.
- Ensure that there are no people or obstacles in the danger zone. Observe field of vision and visual aids during operation.
- Activate the horn before starting the engine.
- Before driving the machine, move the cab lift and loading equipment into a position offering optimum visibility.
- Activate the horn before driving the machine.
- When driving the machine in an area where visibility is poor, a second person must be deployed to offer guidance and protection.

Modifications to the machine undertaken by the operator must not limit the driver's visibility.

2.2.4 Putting the machine into operation safely

- Before putting the machine into operation, always perform a thorough walk-around inspection of the machine.
- Check the machine for loose pins, tears, wear, leaks and deliberate damage.
- Never put a damaged machine into operation.
- Have the damage made good immediately.
- Make sure that all hoods and covers are closed, but locks are not closed off.
- Check that all safety signs are present.
- Check that the windows and the inside and outside mirrors are clean. Secure doors and windows against inadvertent movements.
- Make sure that no-one is working on or under the machine and warn any persons standing nearby by pressing the horn before putting the machine into operation.
- Before putting the machine into operation, adjust the operator's seat, the mirror and the operating levers so you can work comfortably and safely.
- Follow the applicable regulations for the site you are working on.
- Never put the machine into operation without the cab.

2.2.5 Starting the machine safely

- Before starting, check all indicator lamps and instruments to make certain they are working properly, move all operating levers to the neutral position and fold the left armrest down.
- After starting the diesel engine, give a short blast of the horn to warn persons who are in the vicinity of the machine.
- Only start the machine from the operator's seat.
- Unless there are instructions to the contrary, start the diesel engine as described in the operating instructions.
- Only allow the diesel engine to run in enclosed rooms if there is adequate ventilation. If necessary, open doors and windows to ensure a proper supply of fresh air.
- Bring the diesel engine and hydraulic fluid up to operating temperature. Low oil temperatures cause the control system to respond sluggishly.
- Check the loading equipment control unit to ensure it is working properly.
- Carefully move the machine to open terrain and then check all safety-relevant functions.

2.2.6 Safe working with the machine

- The values in the carrying capacity tables must be strictly observed and must not be exceeded.
- Before starting work, familiarize yourself with the specific features of the site of operation, specific requirements and warning signals. The working environment includes, for example, obstructions in the working area, the load bearing capacity of the ground and requirements to close the site off to public traffic.
- Always maintain an adequate safety distance from overhangs, edges, embankments and unsafe ground.
- Be particularly attentive if visibility is poor and soil conditions vary.
- Familiarize yourself with the location of supply lines at the site of operation and be particularly careful when working close to them. If necessary, inform the relevant authorities.
- Keep the machine at an adequate distance from overhead electrical lines. When working in the vicinity of overhead electrical lines, do not move the loading equipment close to the lines. Risk of fatal injuries! Find out what the applicable safety distances are.
- In the event of electrical current jumping from a line to the machine, proceed as follows:
 - do not perform any movements with the machine or its loading equipment,
 - do not leave the cab,
 - warn persons outside not to approach or touch the machine,
 - have the electricity turned off.
- Before moving the machine, always check that accessories are positioned so they will not cause an accident.
- Always turn on the light when visibility is poor or it is dark.
- Do not allow any passengers on the machine.
- Always be seated with the safety belt fastened while working.
- Report all operating faults and make certain all necessary repairs are performed immediately.
- Personally ensure that setting the machine in motion will not put anyone in danger.
- Before starting work, check the brake system according to the requirements in the operating instructions.
- Never leave the operator's seat while the machine is in motion.
- Never leave the machine unattended with the diesel engine running.
- The machine must be used, driven and operated in such a way that it is always stable and not at risk from overturning. Loading equipment must only be used with known loads, especially in grab operation.
- The maximum permissible incline/transverse inclination that the machine can traverse depends on the ground and the attached equipment.
- Adjust the travel speed to on-site conditions.
- Avoid operational movements that could cause the machine to tip over.
- If possible, always work facing uphill or downhill and never sideways to the incline.
- Drive downhill only at the lowest travel speed. Otherwise you risk losing control of the machine.
- Drive downhill only at a low travel speed. Otherwise you risk losing control of the machine. The diesel engine must be running at maximum speed and the speed must be reduced by selecting the lower travel speed range.

- When loading a truck, insist that the truck driver leaves the driver's seat, even if protection from falling rocks is available.
- For crane operation, always use the protective equipment designed for this purpose.
- On terrain where visibility is poor and whenever necessary, have a guide help you. Have only one person assigned to give you signals.
- Only experienced persons must be assigned the task of attaching loads and acting as banksmen to guide the machine operator. Banksmen must remain within the operator's range of vision or stay in voice contact.
- Depending on the combination of equipment, there may be a risk of collision between the grab and the cab, the grab and the cab guard or the grab and the lift cylinders. When the grab moves into this area, the greatest possible care must be taken to avoid damage.

2.2.7 Parking the machine safely

- If at all possible, the machine should be parked on an even and solid surface. If it has to be parked on an incline, chocks should be used to ensure that the machine cannot roll away.
- Lower the loading equipment and anchor the work attachment a little in the ground.
 - ❗ Chapter 4.14 Parking the machine
- Move the operating levers to the neutral position and apply the travel and swing brake.
- Turn off the diesel engine as described in the operating instructions and fold up the left armrest before leaving the operator's seat.
- Lock the machine, remove all keys and secure the machine against unauthorized use.

2.2.8 Transporting the machine safely

- Use only suitable transport and lifting equipment with sufficient carrying capacity.
- Park the machine on flat ground and use chocks to secure the wheels.
- The gradient of the ramp for driving onto the flat bed trailer must not exceed 30°. Wooden planks must be placed on ramps to prevent slipping.
- Clean the undercarriage. The undercarriage must be swept clean. Before driving onto the ramp, any snow, ice and sludge must be cleaned off the wheels.
- Remove the chocks from the wheels.
- Line the machine up exactly with the loading ramp.
- **It is prohibited to turn the uppercarriage whilst the machine is on the transport vehicle.**
- Have a banksman give the machine operator the necessary signs.
- Swing in the loading equipment and drive onto the ramp. Always keep the loading equipment just above the loading surface. Drive onto the ramp very carefully and then onto the transport vehicle.
- Once the machine has been loaded onto the flat bed trailer, the uppercarriage must be secured against the undercarriage to prevent the uppercarriage from turning (swing brake engaged).
- Secure the machine and other individual parts against slipping with chains, in compliance with national requirements for loading and transport.
- Before leaving the machine, relieve all pressure lines of pressure (as described in the operating instructions), remove the ignition key and fold up the left armrest.
- Close all cab and paneling doors.
- Ensure no-one is on the machine during transport.
- Before setting off, find out about the route to be taken, especially with regard to limits for width, height and weight.
- Pay close attention when driving under electrical lines and bridges or driving through tunnels.
- When unloading, proceed as cautiously as when loading.

2.2.9 Towing the machine safely

- Always observe the correct procedure.
 - ❗ Chapter 6.1 Towing the machine
- The machine may be towed only in exceptional cases, for example to bring the machine away from a dangerous site for repair.
- Check that all trailing and towing devices are safe and secure when pulling or towing.
- Towing equipment such as cables, rods, etc., must have sufficient tensile strength and must be fastened to the designated towing lug on the undercarriage. Damage and accidents that occur when towing the machine do not fall under the warranty obligation of the manufacturer.
- When towing, make sure that no-one is in the vicinity of the towing equipment.
- Keep the cable taut and avoid kinks.
- Take care when pulling the cable taut. Sudden jerks can cause sagging cables to tear.
- When towing, comply with the specified transport position, permissible speed and distance.
- Restore the machine to its proper condition after towing.
- When putting the machine back into operation, proceed solely in accordance with the operating instructions.

2.2.10 Hoisting (optional)

If the loading machine is to be put into hoisting operation, the safety equipment prescribed by national law must be present and in full working order. According to EC Machinery Directive 2006/42/EC and DIN EN 474-5:2006+A2:2012, the following are required:

- Overload warning device
- Hose-rupture safety valves on lift cylinders
- Hose-rupture safety valves on dipperstick cylinders
- Carrying capacity table in the cab (included in the operating instructions)
- Suitable attachment (load hooks should be used for loading machine MHL380 D)

2.2.11 Residual risk

Even when used as intended in compliance with all instructions provided, a residual risk cannot be ruled out. As such, misuse or technical defects may cause substantial damage to property and a risk of personal injury, including severe injuries or even death. These residual risks can be kept to a minimum by handling the machine carefully and competently. They cannot, however, be fully eliminated.

2.3 Safe maintenance of the machine

2.3.1 General safety notes

- Maintenance and repair work must only be performed by trained specialist personnel.
- The prescribed intervals or the intervals specified in the operating instructions for periodic checks/inspections must be observed. A suitably equipped workshop absolutely essential for performing maintenance tasks.
- The maintenance and inspection plan precisely defines who must or may perform which tasks. Specific jobs may be performed by the machine operator (or operating personnel). Other tasks may only be performed by specialist personnel with the appropriate training.
- Spare parts have to meet the technical requirements set out by the manufacturer. This is always ensured if you use original spare parts.
- Wear protective work clothing when performing maintenance work. In addition to a safety helmet and safety boots, certain jobs also require protective goggles and protective gloves.
- Keep unauthorized persons well away from the machine during maintenance.
- If necessary, cordon off ample space for the maintenance area.
- Inform operating personnel before starting to perform special and maintenance tasks. Appoint supervisors.
- If nothing is indicated to the contrary in the operating instructions, all maintenance work on the machine must be carried out on a solid and level surface with the loading equipment set down and the diesel engine turned off.
- For all maintenance work, especially when working under the machine, hang a warning sign "Do not turn on" by the ignition key lock, ensuring that it is clearly visible. Remove the ignition key and turn off the battery isolator switch.
- Always tighten screws that were loosened during maintenance and repair tasks.
- If disassembly of safety equipment is required, the safety equipment must be reconnected and checked immediately upon completion of the relevant tasks.

2.3.2 Safety instructions for replacing the (optional) XENON lamp

- Always switch the headlamp off and isolate it from the supply voltage before changing the lamp.
- Never touch the inside of the lamp fitting.
- The electrical connection between headlamp and ballast conducts high voltage and must not be disconnected.
- The ballast (electronic component in the headlamp housing) must never be operated without a lamp, as dangerous voltage flashovers can occur which may cause damage.
- Let the lamp cool down first.
- Wear safety goggles and safety gloves when changing the lamp.
- The glass body of the XENON lamp is filled with various gases and metal gases and is pressurized. **(Risk of splintering!)**
- Never touch the glass lamp of the XENON lamp, hold it only at the base.
- Carefully remove fingerprints with a clean cloth and spirit.
- The XENON lamp should only be operated in a sealed headlamp.
- Should the XENON lamp burst in an enclosed space, the room must be aired for at least 20 minutes to eliminate health risks due to gases.
- Dispose of the old XENON lamp as hazardous waste.
- To ensure that the permissible current intensity for the cable and plug connections is not exceeded, do not connect any further working headlamps in parallel with the existing ones; this will stop fuses blowing.
- Do not replace fuses for electric circuits with fuses that have a higher current rating – otherwise, there is a risk of fire!

| ATTENTION | |
|---|--|
|  | <p><i>In the event of continuing starting difficulties when switching on (flickering light), switch the XENON headlamp off immediately. Otherwise the electronics in the ballast might be damaged beyond repair.</i></p> |

2.3.3 Cleaning the machine

- Before starting maintenance or repair work, clean any oil or fuel off the machine, paying particular attention to the connections and screw couplings. Do not use any aggressive cleaning agents and use lint-free rags.
- Do not use any aggressive cleaning agents or high-pressure cleaners to clean the machine during the first two months after it has been put into operation or after it has been repainted. This will allow the paint to cure completely.
- Do not use flammable liquids to clean the machine.
- Before cleaning the machine with water, high-pressure cleaners, or other cleaning agents:
 - Lubricate all bearing points, bolt connections, and the slewing ring to prevent the ingress of water and steam into the bearing points.
 - Close off or glue shut all openings which water, steam, or cleaning agent must not be allowed to penetrate for safety and/or other reasons. Electrical motors, electrical components, switch cabinets, plug connections and air cleaners are particularly at risk. Propshafts with maintenance-free bearing bushings must also not be cleaned with a high-pressure cleaner. Doing so could have a detrimental effect on the three-lip seal.
- After cleaning:
 - Remove the covers completely.
 - Inspect all fuel, engine oil and hydraulic fluid lines for leaks, loose connections, abrasion and damage.
 - Correct any defects discovered immediately.
 - Lubricate all bearing points, bolt connections and the slewing ring to force out any water or cleaning agent that may have entered.

2.3.4 Crack test on the machine

- Whatever the reason, location, duration and conditions of their use, all machines are subject to a variety of loads. These various loads result in service lives of differing lengths for different components of the machine. This can result in cracks and loose connections, especially on load-bearing parts. To maintain operating safety, the machine must therefore be checked weekly for cracks, loose connections and other visible damage.
- To check for cracks, it is always necessary for the machine to be kept clean and be cleaned regularly.
- To carry out these tests, they should be performed on a solid, level surface, with a changing load and using equipment in longitudinal and transverse direction. Relevant accident prevention requirements must be observed.
- Particular care is required when testing bearing parts, specifically:
 - steel construction undercarriage with axle and gear bearings, outrigger, lower slewing ring support and slewing ring
 - steel construction uppercarriage with bearing block for boom and boom cylinder, upper slewing ring support, cab bearing, fastening of swing gear and counterweight
 - steel parts of the loading equipment, e.g. boom, dipperstick and grab
 - hydraulic cylinders, axles, steering, bolts and bolt connection, steps, ladders, and fastening elements
 - The crack test must be performed visually. To increase test reliability, the color penetration procedure should be used if a crack is suspected or in places that are difficult to see, for example the slewing ring support.
- Any damage that is discovered must be repaired immediately. Welding work on load-bearing parts of loading machines must only be performed by specialist personnel, and only in accordance with accepted welding engineering practice. If you are in any doubt, consult your dealer or a TEREX | Fuchs service engineer for advice on how to proceed.

2.3.5 Welding on the machine

- Welding, burning, and grinding work must only be performed on the machine if it has been explicitly approved by the manufacturer. Clean the machine and the area around it of dust and combustible materials before welding, burning or grinding. Ensure there is adequate ventilation. There is a risk of fire and/or explosion.
- Disconnect the three plug connections on the engine controller and the batteries before working on the electrical system or performing arc welding on the machine.
 - ❗ Chapter 4.6.9 Electronic engine control (EEC)
- Remove the battery isolator switch. Loosen the positive pole of the battery. Connect the positive cable of the battery to the adjacent grounding bolt. When reconnecting the battery, proceed in the opposite order.
- For arc welding, move the ground point on the machine to the immediate vicinity of the welding point.

2.3.6 Repairs on the machine

- Do not attempt to lift heavy parts. Use work aids designed for this purpose with sufficient carrying capacity. Fasten and secure individual parts and large assemblies carefully on lifting equipment so they cannot cause any danger. Use only suitable lifting equipment which is in perfect working order. Loads must be supported by hoisting equipment with sufficient carrying capacity. Do not stand or work under suspended loads.
- Do not use lifting equipment that is damaged or does not have sufficient carrying capacity. Wear protective gloves when working with wire cables.
- Only experienced persons must be assigned the task of attaching loads and acting as banksmen to guide crane drivers. Banksmen must remain within the operator's range of vision or stay in voice contact.
- For jobs above head height, use designated climbing aids and work platforms that meet safety requirements. Do not use machine parts as climbing aids if they were not designed for that purpose. Wear fall protection for work performed at high heights. Keep all grips, steps, platforms, and ladders, etc. free of dirt, snow and ice.
- When working on equipment, ensure there is adequate support. Avoid metal-to-metal contact.
- Always support the machine so that any shifting of weight will not endanger stability. Avoid metal-to-metal contact.
- Work on drive mechanisms, brake and steering systems must only be performed by specialist personnel trained for the task in question.
- If the machine needs to be repaired on an incline, place blocks under the wheels to secure them.
- Only persons with specialist knowledge and experience are permitted to perform work on hydraulic equipment.
- Wear protective gloves when searching for leaks. A fine jet of pressurized liquid can penetrate the skin.
- Do not loosen any lines or screw couplings until the loading equipment has been set down, the diesel engine has been turned off and pressure has been released from the hydraulic system. Once the diesel engine has been turned off, place the ignition key in the contact position and move all joysticks and similar devices (four-way control levers and pedals) in both directions to release the control pressure and dynamic pressures in the hydraulic circuits. Then reduce the pressure inside the container as described in these operating instructions.

2.3.7 Electrical system

- Check the electrical system regularly. Have all faults such as loose connections, blown fuses and bulbs, or singed or worn away wiring repaired by specialist personnel immediately.
- Use only original fuses with the recommended current rating.
- Work on electrical equipment must only be performed by an electrical specialist or trained persons under the supervision of an electrician in accordance with electrical requirements.
- When working on live parts, enlist the assistance of a second person to press the emergency stop or battery isolator switch in the event of an emergency. Close off the work area with a red-and-white safety cordon and a warning sign. Use only electrically insulated tools.
- Start by checking live parts to ensure they are free of voltage. Then ground them and short-circuit them. Isolate adjacent parts that are under voltage.
- Disconnect the three plug connections on the engine controller and the batteries before working on the electrical system or performing arc welding on the machine.

Loosen the negative pole of the battery first, then the positive one. Connect the positive cable of the battery to the adjacent grounding bolt. When reconnecting the battery, proceed in the opposite order.

2.3.8 Hydroaccumulators

- All work on hydroaccumulators must be performed by trained specialist personnel only.
- Unsuitable mounting and handling of hydroaccumulators can result in serious accidents.
- Do not put damaged hydroaccumulators into operation.
- Before working on a hydroaccumulator, reduce the pressure in the hydraulic system as described in these operating instructions.
- Do not weld or solder onto the hydroaccumulator and do not perform any mechanical work. The hydroaccumulator can be damaged by the effects of heat and can burst due to mechanical processing. **DANGER OF EXPLOSION!**
- Only specialist personnel are permitted to fill the hydroaccumulator with nitrogen. Using oxygen or air will result in **DANGER OF EXPLOSION!**
- The body of the accumulator may become hot during operation, resulting in a risk of burns.
- New hydroaccumulators must be filled with the necessary pressure for the intended purpose prior to putting the machine into operation.
- Operating data (minimum and maximum pressure) must be constantly indicated on the hydroaccumulators. The indicator must remain permanently visible.

2.3.9 Hydraulic hoses and hose lines

- It is forbidden to repair hydraulic hoses and hydraulic hose lines!
- All hoses, hose lines, and screw couplings must be regularly inspected every 2 weeks (or immediately if damage is suspected) for leaks and externally visible damage! Replace any damaged parts immediately! Spraying oil can cause injuries and/or fires.
- Even if they are stored properly and subjected only to permissible loads, hoses and hose lines are susceptible to natural wear. Their service life is therefore limited.
 - Improper storage, mechanical damage and impermissible use are the most frequent causes of failure.
 - With regard to service life, all standards, rules, and regulations regarding hoses and hose lines which are applicable at the site of operation must be observed.
 - Use in the limit zone of permissible load can reduce service life (for example high temperatures, frequent changing movements, extremely high pulse frequencies, multi-shift operation).
- Hoses and hose lines must be replaced if any of the following conditions are encountered during inspections:
 - damage to the outer hose up to the insert (e.g. abrasion, cuts and tears)
 - thinning of the outer layer (appearance of cracks in the hose material)
 - deformation distorting the natural shape of the hose or hose line both when pressurized and when depressurized, as well as when bent (e.g. separation of layers, formation of bubbles)
 - leaks
- noncompliance with installation requirements
- damage to or deformation of the hose fitting that reduces the stability of the fitting or the hose/fitting connection
- hose coming loose from the fitting
- corrosion of the fitting which reduces functionality and stability
- exceeding of storage times and usage periods
- When replacing hoses and hose lines, use only original spare parts.
- Lay and mount hoses and hose lines properly. Do not mix up connections.
- When replacing hoses and hose lines, please note:
 - Always make certain hoses and hose lines are not under torsion when installed. For high-pressure hose lines, the screws and half-clamps or full flanges at both ends of the hose must be fitted first and then tightened.
 - For high-pressure hoses and hose lines with curved fittings, when tightening the flange, the side with the curved fitting must always be tightened first, followed by the side with the straight fitting.
 - Any fastening clamps located in the middle of the hose must be attached first and then tightened.
 - Check daily to make certain all clamps, covers, and protective devices are properly fastened. This will prevent vibrations and damage during operation.
 - Lay the hoses and hose lines so that they cannot rub against other hoses or parts.

- When replacing hoses and hose lines on moving parts (for example from the boom to the dipperstick), check the entire range of movement for abrasion points before putting the machine into operation for the first time.

2.4 Lubricants, coolants and fuels

- Applicable safety requirements must be observed when working with oils, greases and other chemical substances.
- Ensure that fuels, lubricants and coolants, as well as replaced parts, are disposed of in an environmentally friendly manner.
- Proceed carefully when working with hot lubricants, coolants and fuels (risk of burns and scalding).

2.4.1 Refrigerant

If the air conditioning system incurs any damage, R134a refrigerant may escape. This causes a burning sensation if it comes into contact with your eyes and skin as a fluid. Do not inhale evaporating coolant!

Work on the air conditioning system is only to be performed by an authorized service engineer.

2.5 Cab which can be raised and moved forwards

- Park the machine on a level and horizontal surface. Position the uppercarriage in relation to the undercarriage so that the steps on each line up.
- Keep steps, ladder and handrails (handles) in good order. Particular care should be taken to ensure that they are free of dirt, oil, ice and snow.
- When climbing up, face the machine and always use the three-point support technique, i.e. two hands and one foot or two feet and one hand must always be in contact with the access system simultaneously.
- When you can reach the door handle with your free hand, open the door first before you climb higher. External influences, for example wind, can make it difficult to open the door. You should therefore keep your hand on the door at all times when opening it. Make sure that the door snaps into place once it is open, to prevent it opening or closing.
- Then climb up and take your seat in the cab straight away. Next, close the door and put on the safety belt.
- When leaving the machine proceed with the same care as when entering.
- Park the machine on a level and horizontal surface. Position the uppercarriage in relation to the undercarriage so that the steps on each line up. Open the safety belt.
- When climbing down stand with your face toward the machine and use the three-point support technique. Climb down as far as you need to in order to be able to close the door safely. Keep your hand on the door at all times when closing it.
- Then climb down to the ground.

2.5.1 Cab protective grating

Raised loading equipment constitutes a hazard due to potential oscillations which could result in the attached load falling off.

If such a risk exists, a protective front roof grating (FOPS) conforming to ISO 10262 must be fitted to the front of the cab.

A protective roof grating (FOPS) conforming to DIN EN ISO 3449-II must be installed if there is a risk of objects falling from above.

If there is a risk that objects could fall through the gaps in between the cab protective grating, then the cab must also be fitted with reinforced glass.

ATTENTION

Cab protective grating is a safety component which will need to be replaced if original parts provided by the machine manufacturer sustain any damages.

2.5.1.1 FOPS/Protective roof grating conforming to DIN EN ISO 3449-II

The cab features four holes in the roof for fitting a protective roof grating. This guard is a special version for the applications in question. Test certificates to DIN EN ISO 3449-II can be obtained from the manufacturer.

2.5.1.2 FOPS/Front protective roof grating conforming to DIN EN ISO 10262

The cab features six holes on the front and in the roof for fitting the front protective roof grating. Test certificates to ISO 10262: 1998-06 and SAE J 1356: 2002-08 can be obtained from the manufacturer.

2.6 Equipment and attachment parts

Equipment and attachment parts from third-party manufacturers or those that have not been generally approved by TEREX | Fuchs for fitting or mounting must not be fitted to or mounted on the machine without the prior written consent of TEREX | Fuchs.

TEREX | Fuchs must provide the necessary technical data for this purpose.

2.6.1 Retrofitting an electric motor

If an electric motor is switched off, it will continue to rotate for a short period of time and, as a result of this, voltage may be fed into the on-board power supply. Consequently, machine malfunctions may occur. To prevent this, the motor must be switched via a relay.

2.6.2 Additional devices (wireless, mobile, radio)

If additional devices are connected, they must satisfy the requirements of the international standard ISO 13766. In particular, these devices must not output interferences above 24 V/m.

⚠ Failure to observe this notice may result in malfunctions to the machine control unit, potentially causing severe or even fatal injuries as well as serious damage to the machine.

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3 Technical data

3.1 Dimensions

3.1.1 Uppercarriage and undercarriage

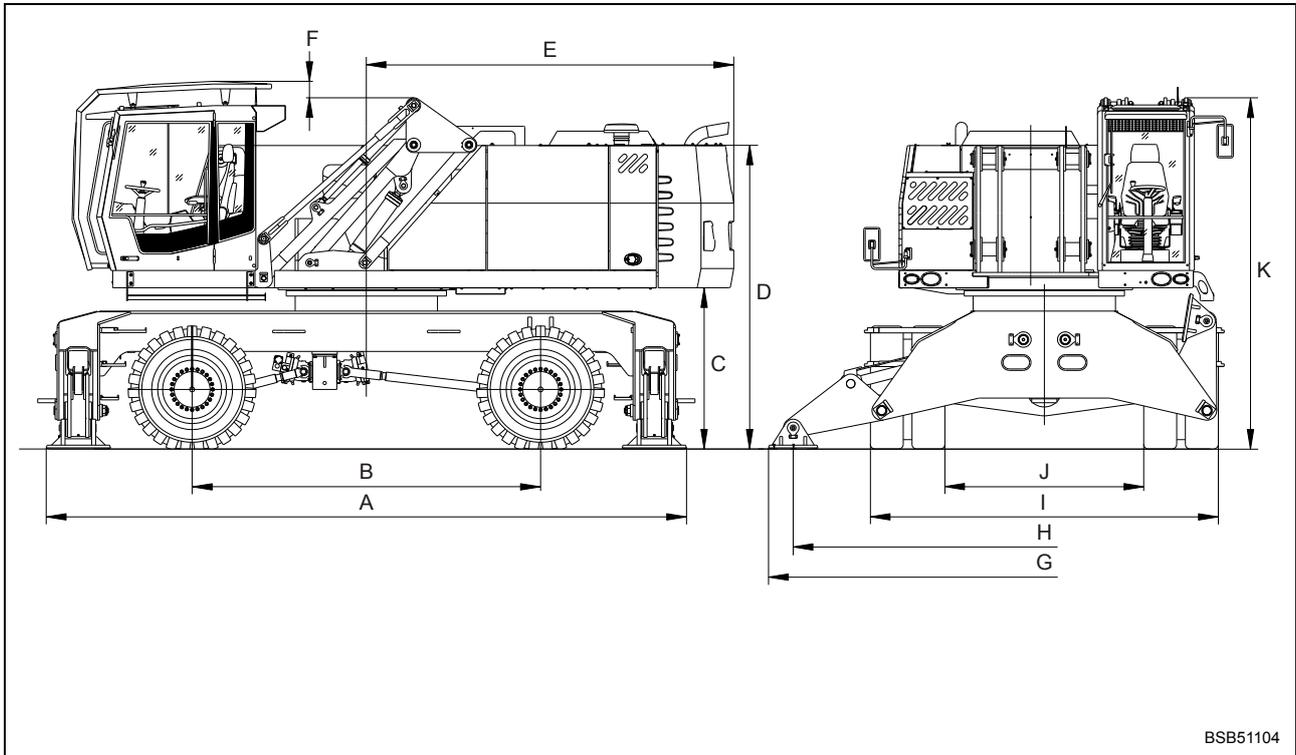


Fig. 5 Dimensions with tires 14.00-24

| Uppercarriage and undercarriage | | | |
|---------------------------------|------|---|------|
| A | 6620 | G | 5700 |
| B | 3600 | H | 5190 |
| C | 1680 | I | 3590 |
| D | 3160 | J | 2050 |
| E | 3800 | K | 3650 |
| F | 170* | | |
| Measurements in mm | | | |
| * Protective grating (optional) | | | |

3.1.2 Loading equipment 18.5 m, 20 m, 21 m, and 22 m

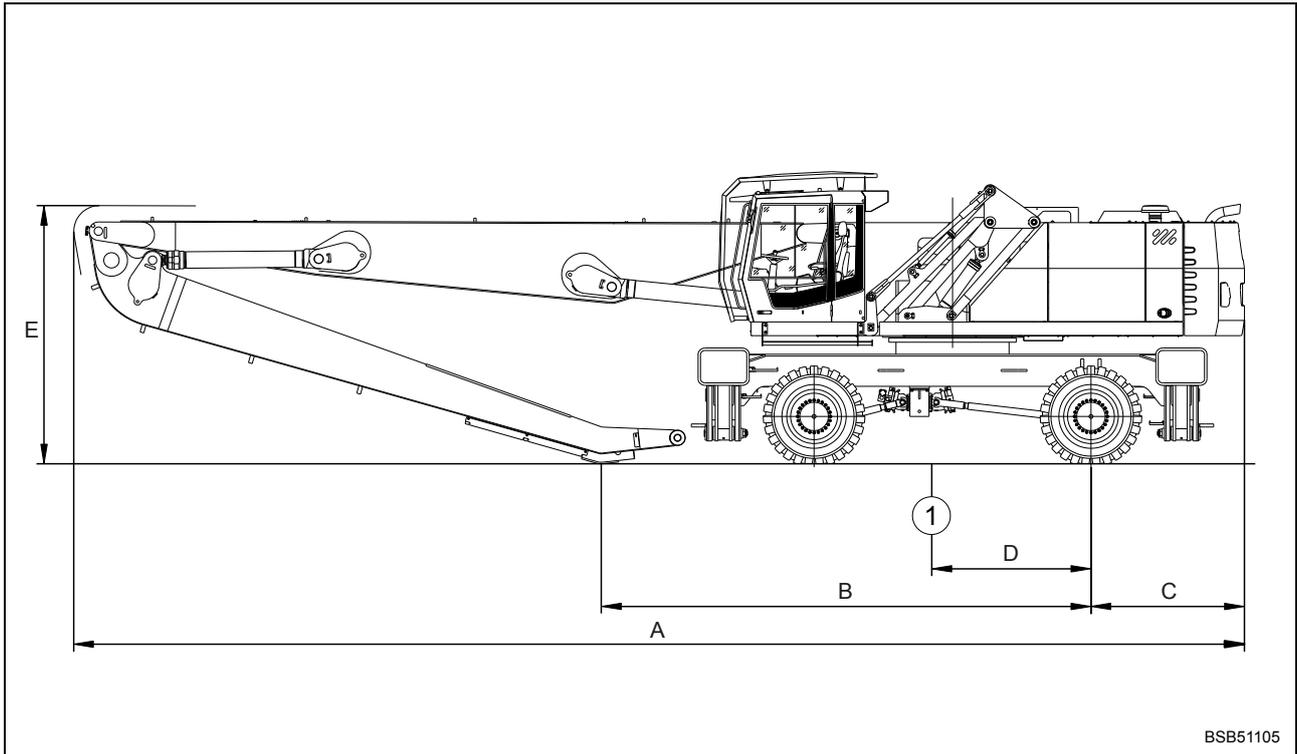
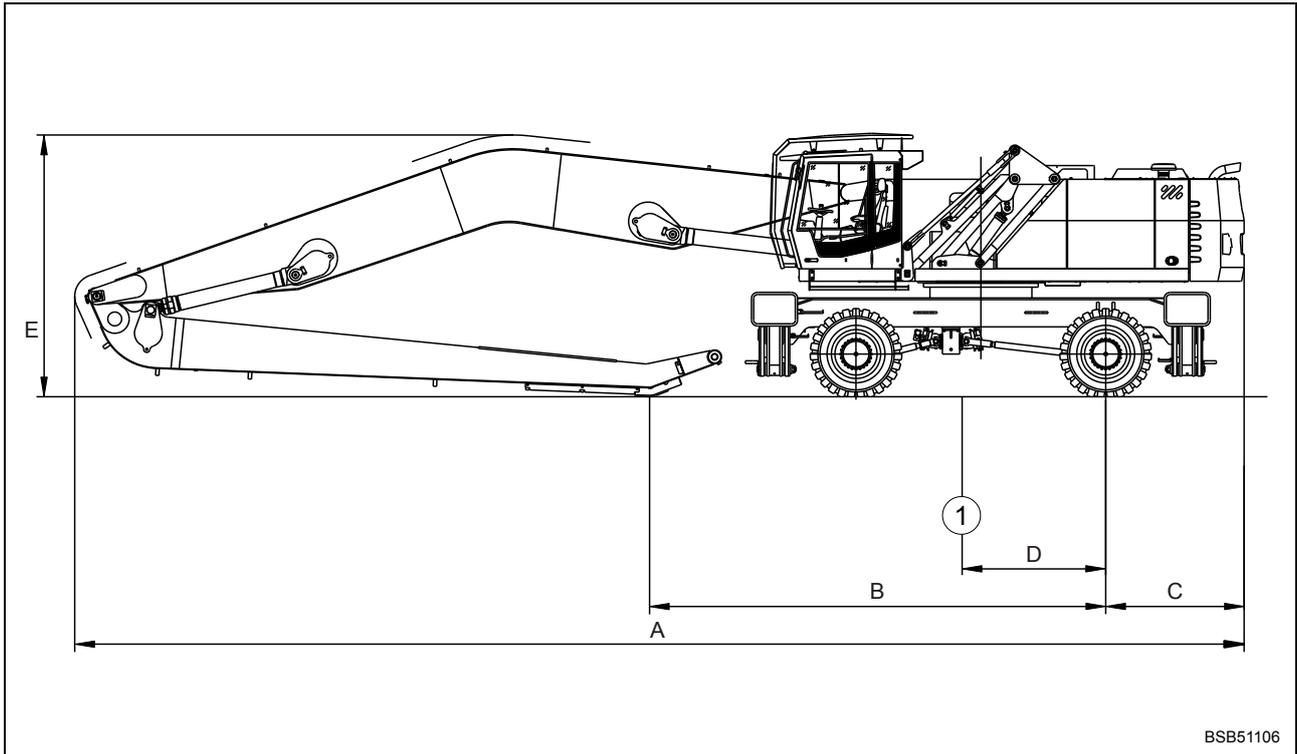


Fig. 6 Transport dimensions
 1 Average center of gravity in transport position

| TRANSPORT DIMENSIONS | | | | |
|----------------------|--------|-------|-------|-------|
| Loading equipment | | | | |
| | 18.5 m | 20 m | 21 m | 22 m |
| A | 15520 | 16960 | 16960 | 16970 |
| B | 6370 | 7940 | 7220 | 6160 |
| C | 2000 | 2000 | 2000 | 2000 |
| D | 2070 | 2070 | 2070 | 2070 |
| E | 3380 | 2960 | 3710 | 3590 |
| Measurements in mm | | | | |

3.1.3 Loading equipment 21 m and 22 m cranked

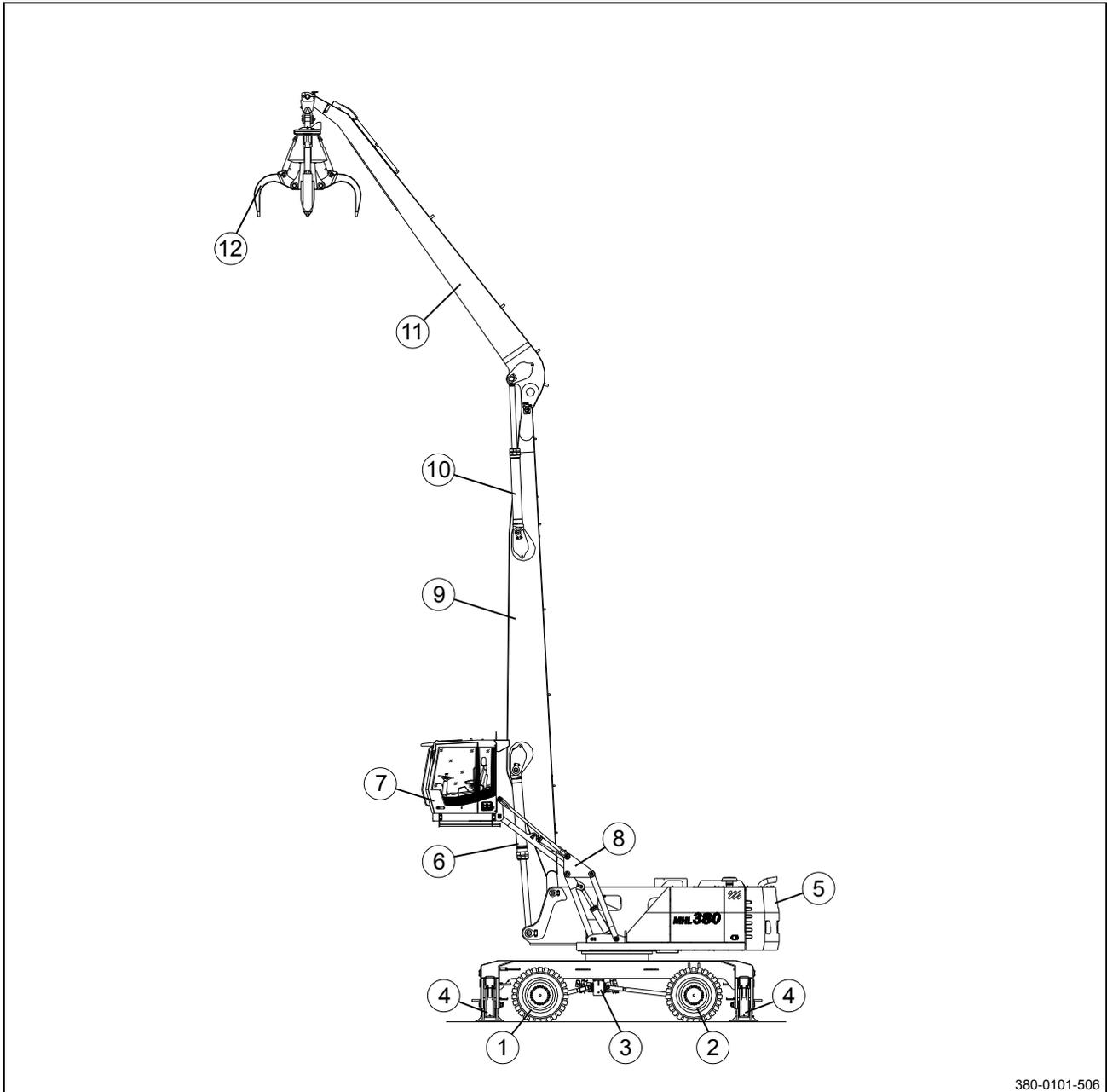


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Fig. 7 Transport dimensions
 1 Average center of gravity in transport position

| TRANSPORT DIMENSIONS | | | | |
|----------------------|-------|-------|--|--|
| Loading equipment | | | | |
| | 21 m | 22 m | | |
| A | 16860 | 16980 | | |
| B | 6580 | 6210 | | |
| C | 2000 | 2000 | | |
| D | 2070 | 2070 | | |
| E | 3800 | 4700 | | |
| Measurements in mm | | | | |

3.2 General structure



380-0101-506

Fig. 8 General structure

- | | |
|---|---|
| <ul style="list-style-type: none"> 1 Front axle (steering axle) 2 Rear axle (full floating axle) 3 Single-stage transfer gear with two variable speed axial piston motors 4 4-point outrigger 5 Counterweight 6 Lift cylinder | <ul style="list-style-type: none"> 7 Cab which can be raised and moved forwards 8 Cab lift mechanism 9 Boom 10 Dipperstick cylinder 11 Dipperstick 12 Cactus grab |
|---|---|

3.3 Diesel engine

| | |
|---------------------------|---|
| Manufacturer and model | Deutz TCD 2015 L06 4V |
| Design | 6-cylinder V engine |
| Control | Electronic Engine Control (EEC III) Direct fuel injection with pump/line/nozzle, turbocharger, charge cooling |
| Engine power | 273 kW |
| Rated speed | 1800 U/min |
| Stroke displacement | 11.91 l |
| Cooling system | Water and charge air cooling with temperature-controlled fan speed |
| Emission standard | COM III and EPA Tier III |
| Specific fuel consumption | 202 g/kWh at 100 % nominal output |
| Air cleaner type | Two-stage filter with relief valve |

3.4 Electrical system

| | |
|--|---|
| Operating voltage | 24 V |
| Battery | 2 x 12 V / 143 Ah / 950 A (according to EN) |
| Alternator | 28 V / 80 A |
| Starter | 24 V / 5.4 kW |
| Cold start auxiliary device | 2 x flame glow plug |
| Lighting system | 1 x H3 headlamp at dipperstick 1 x H3 headlamp on uppercarriage, 1 x H3 headlamp on cab floor, Limiting lights and flashers Option of up to 8 x working floodlights (dipper stick, boom, at the front of the cab roof, at the rear of the cab roof) All working headlamps are available in H3 or in XENON. |
| System for operation with magnetic plate | 30 kW three-phase alternator DC generator with control unit driven directly by diesel engine via V-belts. The generator is equipped with a dust protection filter and an overheating display. |

3.5 Hydraulic system

Main pump

Adjustable double displacement pump + separate turning circle pump in closed circuit

Pump capacity: max. 640 l/min at
200 rpm in turning
circle at 1800 rpm

Working pressure: max. 360 bar

The pump is regulated by the amount of current required and thus pumps only the amount of oil actually required by the consumers.

Power transfer between the pump and the diesel engine is monitored by the load limit sensing control. The diesel engine is thus protected, even in the partial throttle range, against excessive reductions in speed and overloads. As such, load limit sensing control optimizes the use of the available engine rating.

Additional pumps

Gear pumps in the open circuit for supplying auxiliary loads such as "Movable cab" or the functions "Grab rotation", "Brake", "Pilot control", "Fan motor for hydraulic oil cooler", "Steering" and "Oscillating axle".

Control block

Control block in sector design – single-circuit system

Oil cooler

The fan speed is controlled thermostatically. This ensures that the hydraulic system will reach its operating temperature quickly and stay at that level constantly. The reduction in noise level produced by thermostatic control and the resulting speed adjustment is beneficial for both the operator and the environment.

3.6 Travel drive

The hydrostatic travel drive is controlled by two variable speed axial piston motors with a directly attached brake pedal valve with a flange connection on the single-stage transfer gear.

4 wheel drive via propshafts between drive transmission and axles.

| | |
|--------------------|------------|
| Travel speed: | 0 – 8 km/h |
| Max. drawbar pull: | 90 kN |
| Gradability: | max. 11 % |
| Turning radius: | 9.9 m |

3.7 Rotary drive

Well-dimensioned slewing ring with inner gear teeth. The drive is provided by a 2-stage planetary gear with an integrated multi-disk brake which is set in motion and locked via a pushbutton.

| | |
|----------------------------|------------------------|
| Uppercarriage swing speed: | 0 – 6 rpm |
| Swing range: | 360° unlimited |
| Max. torque: | 164 kNm |
| Swing brake: | electrically activated |

3.8 Undercarriage

| | |
|------------|--|
| Front axle | Planetary drive axle with integrated drum brake, rigid bearing, max. steering angle 30° |
| Rear axle | Planetary drive axle with integrated drum brake, with self-aligning bearing and switching oscillating lock |
| Outrigger | 4-point outrigger, enlarged support plates (optional) |
| Tires | Solid rubber elastic 8x 14.00-24 |

3.8.1 Brakes

Service brake

A hydraulically activated single-circuit brake system that works on all four pairs of wheels.

Parking brake

Electrically or hydraulically activated spring applied disc brake on the drive transmission that transfers power to the front and rear axles via the cardan shafts.

3.9 Cab

Elastic bearings, variable hydraulic height adjustment up to a viewing height of 6.20 m and independently moveable by 2.20 m.

As an option, the cab can be supplied with reinforced glass or LEXAN glazing (wind-screen and skylight).

With an ideal seat position, the arrangement of the control elements and ample thermal panoramic glass windows, the standard cab ensures an excellent all-round view.

Heating

Hot water heating with variable temperature setting and multi-level blower plus four adjustable defroster nozzles.

Driver's seat

Air-cushioned comfort seat with integrated headrest, safety belt and lower lumbar support, heated seat with passive air conditioning if required. Eliminates fatigue thanks to the universal adjustment options for the seat position and the seat incline, as well as the position of the seat cushion with regard to the armrests and pilot controls.

Monitoring

Ergonomically positioned, glare-free instrument cluster, multifunction display, automatic monitoring, warning and saving functions for deviating operating conditions (e.g., filter pressure monitoring with warning display and cut-off function for the pilot controls, and warning or cut-off of the pilot controls if the hydraulic oil temperature limits are exceeded).

Air conditioning

Air conditioning system with reheat function

3.10 Control

The loading machine is equipped with an ISO control as standard.

 Chapter 5.1 Controls

3.11 Weights and loads

| | |
|---|--|
| Minimum charge weight | 62.5 t |
| Maximum charge weight | 68.5 t |
| Permissible axle load, front | 51.0 t |
| Permissible axle load, rear | 51.0 t |
| * Maximum surface load with 4-point outrigger | $p_{\max.} = 185 \text{ N/cm}^2$ (60 N/cm ² , enlarged support plates (optional)) |

(* Load assumption according to carrying capacity table in accordance with DIN ISO 10567 – 21 m loading equipment)

3.12 Noise level values

Measuring method according to directive 2000/14/EC

| | |
|---|--|
| Measured representative sound power level | L_{WA} : 103.1 dB(A) according to Directive 2000/14/EC |
| Guaranteed sound power level | L_{WA} : 104 dB(A) according to Directive 2000/14/EC |
| Sound pressure level at the operator's seat | L_{pA} : 71 dB(A) according to ISO6396:2008 |

3.12.1 Vibrations

Weighted r.m.s. value of acceleration of upper limbs is below 2.5 m/s².

Weighted r.m.s. value of acceleration for seat area and feet is below 0.5 m/s².

3.13 Working range of the machine

3.13.1 Working range diagram (18.5 m loading equipment)

Work equipment: boom 9.6 m, dipperstick 8.0 m and cactus grab

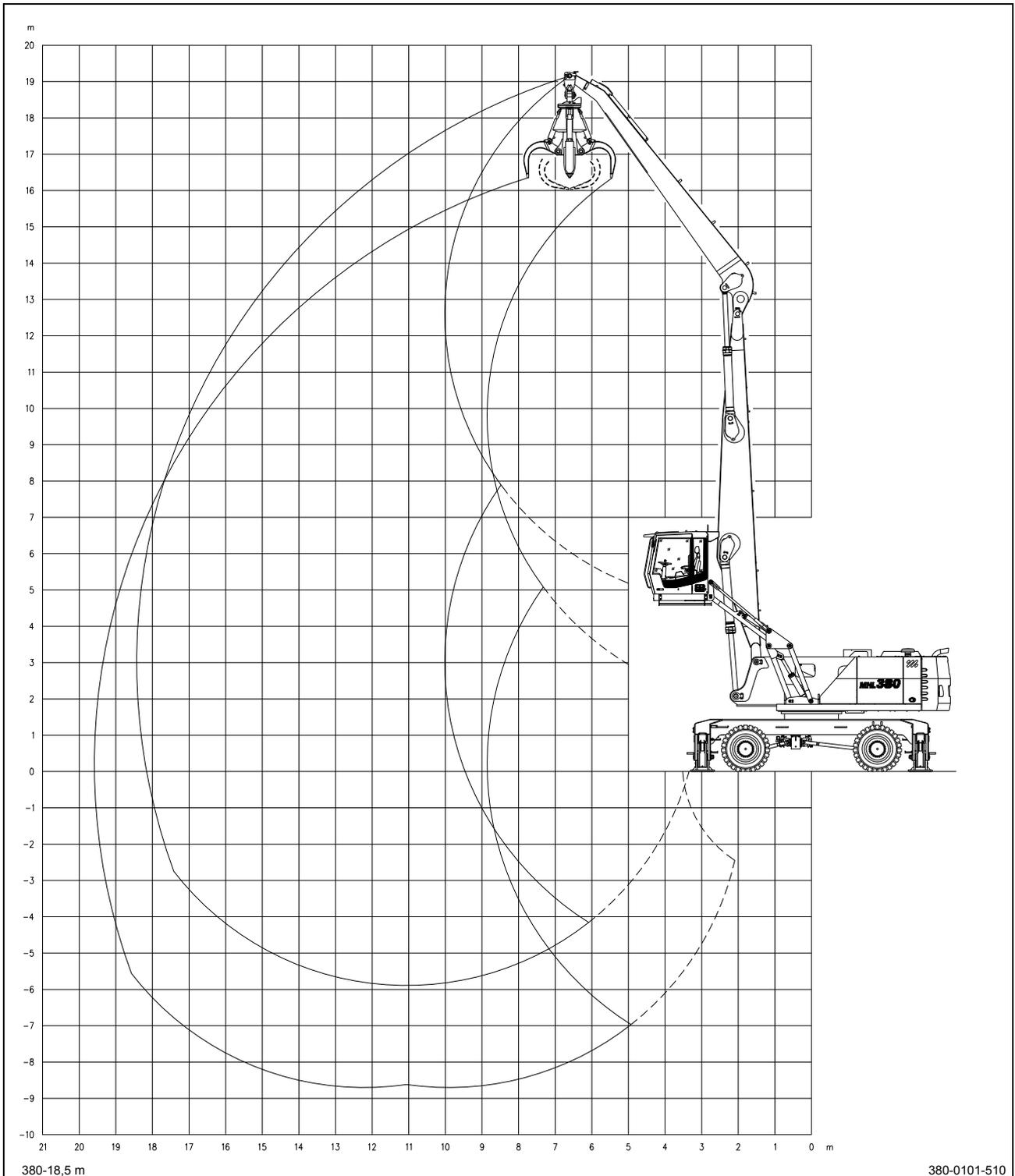


Fig. 9 Working range diagram (18.5 m work equipment)

3.13.2 Provisional carrying capacity table (18.5 m loading equipment)

The carrying capacity values are stated in metric tons (t). The pump pressure is 360 bar. The values represent 75% of the static tipping load or 87% of the hydraulic lifting force (marked), in accordance with ISO 10567. On solid and level ground, the values apply to a swing range of 360°. The (...) values apply in the longitudinal direction of the undercarriage. The values for "not supported" apply when the load is hoisted above the steering axle or the locked oscillating axle.

ATTENTION

The weight of the attached hoisting equipment (grab, load hook, etc.) must be deducted from the carrying capacity values. The safe working load of the hoisting equipment must be observed.

In accordance with EU Standard EN 474-5, hose-rupture safety devices on the lift and dipperstick cylinders, an overload warning device, and a carrying capacity table in the cab are required for hoisting. Only hoist when the machine's outriggers are up.

| Work equipment: boom 9.6 m. dipperstick 8.0 m | | | | | | | | | | |
|--|---------------------------------|--------------------------|-------------------------|-------------------------|--------------------------|------------------------|------------------------|----------------------|----------------------|----------------------|
| Height m | Undercarriage Outrigger | Reach in m | | | | | | | | |
| | | 6 | 7.5 | 9 | 10.5 | 12 | 13.5 | 15 | 16.5 | 18 |
| 18 | not supported 4-pt supported | | | (9.3°) 9.3° (9.3°) | | | | | | |
| 16.5 | not supported 4-pt supported | | | | (10.0°) 10.0° (10.0°) | | | | | |
| 15 | not supported 4-pt supported | | | | (11.7) 12.1° (12.1°) | (9.3) 10.0° (10.0°) | | | | |
| 13.5 | not supported 4-pt supported | | | | (11.8°) 11.8° (11.8°) | (9.5) 11.1° (11.1°) | (7.7) 9.6° (9.6°) | | | |
| 12 | not supported 4-pt supported | | | | (11.8°) 11.8° (11.8°) | (9.5) 11.0° (11.0°) | (7.7) 10.4° (10.4°) | (6.3) 8.6° (8.6°) | | |
| 10.5 | not supported 4-pt supported | | | | (11.8) 12.0° (12.0°) | (9.4) 11.2° (11.2°) | (7.7) 10.4° (10.4°) | (6.3) 9.7° (9.7°) | (5.2) 6.5° (6.5°) | |
| 9 | not supported 4-pt supported | | | | (11.6) 12.4° (12.4°) | (9.3) 11.4° (11.4°) | (7.6) 10.6° (10.6°) | (6.3) 9.7 (9.9°) | (5.2) 8.2 (8.7°) | |
| 7.5 | not supported 4-pt supported | | | (14.4) 14.6° (14.6°) | (11.2) 13.1° (13.1°) | (9.0) 11.9° (11.9°) | (7.4) 10.9° (10.9°) | (6.2) 9.6 (10.0°) | (5.2) 8.1 (9.3°) | |
| 6 | not supported 4-pt supported | | (18.3) 18.6° (18.6°) | (13.7) 15.9° (15.9°) | (10.8) 13.9° (13.9°) | (8.7) 12.4° (12.4°) | (7.2) 11.1° (11.1°) | (6.0) 9.4 (10.2°) | (5.1) 8.1 (9.3°) | (4.3) 6.5° (6.5°) |
| 4.5 | not supported 4-pt supported | (24.1) 27.1° (27.1°) | (17.1) 21.0° (21.0°) | (13.0) 17.2° (17.2°) | (10.3) 14.7° (14.7°) | (8.4) 12.9° (12.9°) | (7.0) 10.9 (11.5°) | (5.9) 9.2 (10.4°) | (5.0) 7.9 (9.4°) | (4.3) 6.9 (7.6°) |
| 3 | not supported 4-pt supported | (21.6) 31.2° (31.2°) | (15.7) 23.1° (23.1°) | (12.2) 18.5° (18.5°) | (9.8) 15.4° (15.4°) | (8.0) 12.6 (13.4°) | (6.7) 10.6 (11.8°) | (5.7) 9.1 (10.5°) | (4.9) 7.8 (9.4°) | (4.2) 6.9 (8.2°) |
| 1.5 | not supported 4-pt supported | (14.5°) 14.5° (14.5°) | (14.6) 24.5° (24.5°) | (11.4) 18.6 (19.4°) | (9.3) 14.9 (16.1°) | (7.7) 12.3 (13.8°) | (6.5) 10.3 (12.0°) | (5.6) 8.9 (10.6°) | (4.8) 7.7 (9.2°) | (4.2) 6.8 (8.1°) |
| 0 | not supported 4-pt supported | (11.3°) 11.3° (11.3°) | (13.8) 23.6 (24.6°) | (10.9) 18.0 (19.8°) | (8.9) 14.4 (16.4°) | (7.4) 12.0 (13.9°) | (6.3) 10.1 (12.0°) | (5.4) 8.7 (10.5°) | (4.7) 7.6 (9.1°) | (4.2) 6.8 (7.5°) |
| -1.5 | not supported 4-pt supported | (11.2°) 11.2° (11.2°) | (13.4) 19.8° (19.8°) | (10.5) 17.6 (19.6°) | (8.6) 14.1 (16.2°) | (7.2) 11.7 (13.7°) | (6.1) 10.0 (11.8°) | (5.3) 8.6 (10.1°) | (4.7) 7.6 (8.6°) | |
| -3 | not supported 4-pt supported | (12.0°) 12.0° (12.0°) | (13.2) 18.7° (18.7°) | (10.3) 17.3 (18.6°) | (8.4) 13.9 (15.5°) | (7.1) 11.6 (13.1°) | (6.1) 9.9 (11.2°) | (5.3) 8.6 (9.5°) | (4.7) 7.6 (7.8°) | |
| -4.5 | not supported 4-pt supported | | (13.2) 19.0° (19.0°) | (10.3) 17.0° (17.0°) | (8.4) 13.9 (14.3°) | (7.0) 11.5 (12.1°) | (6.0) 9.9 (10.2°) | (5.3) 8.4° (8.4°) | | |

Fig. 10 Provisional carrying capacity table (18.5 m loading equipment)

3.13.3 Working range diagram (20 m loading equipment)

Loading equipment: boom 11.35 m, dipperstick 8.0 m, and cactus grab

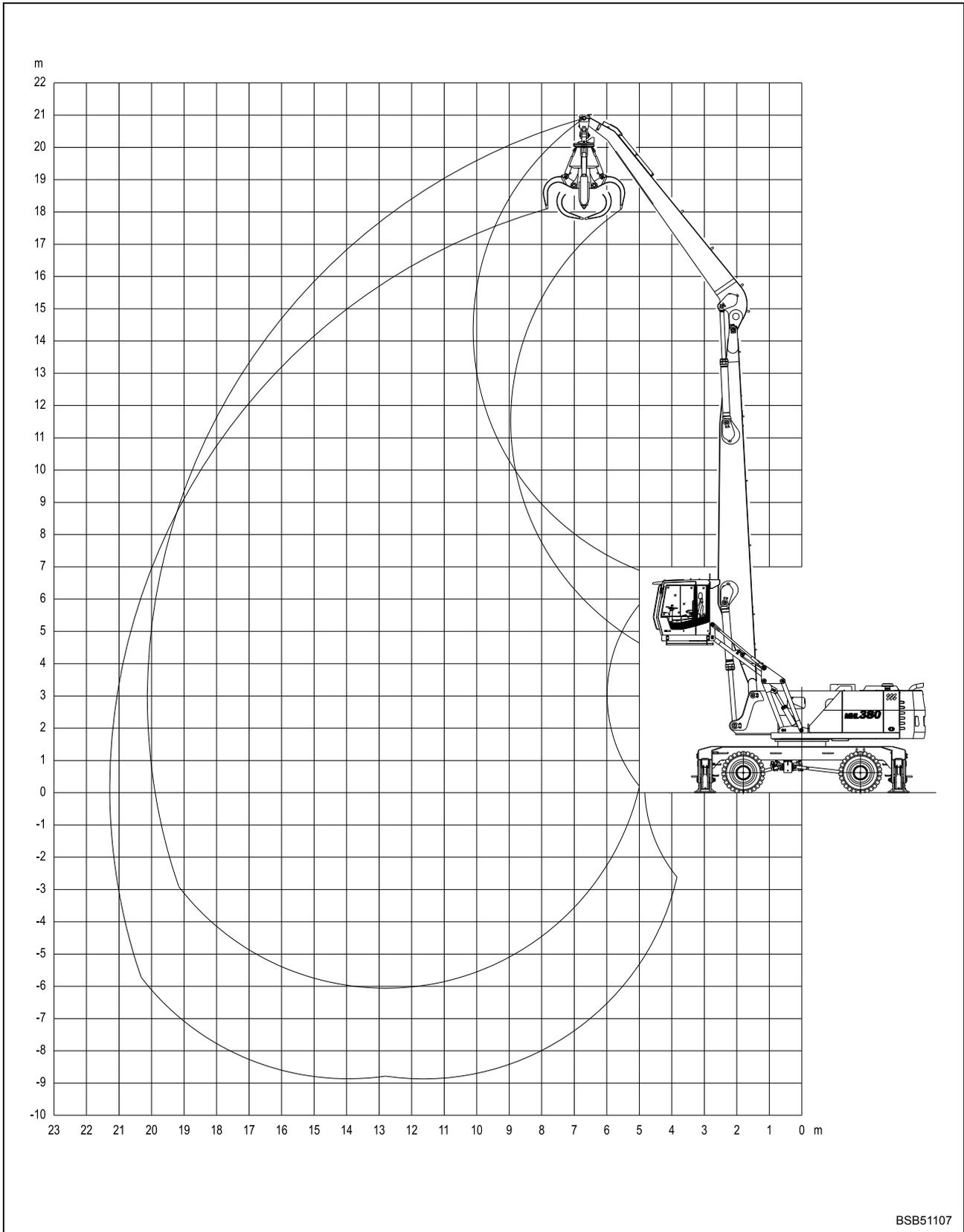


Fig. 11 Working range diagram (20 m loading equipment)

3.13.4 Carrying capacity table (20 m loading equipment)

The carrying capacity values are stated in metric tons (t). The pump pressure is 360 bar. The values represent 75% of the static tipping load or 87% of the hydraulic lifting force (marked), in accordance with ISO 10567. On solid and level ground, the values apply to a swing range of 360°. The (...) values apply in the longitudinal direction of the undercarriage. The values for "not supported" apply when the load is hoisted above the steering axle or the locked oscillating axle.

ATTENTION

The weight of the attached hoisting equipment (grab, load hook, etc.) must be deducted from the carrying capacity values. The safe working load of the hoisting equipment must be observed.

In accordance with EU Standard EN 474-5, hose-rupture safety devices on the lift and dipperstick cylinders, an overload warning device, and a carrying capacity table in the cab are required for hoisting. Only hoist when the machine's outriggers are up.

| Loadina equipment: boom 11.35 m. dipperstick 8.0 m | | | | | | | | | | | |
|---|---------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|------------------------|------------------------|----------------------|----------------------|---------------------|---------------------|
| Height m | Undercarriage Outrigger | Reach in m | | | | | | | | | |
| | | 6 | 7.5 | 9 | 10.5 | 12 | 13.5 | 15 | 16.5 | 18 | 19.5 |
| 19.5 | not supported 4-pt supported | | | (11.8°) 11.8° (11.8°) | | | | | | | |
| 18 | not supported 4-pt supported | | | | (11.5) 12.1° (12.1°) | (9.0) 9.6° (9.6°) | | | | | |
| 16.5 | not supported 4-pt supported | | | | (11.8°) 11.8° (11.8°) | (9.3) 10.7° (10.7°) | (7.5) 9.8° (9.8°) | | | | |
| 15 | not supported 4-pt supported | | | | (11.6°) 11.6° (11.6°) | (9.5) 10.6° (10.6°) | (7.6) 9.8° (9.8°) | (6.2) 9.1° (9.1°) | | | |
| 13.5 | not supported 4-pt supported | | | | (11.6°) 11.6° (11.6°) | (9.5) 10.6° (10.6°) | (7.7) 9.7° (9.7°) | (6.3) 9.0° (9.0°) | (5.1) 8.1 (8.2°) | | |
| 12 | not supported 4-pt supported | | | | (11.8°) 11.8° (11.8°) | (9.4) 10.7° (10.7°) | (7.6) 9.8° (9.8°) | (6.3) 9.0° (9.0°) | (5.2) 8.1 (8.4°) | | |
| 10.5 | not supported 4-pt supported | | | | (11.5) 12.1° (12.1°) | (9.2) 10.9° (10.9°) | (7.5) 9.9° (9.9°) | (6.2) 9.1° (9.1°) | (5.1) 8.1 (8.4°) | (4.3) 6.9 (7.8°) | |
| 9 | not supported 4-pt supported | | | (14.3°) 14.3° (14.3°) | (11.1) 12.6° (12.6°) | (8.9) 11.2° (11.2°) | (7.3) 10.1° (10.1°) | (6.0) 9.3° (9.3°) | (5.0) 8.0 (8.5°) | (4.2) 6.9 (7.8°) | |
| 7.5 | not supported 4-pt supported | | (18.1) 18.4° (18.4°) | (13.5) 15.4° (15.4°) | (10.6) 13.2° (13.2°) | (8.5) 11.6° (11.6°) | (7.0) 10.4° (10.4°) | (5.9) 9.2 (9.4°) | (4.9) 7.9 (8.6°) | (4.2) 6.8 (7.9°) | (3.5) 5.9 (6.9°) |
| 6 | not supported 4-pt supported | (23.3) 26.6° (26.6°) | (16.6) 20.2° (20.2°) | (12.6) 16.4° (16.4°) | (10.0) 13.9° (13.9°) | (8.1) 12.1° (12.1°) | (6.7) 10.6° (10.6°) | (5.6) 9.0 (9.6°) | (4.8) 7.7 (8.7°) | (4.1) 6.7 (7.9°) | (3.5) 5.8 (7.0°) |
| 4.5 | not supported 4-pt supported | (17.4°) 17.4° (17.4°) | (14.9) 21.9° (21.9°) | (11.6) 17.4° (17.4°) | (9.3) 14.5° (14.5°) | (7.7) 12.3 (12.5°) | (6.4) 10.3 (10.9°) | (5.4) 8.8 (9.7°) | (4.6) 7.6 (8.7°) | (4.0) 6.6 (7.9°) | (3.4) 5.8 (7.0°) |
| 3 | not supported 4-pt supported | (6.4°) 6.4° (6.4°) | (13.4) 21.5° (21.5°) | (10.7) 17.8 (18.1°) | (8.7) 14.3 (15.0°) | (7.2) 11.8 (12.8°) | (6.1) 9.9 (11.1°) | (5.2) 8.5 (9.8°) | (4.5) 7.4 (8.8°) | (3.9) 6.5 (7.8°) | (3.3) 5.7 (6.9°) |
| 1.5 | not supported 4-pt supported | (5.4°) 5.4° (5.4°) | (12.4) 13.3° (13.3°) | (9.9) 17.0 (18.4°) | (8.2) 13.7 (15.2°) | (6.8) 11.4 (12.9°) | (5.8) 9.6 (11.2°) | (5.0) 8.3 (9.8°) | (4.3) 7.2 (8.7°) | (3.8) 6.4 (7.7°) | (3.3) 5.7 (6.7°) |
| 0 | not supported 4-pt supported | (6.3°) 6.3° (6.3°) | (11.7°) 11.7° (11.7°) | (9.4) 16.4 (18.2°) | (7.8) 13.2 (15.1°) | (6.5) 11.0 (12.8°) | (5.6) 9.4 (11.1°) | (4.8) 8.1 (9.7°) | (4.2) 7.1 (8.5°) | (3.7) 6.3 (7.4°) | (3.3) 5.6 (6.3°) |
| -1.5 | not supported 4-pt supported | (7.6°) 7.6° (7.6°) | (11.6) 11.8° (11.8°) | (9.1) 16.1 (17.4°) | (7.5) 12.9 (14.6°) | (6.3) 10.8 (12.5°) | (5.4) 9.2 (10.8°) | (4.7) 8.0 (9.4°) | (4.1) 7.0 (8.2°) | (3.6) 6.2 (7.1°) | (3.2) 5.6 (5.7°) |
| -3 | not supported 4-pt supported | | (11.5) 12.7° (12.7°) | (9.0) 15.9 (16.2°) | (7.3) 12.8 (13.8°) | (6.2) 10.7 (11.8°) | (5.3) 9.1 (10.2°) | (4.6) 7.9 (8.9°) | (4.1) 7.0 (7.7°) | (3.6) 6.2 (6.4°) | |
| -4.5 | not supported 4-pt supported | | | (9.0) 14.5° (14.5°) | (7.3) 12.5° (12.5°) | (6.1) 10.6 (10.9°) | (5.3) 9.1 (9.4°) | (4.6) 7.9 (8.1°) | (4.1) 6.9° (6.9°) | | |
| -6 | not supported 4-pt supported | | | | | (6.2) 9.5° (9.5°) | (5.3) 8.2° (8.2°) | | | | |

Fig. 12 Carrying capacity table (20 m loading equipment)

3.13.5 Working range diagram (21 m work equipment)

Work equipment: boom 11.35 m, dipperstick 8.95 m and cactus grab

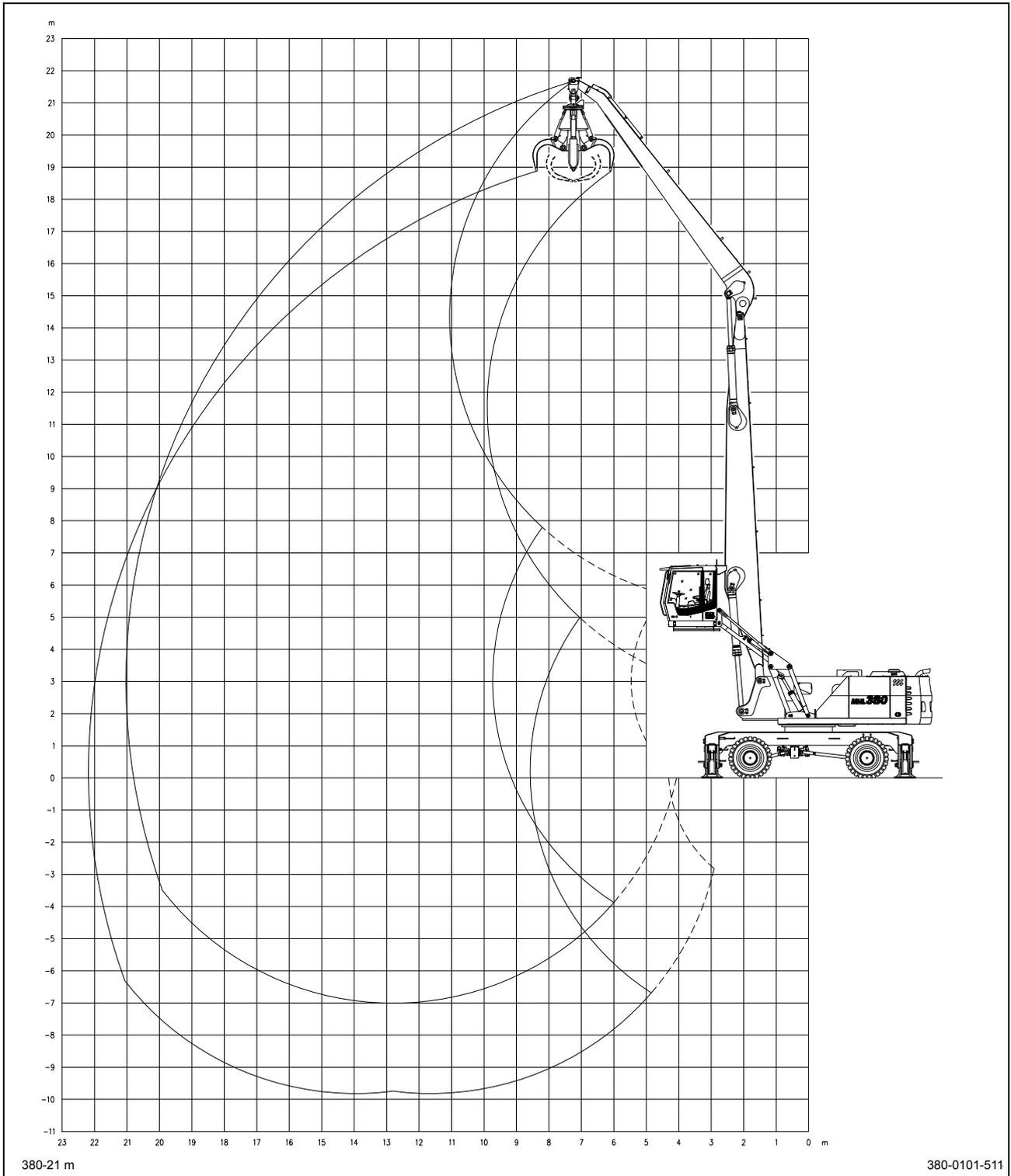


Fig. 13 Working range diagram (21 m work equipment)

3.13.6 Provisional table of carrying capacity (21 m work equipment)

The carrying capacity values are stated in metric tons (t). The pump pressure is 360 bar. The values represent 75% of the static tipping load or 87% of the hydraulic lifting force (marked), in accordance with ISO 10567. On solid and level ground, the values apply to a swing range of 360°. The (...) values apply in the longitudinal direction of the undercarriage. The values for "not supported" apply when the load is hoisted above the steering axle or the locked oscillating axle.

ATTENTION

The weight of the attached hoisting equipment (grab, load hook, etc.) must be deducted from the carrying capacity values. The safe working load of the hoisting equipment must be observed.

In accordance with EU Standard EN 474-5, hose-rupture safety devices on the lift and dipperstick cylinders, an overload warning device, and a carrying capacity table in the cab are required for hoisting. Only hoist when the machine's outriggers are up.

| Work equipment: boom 11.35 m, dipperstick 8.95 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------------------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------|----------------|-------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|--|------|----------------|-------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|--|------|----------------|-------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|--|------|----------------|-------------|--------------|--------------|--------------|---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| Height m | Undercarriage Outrigger | Reach in m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 6 | 7.5 | 9 | 10.5 | 12 | 13.5 | 15 | 16.5 | 18 | 19.5 | 21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19.5 | not supported | | | | (10.2°) | | | | | | | | | 4-pt supported | | | | 10.2°(10.2°) | | | | | | | | 18 | not supported | | | | (11.3°) | (9.4) | (7.5) | | | | | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 8.0° (8.0°) | | | | | | 16.5 | not supported | | | | | (9.6) | (7.7) | (6.2) | | | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.3° (9.3°) | 7.8° (7.8°) | | | | | 15 | not supported | | | | | (9.7) | (7.8) | (6.4) | (5.2) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | |
| | 4-pt supported | | | | 10.2°(10.2°) | | | | | | | | 18 | not supported | | | | (11.3°) | (9.4) | (7.5) | | | | | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 8.0° (8.0°) | | | | | | 16.5 | not supported | | | | | (9.6) | (7.7) | (6.2) | | | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.3° (9.3°) | 7.8° (7.8°) | | | | | 15 | not supported | | | | | (9.7) | (7.8) | (6.4) | (5.2) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | |
| 18 | not supported | | | | (11.3°) | (9.4) | (7.5) | | | | | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 8.0° (8.0°) | | | | | | 16.5 | not supported | | | | | (9.6) | (7.7) | (6.2) | | | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.3° (9.3°) | 7.8° (7.8°) | | | | | 15 | not supported | | | | | (9.7) | (7.8) | (6.4) | (5.2) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 8.0° (8.0°) | | | | | | 16.5 | not supported | | | | | (9.6) | (7.7) | (6.2) | | | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.3° (9.3°) | 7.8° (7.8°) | | | | | 15 | not supported | | | | | (9.7) | (7.8) | (6.4) | (5.2) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16.5 | not supported | | | | | (9.6) | (7.7) | (6.2) | | | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.3° (9.3°) | 7.8° (7.8°) | | | | | 15 | not supported | | | | | (9.7) | (7.8) | (6.4) | (5.2) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | | | 10.0°(10.0°) | 9.3° (9.3°) | 7.8° (7.8°) | | | | | 15 | not supported | | | | | (9.7) | (7.8) | (6.4) | (5.2) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | not supported | | | | | (9.7) | (7.8) | (6.4) | (5.2) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.6° (8.6°) | 7.1° (7.1°) | | | | 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13.5 | not supported | | | | | (9.7) | (7.9) | (6.4) | (5.3) | | | | | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | | | 9.9° (9.9°) | 9.2° (9.2°) | 8.5° (8.5°) | 8.0° (8.0°) | | | | 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | not supported | | | | | (9.6) | (7.8) | (6.4) | (5.3) | (4.4) | | | | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | | | 10.0°(10.0°) | 9.2° (9.2°) | 8.6° (8.6°) | 8.0° (8.0°) | 7.0 (7.5°) | | | 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10.5 | not supported | | | | (11.3°) | (9.4) | (7.6) | (6.3) | (5.2) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | | 11.3°(11.3°) | 10.3°(10.3°) | 9.4° (9.4°) | 8.7° (8.7°) | 8.1° (8.1°) | 7.0 (7.5°) | 5.7° (5.7°) | | 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | not supported | | | | (11.4) | (9.1) | (7.4) | (6.1) | (5.1) | (4.3) | (3.6) | | | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | | 11.8°(11.8°) | 10.6°(10.6°) | 9.6° (9.6°) | 8.8° (8.8°) | 8.1° (8.1°) | 6.9 (7.5°) | 6.0 (7.0°) | | 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.5 | not supported | | | (14.1) | (10.9) | (8.8) | (7.2) | (6.0) | (5.0) | (4.2) | (3.5) | | | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | 14.3°(14.3°) | 12.5°(12.5°) | 11.0°(11.0°) | 9.9° (9.9°) | 9.0° (9.0°) | 8.0 (8.3°) | 6.8 (7.6°) | 5.9 (7.0°) | | 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | not supported | (24.0°) | (17.5) | (13.2) | (10.3) | (8.3) | (6.9) | (5.7) | (4.8) | (4.1) | (3.5) | | | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | 24.0°(24.0°) | 18.7°(18.7°) | 15.4°(15.4°) | 13.2°(13.2°) | 11.5°(11.5°) | 10.3°(10.3°) | 9.1° (9.1°) | 7.8 (8.4°) | 6.7 (7.7°) | 5.8 (7.0°) | | 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 | not supported | (22.0) | (15.9) | (12.1) | (9.6) | (7.9) | (6.5) | (5.5) | (4.6) | (4.0) | (3.4) | | | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | 27.7°(27.7°) | 20.7°(20.7°) | 16.6°(16.6°) | 13.9°(13.9°) | 12.0°(12.0°) | 10.4°(10.4°) | 8.8 (9.4°) | 7.6 (8.5°) | 6.6 (7.7°) | 5.8 (7.0°) | | 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | not supported | (10.8°) | (14.2) | (11.1) | (9.0) | (7.4) | (6.2) | (5.2) | (4.5) | (3.8) | (3.3) | (2.9) | | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | 10.8°(10.8°) | 22.3°(22.3°) | 17.6°(17.6°) | 14.5°(14.5°) | 12.0 (12.4°) | 10.1 (10.8°) | 8.6 (9.6°) | 7.4 (8.6°) | 6.5 (7.7°) | 5.7 (6.9°) | 5.0 (6.0°) | 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | not supported | (6.5°) | (12.9) | (10.3) | (8.4) | (7.0) | (5.9) | (5.0) | (4.3) | (3.7) | (3.2) | | | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | 6.5° (6.5°) | 16.2°(16.2°) | 17.4 (18.1°) | 13.9 (14.9°) | 11.5 (12.7°) | 9.7 (11.0°) | 8.3 (9.7°) | 7.2 (8.6°) | 6.3 (7.6°) | 5.6 (6.8°) | | 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | not supported | (6.2°) | (11.9°) | (9.6) | (7.9) | (6.6) | (5.6) | (4.8) | (4.2) | (3.6) | (3.2) | | | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | 6.2° (6.2°) | 11.9°(11.9°) | 16.6 (18.2°) | 13.4 (15.0°) | 11.1 (12.7°) | 9.4 (11.0°) | 8.1 (9.6°) | 7.1 (8.5°) | 6.2 (7.5°) | 5.5 (6.5°) | | -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -1.5 | not supported | (6.8°) | (11.0°) | (9.2) | (7.5) | (6.3) | (5.4) | (4.6) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | 6.8° (6.8°) | 11.0°(11.0°) | 16.2 (17.8°) | 13.0 (14.8°) | 10.8 (12.6°) | 9.2 (10.8°) | 8.0 (9.4°) | 7.0 (8.3°) | 6.1 (7.2°) | 5.5 (6.2°) | | -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -3 | not supported | (7.7°) | (11.2°) | (9.0) | (7.3) | (6.1) | (5.2) | (4.5) | (4.0) | (3.5) | (3.1) | | | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | 7.7° (7.7°) | 11.2°(11.2°) | 15.9 (16.9°) | 12.8 (14.2°) | 10.6 (12.1°) | 9.0 (10.5°) | 7.8 (9.1°) | 6.9 (7.9°) | 6.1 (6.8°) | 5.5° (5.5°) | | -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -4.5 | not supported | | (11.5) | (8.9) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.5) | | | | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | 11.8°(11.8°) | 15.6°(15.6°) | 12.7 (13.3°) | 10.5 (11.4°) | 9.0 (9.8°) | 7.8 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | | | -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| -6 | not supported | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.5) | (3.9) | | | | | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4-pt supported | | | 13.8°(13.8°) | 11.9°(11.9°) | 10.3°(10.3°) | 8.9° (8.9°) | 7.6° (7.6°) | 6.4° (6.4°) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Fig. 14 Provisional carrying capacity table (21 m loading equipment)

3.13.7 Working range diagram (22 m loading equipment)

Loading equipment: boom 11.35 m, dipperstick 9.9 m, and cactus grab

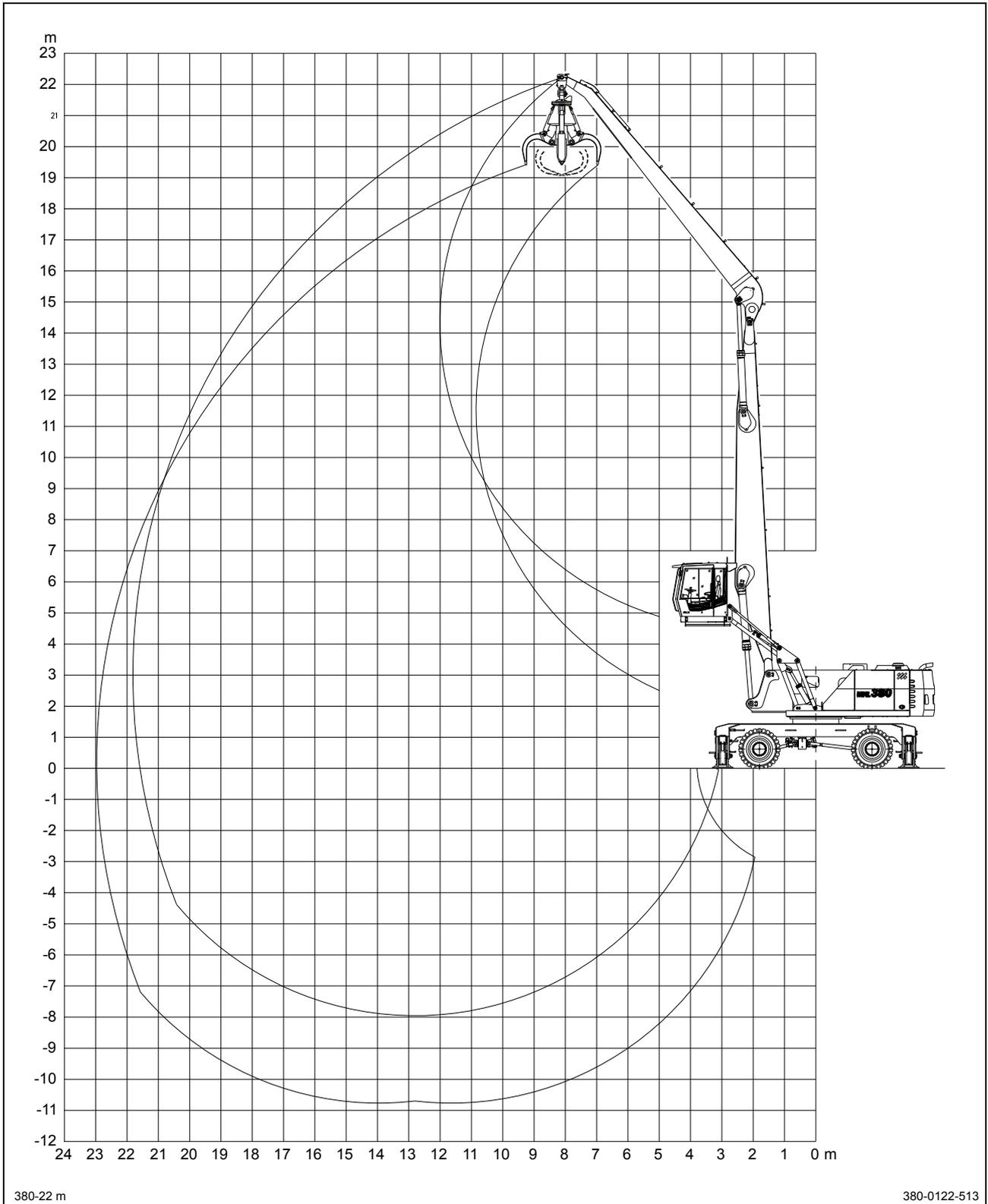


Fig. 15 Working range diagram (22 m loading equipment)

3.13.8 Provisional carrying capacity table (22 m loading equipment)

The carrying capacity values are stated in metric tons (t). The pump pressure is 360 bar. The values represent 75% of the static tipping load or 87% of the hydraulic lifting force (marked), in accordance with ISO 10567. On solid and level ground, the values apply to a swing range of 360°. The (...) values apply in the longitudinal direction of the undercarriage. The values for "not supported" apply when the load is hoisted above the steering axle or the locked oscillating axle.

ATTENTION

The weight of the attached hoisting equipment (grab, load hook, etc.) must be deducted from the carrying capacity values. The safe working load of the hoisting equipment must be observed.

In accordance with EU Standard EN 474-5, hose-rupture safety devices on the lift and dipperstick cylinders, an overload warning device, and a carrying capacity table in the cab are required for hoisting. Only hoist when the machine's outriggers are up.

| Loading equipment: boom 11.35 m, dipperstick 9.9 m | | | | | | | | | | | | |
|--|---------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Height m | Undercarriage Outrigger | Reach in m | | | | | | | | | | |
| | | 6 | 7.5 | 9 | 10.5 | 12 | 13.5 | 15 | 16.5 | 18 | 19.5 | 21 |
| 19.5 | not supported 4-pt supported | | | | | (7.8°) 7.8° (7.8°) | | | | | | |
| 18 | not supported 4-pt supported | | | | | (9.7°) 9.7° (9.7°) | (8.2°) 9.1° (9.1°) | (6.7°) 7.8° (7.8°) | (5.4°) 5.4° (5.4°) | | | |
| 16.5 | not supported 4-pt supported | | | | | (9.6°) 9.6° (9.6°) | (8.3°) 9.0° (9.0°) | (6.8°) 8.4° (8.4°) | (5.6°) 7.3° (7.3°) | | | |
| 15 | not supported 4-pt supported | | | | | (9.7°) 9.9° (9.9°) | (7.8°) 9.2° (9.2°) | (6.4°) 8.6° (8.6°) | (5.2°) 7.1° (7.1°) | | | |
| 13.5 | not supported 4-pt supported | | | | | (9.6°) 9.6° (9.6°) | (8.3°) 8.9° (8.9°) | (6.8°) 8.4° (8.4°) | (5.6°) 7.8° (7.8°) | (4.6°) 6.5° (6.5°) | | |
| 12 | not supported 4-pt supported | | | | | (9.7°) 9.7° (9.7°) | (8.2°) 9.0° (9.0°) | (6.4°) 8.6° (8.6°) | (5.6°) 7.9° (7.9°) | (4.6°) 7.3° (7.3°) | (3.8°) 5.1° (5.1°) | |
| 10.5 | not supported 4-pt supported | | | | | (10.0°) 10.0° (10.0°) | (8.1°) 9.2° (9.2°) | (6.7°) 8.5° (8.5°) | (5.5°) 7.9° (7.9°) | (4.6°) 7.3° (7.3°) | (3.8°) 6.2° (6.6°) | |
| 9 | not supported 4-pt supported | | | | (11.4°) 11.4° (11.4°) | (9.7°) 10.3° (10.3°) | (7.9°) 9.4° (9.4°) | (6.5°) 8.7° (8.7°) | (5.4°) 8.0° (8.0°) | (4.5°) 7.2° (7.5°) | (3.8°) 6.2° (6.9°) | |
| 7.5 | not supported 4-pt supported | | | | (11.6°) 12.0° (12.0°) | (9.3°) 10.7° (10.7°) | (7.6°) 9.7° (9.7°) | (6.3°) 8.9° (8.9°) | (5.2°) 8.2° (8.2°) | (4.4°) 7.1° (7.5°) | (3.7°) 6.1° (7.0°) | (3.1°) 5.3° (5.5°) |
| 6 | not supported 4-pt supported | | (17.5°) 17.5° (17.5°) | (14.0°) 14.7° (14.7°) | (10.9°) 12.7° (12.7°) | (8.8°) 11.2° (11.2°) | (7.2°) 10.0° (10.0°) | (6.0°) 9.1° (9.1°) | (5.1°) 8.0° (8.3°) | (4.3°) 6.9° (7.6°) | (3.6°) 6.0° (7.0°) | (3.1°) 5.3° (6.3°) |
| 4.5 | not supported 4-pt supported | (24.2°) 25.4° (25.4°) | (17.0°) 19.4° (19.4°) | (12.9°) 15.8° (15.8°) | (10.2°) 13.4° (13.4°) | (8.2°) 11.7° (11.7°) | (6.8°) 10.3° (10.3°) | (5.7°) 9.1° (9.3°) | (4.8°) 7.8° (8.4°) | (4.1°) 6.8° (7.7°) | (3.5°) 5.9° (7.0°) | (3.0°) 5.2° (6.3°) |
| 3 | not supported 4-pt supported | (20.6°) 28.6° (28.6°) | (15.1°) 21.2° (21.2°) | (11.7°) 16.9° (16.9°) | (9.4°) 14.1° (14.1°) | (7.7°) 12.1° (12.1°) | (6.4°) 10.3° (10.6°) | (5.4°) 8.8° (9.5°) | (4.6°) 7.6° (8.5°) | (4.8°) 6.6° (7.7°) | (3.4°) 5.8° (7.0°) | (3.0°) 5.1° (6.2°) |
| 1.5 | not supported 4-pt supported | (10.5°) 10.5° (10.5°) | (13.4°) 22.3° (22.3°) | (10.6°) 17.6° (17.6°) | (8.6°) 14.2° (14.6°) | (7.2°) 11.8° (12.4°) | (6.0°) 9.9° (10.8°) | (5.1°) 8.35° (9.6°) | (4.4°) 7.4° (8.6°) | (3.8°) 6.4° (7.7°) | (3.3°) 5.7° (6.9°) | (2.9°) 5.1° (6.1°) |
| 0 | not supported 4-pt supported | (8.0°) 8.0° (8.0°) | (12.3°) 15.7° (15.7°) | (9.8°) 16.8° (17.9°) | (8.0°) 13.6° (14.8°) | (6.7°) 11.3° (12.6°) | (5.7°) 9.6° (10.9°) | (4.9°) 8.2° (9.6°) | (4.2°) 7.2° (8.5°) | (3.7°) 6.3° (7.6°) | (3.2°) 5.6° (6.8°) | (2.8°) 5.0° (5.9°) |
| -1.5 | not supported 4-pt supported | (7.8°) 7.8° (7.8°) | (11.5°) 12.8° (12.8°) | (9.2°) 16.1° (17.8°) | (7.5°) 13.0° (14.7°) | (6.4°) 10.9° (12.5°) | (5.4°) 9.3° (10.8°) | (4.7°) 8.0° (9.5°) | (4.1°) 7.0° (8.4°) | (3.6°) 6.2° (7.4°) | (3.2°) 5.5° (6.5°) | (2.8°) 5.0° (5.5°) |
| -3 | not supported 4-pt supported | (8.2°) 8.2° (8.2°) | (11.1°) 12.1° (12.1°) | (8.8°) 15.7° (17.2°) | (7.2°) 12.7° (14.3°) | (6.1°) 10.6° (12.2°) | (5.2°) 9.0° (10.6°) | (4.5°) 7.8° (9.2°) | (4.0°) 6.9° (8.1°) | (3.5°) 6.1° (7.1°) | (3.1°) 5.5° (6.1°) | |
| -4.5 | not supported 4-pt supported | (8.9°) 8.9° (8.9°) | (11.0°) 12.1° (12.1°) | (8.6°) 15.5° (16.1°) | (7.0°) 12.5° (13.6°) | (5.9°) 10.4° (11.7°) | (5.1°) 8.9° (10.1°) | (4.4°) 7.7° (8.8°) | (3.9°) 6.8° (7.6°) | (3.4°) 6.1° (6.6°) | (3.1°) 5.5° (5.5°) | |
| -6 | not supported 4-pt supported | | (11.0°) 12.6° (12.6°) | (8.5°) 14.6° (14.6°) | (7.0°) 12.4° (12.5°) | (5.8°) 10.3° (10.8°) | (5.0°) 8.8° (9.3°) | (4.4°) 7.7° (8.1°) | (3.9°) 6.8° (7.0°) | (3.5°) 5.8° (5.8°) | | |
| -7.5 | not supported 4-pt supported | | | | (7.0°) 11.0° (11.0°) | (5.9°) 9.5° (9.5°) | (5.0°) 8.3° (8.3°) | (4.4°) 7.1° (7.1°) | | | | |

Fig. 16 Provisional carrying capacity table (22 m loading equipment)

3.13.9 Working range diagram (21 m loading equipment cranked)

Loading equipment: Boom cranked 11.35 m, dipperstick 8.95 m, and cactus grab

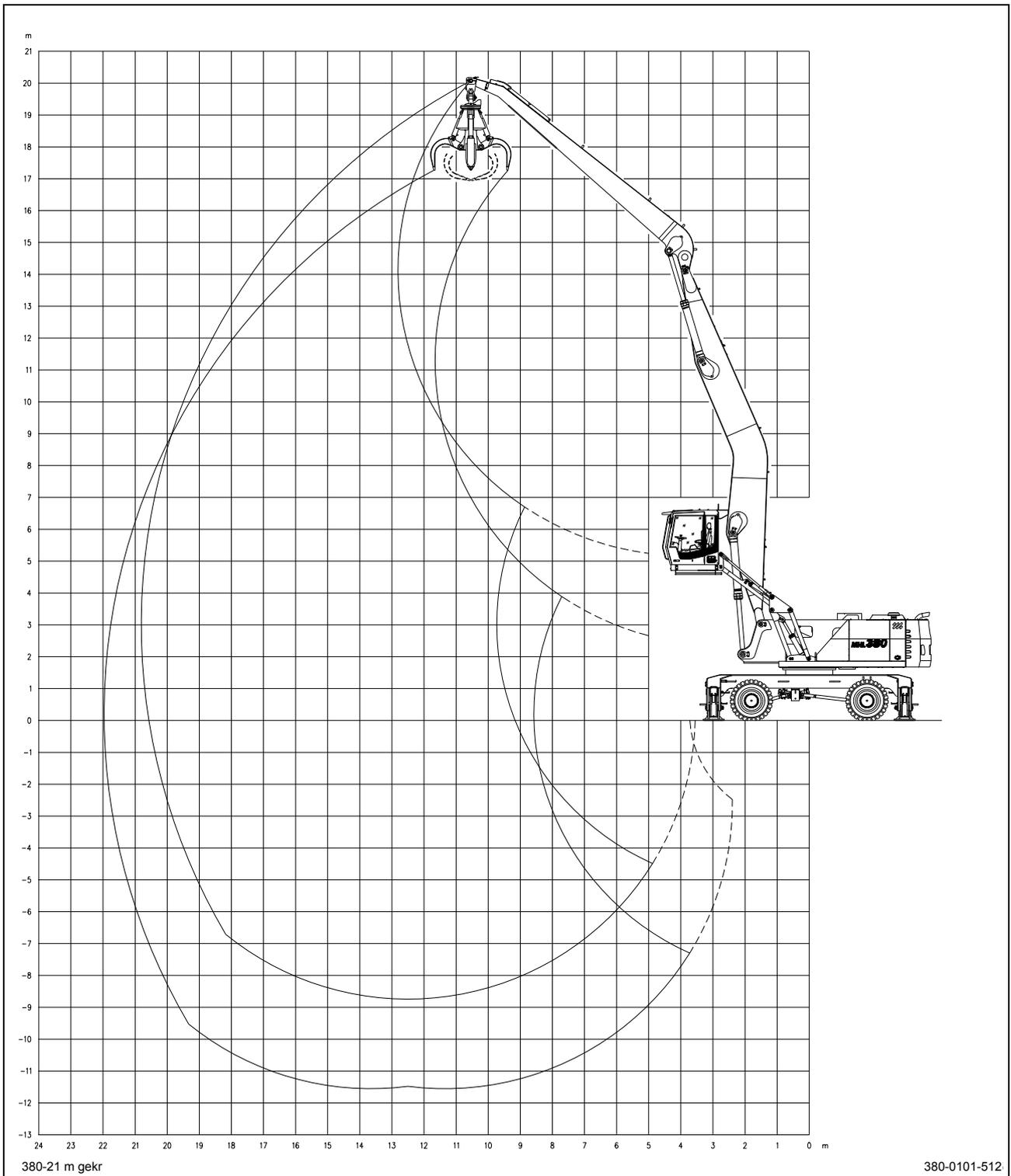


Fig. 17 Working range diagram (21 m work equipment offset)

3.13.10 Table of carrying capacity (21 m work equipment offset)

The carrying capacity values are stated in metric tons (t). The pump pressure is 360 bar. The values represent 75% of the static tipping load or 87% of the hydraulic lifting force (marked \circ), in accordance with ISO 10567. On solid and level ground, the values apply to a swing range of 360°. The (...) values apply in the longitudinal direction of the undercarriage. The values for "not supported" apply when the load is hoisted above the steering axle or the locked oscillating axle.

ATTENTION

The weight of the attached hoisting equipment (grab, load hook, etc.) must be deducted from the carrying capacity values. The safe working load of the hoisting equipment must be observed.

In accordance with EU Standard EN 474-5, hose-rupture safety devices on the lift and dipperstick cylinders, an overload warning device, and a carrying capacity table in the cab are required for hoisting. Only hoist when the machine's outriggers are up.

| Work equipment: boom offset 11.35 m, dipper stick 8.95 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------------------|------------|---------|--------|---------|---------|--------|--------|--------|-------|-------|-------|----------------|--|--|--|--|---------------|---------------|---------------|---------------|---------------|---------------|-------------|-------------|-------------|-------------|------------|
| Height m | Undercarriage Outrigger | Reach in m | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 4.5 | 6 | 7.5 | 9 | 10.5 | 12 | 13.5 | 15 | 16.5 | 18 | 19.5 | | | | | | | | | | | | | | | | |
| 18 | not supported | | | | | | (8.3°) | (5.9°) | | | | | 4-pt supported | | | | | 8.3° (8.3°) | 5.9° (5.9°) | | | | | | | | | |
| 16.5 | not supported | | | | | | | (7.7°) | (5.9°) | | | | 4-pt supported | | | | | 7.7° (7.7°) | 5.9° (5.9°) | | | | | | | | | |
| 15 | not supported | | | | | | | (7.7°) | (6.4) | (5.1) | | | 4-pt supported | | | | | 7.7° (7.7°) | 7.3° (7.3°) | 5.3° (5.3°) | | | | | | | | |
| 13.5 | not supported | | | | | | | (7.7°) | (6.4) | (5.2) | | | 4-pt supported | | | | | 7.7° (7.7°) | 7.3° (7.3°) | 7.0° (7.0°) | | | | | | | | |
| 12 | not supported | | | | | | | (7.7°) | (6.4) | (5.2) | (4.3) | | 4-pt supported | | | | | 7.7° (7.7°) | 7.3° (7.3°) | 7.0° (7.0°) | 6.2° (6.2°) | | | | | | | |
| 10.5 | not supported | | | | | | | (7.6) | (6.3) | (5.2) | (4.3) | | 4-pt supported | | | | | 7.9° (7.9°) | 7.4° (7.4°) | 7.0° (7.0°) | 6.7° (6.7°) | | | | | | | |
| 9 | not supported | | | | | | (8.9°) | (7.4) | (6.1) | (5.1) | (4.2) | (3.5) | 4-pt supported | | | | | 8.9° (8.9°) | 8.2° (8.2°) | 7.6° (7.6°) | 7.2° (7.2°) | 6.8° (6.8°) | 5.7° (5.7°) | | | | | |
| 7.5 | not supported | | | | | (10.4°) | (8.8) | (7.1) | (5.9) | (4.9) | (4.2) | (3.5) | 4-pt supported | | | | | 10.4° (10.4°) | 9.4° (9.4°) | 8.6° (8.6°) | 7.9° (7.9°) | 7.3° (7.3°) | 6.8° (6.8°) | 5.9 (6.5°) | | | | |
| 6 | not supported | | | | (13.0°) | (10.3) | (8.3) | (6.8) | (5.7) | (4.8) | (4.0) | (3.4) | 4-pt supported | | | | | 13.0° (13.0°) | 11.3° (11.3°) | 10.0° (10.0°) | 9.0° (9.0°) | 8.2° (8.2°) | 7.5° (7.5°) | 6.7 (7.0°) | 5.8 (6.5°) | | | |
| 4.5 | not supported | | (22.0) | (15.8) | (12.1) | (9.6) | (7.8) | (6.5) | (5.4) | (4.6) | (3.9) | (3.3) | 4-pt supported | | | | | 23.9° (23.9°) | 17.9° (17.9°) | 14.4° (14.4°) | 12.2° (12.2°) | 10.6° (10.6°) | 9.4° (9.4°) | 8.5° (8.5°) | 7.6 (7.8°) | 6.6 (7.1°) | 5.7 (6.6°) | |
| 3 | not supported | | (13.0°) | (14.1) | (11.1) | (8.9) | (7.3) | (6.1) | (5.2) | (4.4) | (3.8) | (3.3) | 4-pt supported | | | | | 13.0° (13.0°) | 20.0° (20.0°) | 15.7° (15.7°) | 13.0° (13.0°) | 11.2° (11.2°) | 9.8° (9.8°) | 8.5 (8.8°) | 7.4 (8.0°) | 6.4 (7.3°) | 5.6 (6.7°) | |
| 1.5 | not supported | | (7.8°) | (12.8) | (10.2) | (8.3) | (6.9) | (5.8) | (4.9) | (4.2) | (3.7) | (3.2) | 4-pt supported | | | | | 7.8° (7.8°) | 18.0° (18.0°) | 16.7° (16.7°) | 13.7° (13.7°) | 11.5° (11.5°) | 9.7 (10.2°) | 8.3 (9.0°) | 7.2 (8.1°) | 6.3 (7.3°) | 5.5 (6.7°) | |
| 0 | not supported | (4.1°) | (7.1°) | (11.9) | (9.5) | (7.8) | (6.5) | (5.5) | (4.7) | (4.1) | (3.6) | (3.1) | 4-pt supported | | | | | 4.1° (4.1°) | 7.1° (7.1°) | 13.1° (13.1°) | 16.5 (17.4°) | 13.3 (14.2°) | 11.1 (12.0°) | 9.4 (10.4°) | 8.1 (9.2°) | 7.0 (8.2°) | 6.2 (7.4°) | 5.5 (6.6°) |
| -1.5 | not supported | (5.2°) | (7.6°) | (11.5) | (9.1) | (7.4) | (6.2) | (5.3) | (4.6) | (4.0) | (3.5) | (3.1) | 4-pt supported | | | | | 5.2° (5.2°) | 7.6° (7.6°) | 11.8° (11.8°) | 16.0 (17.6°) | 12.9 (14.4°) | 10.8 (12.2°) | 9.1 (10.6°) | 7.9 (9.3°) | 6.9 (8.2°) | 6.1 (7.3°) | 5.4 (6.5°) |
| -3 | not supported | (6.4°) | (8.3°) | (11.3) | (8.8) | (7.2) | (6.0) | (5.2) | (4.5) | (3.9) | (3.4) | (3.1) | 4-pt supported | | | | | 6.4° (6.4°) | 8.3° (8.3°) | 11.7° (11.7°) | 15.8 (17.3°) | 12.7 (14.4°) | 10.5 (12.2°) | 9.0 (10.5°) | 7.8 (9.2°) | 6.8 (8.1°) | 6.0 (7.1°) | 5.4 (6.2°) |
| -4.5 | not supported | | (9.1°) | (11.3) | (8.7) | (7.1) | (5.9) | (5.1) | (4.4) | (3.8) | (3.4) | | 4-pt supported | | | | | | 9.1° (9.1°) | 12.1° (12.1°) | 15.7 (16.7°) | 12.6 (14.0°) | 10.4 (11.9°) | 8.9 (10.3°) | 7.7 (8.9°) | 6.8 (7.8°) | 6.0 (6.8°) | |
| -6 | not supported | | | (11.4) | (8.8) | (7.1) | (5.9) | (5.1) | (4.4) | (3.9) | (3.5) | | 4-pt supported | | | | | | | 12.7° (12.7°) | 15.7° (15.7°) | 12.6 (13.2°) | 10.4 (11.3°) | 8.9 (9.8°) | 7.7 (8.5°) | 6.8 (7.3°) | 6.1° (6.1°) | |
| -7.5 | not supported | | | | (8.9) | (7.2) | (6.0) | (5.1) | (4.4) | (3.9) | | | 4-pt supported | | | | | | | | 14.2° (14.2°) | 12.1° (12.1°) | 10.4° (10.4°) | 8.9° (8.9°) | 7.7° (7.7°) | 6.5° (6.5°) | | |

Fig. 18 Table of carrying capacity (21 m work equipment offset)

3.13.11 Working range diagram (22 m loading equipment cranked)

Loading equipment: boom 11.35 m, dipperstick 9.9 m, and cactus grab

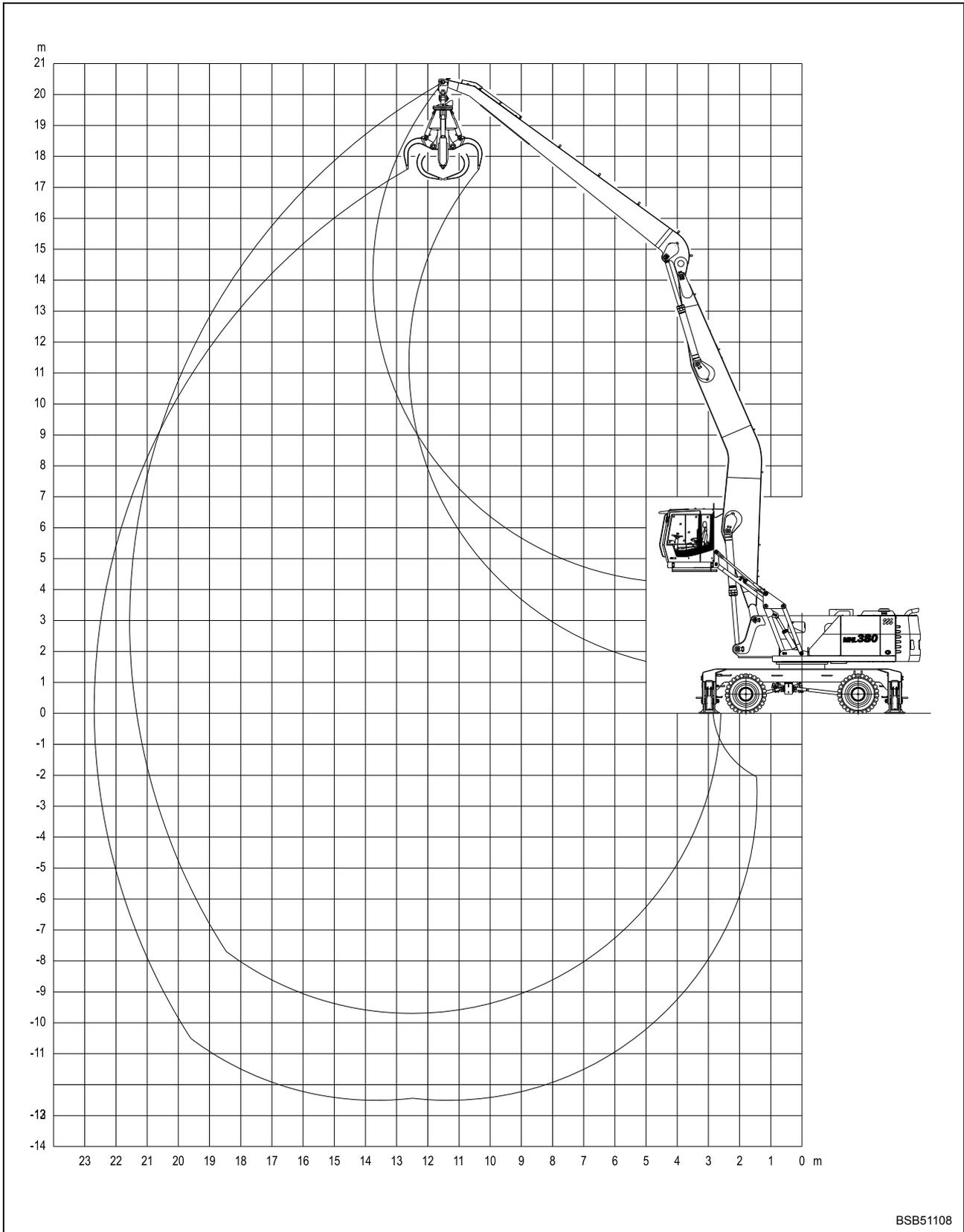


Fig. 19 Working range diagram (22 m loading equipment cranked)

3.13.12 Provisional carrying capacity table (22 m loading equipment cranked)

The carrying capacity values are stated in metric tons (t). The pump pressure is 360 bar. The values represent 75% of the static tipping load or 87% of the hydraulic lifting force (marked \circ), in accordance with ISO 10567. On solid and level ground, the values apply to a swing range of 360°. The (...) values apply in the longitudinal direction of the undercarriage. The values for "not supported" apply when the load is hoisted above the steering axle or the locked oscillating axle.

ATTENTION

The weight of the attached hoisting equipment (grab, load hook, etc.) must be deducted from the carrying capacity values. The safe working load of the hoisting equipment must be observed.

In accordance with EU Standard EN 474-5, hose-rupture safety devices on the lift and dipperstick cylinders, an overload warning device, and a carrying capacity table in the cab are required for hoisting. Only hoist when the machine's outriggers are up.

| Loading equipment: boom 11.35 m, dipperstick 9.9 m | | | | | | | | | | | | |
|--|---------------------------------|--------------------------|-------------------------|--------------------------|------------------------|------------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|----------------------|
| Height m | Undercarriage Outrigger | Reach in m | | | | | | | | | | |
| | | 6 | 7.5 | 9 | 10.5 | 12 | 13.5 | 15 | 16.5 | 18 | 19.5 | 21 |
| 18 | not supported 4-pt supported | | | | | | (7.4°) 7.4° (7.4°) | (5.2°) 5.2° (5.2°) | | | | |
| 16.5 | not supported 4-pt supported | | | | | | (7.5°) 7.5° (7.5°) | (6.7) 7.2° (7.2°) | (4.9°) 4.9° (4.9°) | | | |
| 15 | not supported 4-pt supported | | | | | | | (6.8) 7.1° (7.1°) | (5.6) 6.8° (6.8°) | | | |
| 13.5 | not supported 4-pt supported | | | | | | | (6.8) 7.1° (7.1°) | (5.6) 6.8° (6.8°) | (4.6) 6.1° (6.1°) | | |
| 12 | not supported 4-pt supported | | | | | | | (6.8) 7.1° (7.1°) | (5.6) 6.8° (6.8°) | (4.6) 6.5° (6.5°) | (3.8) 4.6° (4.6°) | |
| 10.5 | not supported 4-pt supported | | | | | | (7.7°) 7.7° (7.7°) | (6.7) 7.2° (7.2°) | (5.5) 6.9° (6.9°) | (4.6) 6.6° (6.6°) | (3.8) 6.1° (6.1°) | |
| 9 | not supported 4-pt supported | | | | | | (7.9°) 7.9° (7.9°) | (6.5) 7.4° (7.4°) | (5.4) 7.0° (7.0°) | (4.5) 6.6° (6.6°) | (3.8) 6.2° (6.3°) | |
| 7.5 | not supported 4-pt supported | | | | | (9.0°) 9.0° (9.0°) | (7.6) 8.3° (8.3°) | (6.3) 7.7° (7.7°) | (5.2) 7.2° (7.2°) | (4.4) 6.8° (6.8°) | (3.7) 6.1° (6.4°) | (3.1) 5.0° (5.0°) |
| 6 | not supported 4-pt supported | | | (10.7°) 10.7° (10.7°) | (8.8) 9.6° (9.6°) | (8.2) 8.7° (8.7°) | (7.2) 8.0° (8.0°) | (6.0) 7.4° (7.4°) | (5.0) 6.9° (6.9°) | (4.3) 6.0° (6.5°) | (3.6) 6.0° (6.5°) | (3.1) 5.3° (5.8°) |
| 4.5 | not supported 4-pt supported | (16.4°) 16.4° (16.4°) | (12.9) 13.5° (13.5°) | (10.2) 11.6° (11.6°) | (8.2) 10.2° (10.2°) | (6.8) 9.1° (9.1°) | (5.7) 8.3° (8.3°) | (4.8) 7.6° (7.6°) | (4.1) 6.8° (7.0°) | (3.5) 5.9° (6.6°) | (3.0) 5.2° (6.1°) | |
| 3 | not supported 4-pt supported | (20.6) 25.2° (25.2°) | (15.1) 18.6° (18.6°) | (11.7) 14.8° (14.8°) | (9.4) 12.4° (12.4°) | (7.7) 10.8° (10.8°) | (6.4) 9.5° (9.5°) | (5.4) 8.6° (8.6°) | (4.6) 7.6° (7.8°) | (3.9) 6.6° (7.2°) | (3.4) 5.8° (6.6°) | (2.9) 5.1° (6.1°) |
| 1.5 | not supported 4-pt supported | (11.4°) 11.4° (11.4°) | (13.4) 20.3° (20.3°) | (10.6) 16.0° (16.0°) | (8.6) 13.2° (13.2°) | (7.1) 11.3° (11.3°) | (6.0) 9.9° (9.9°) | (5.1) 8.5° (8.8°) | (4.4) 7.4° (8.0°) | (3.8) 6.4° (7.3°) | (3.3) 5.7° (6.7°) | (2.9) 5.0° (6.1°) |
| 0 | not supported 4-pt supported | (8.6°) 8.6° (8.6°) | (12.2) 16.5° (16.5°) | (9.7) 16.8° (16.8°) | (8.0) 13.5° (13.8°) | (6.7) 11.2° (11.7°) | (5.7) 9.5° (10.2°) | (4.9) 8.2° (9.1°) | (4.2) 7.2° (8.1°) | (3.7) 6.3° (7.4°) | (3.2) 5.6° (6.7°) | (2.8) 5.0° (6.0°) |
| -1.5 | not supported 4-pt supported | (8.3°) 8.3° (8.3°) | (11.4) 13.3° (13.3°) | (9.1) 16.1° (17.2°) | (7.5) 13.0° (14.1°) | (6.3) 10.8° (12.0°) | (5.4) 9.2° (10.4°) | (4.6) 8.0° (9.2°) | (4.0) 7.0° (8.2°) | (3.5) 6.2° (7.4°) | (3.1) 5.5° (6.6°) | (2.8) 4.9° (5.9°) |
| -3 | not supported 4-pt supported | (8.6°) 8.6° (8.6°) | (11.0) 12.4° (12.4°) | (8.7) 15.7° (17.2°) | (7.2) 12.6° (14.2°) | (6.0) 10.5° (12.1°) | (5.2) 9.0° (10.5°) | (4.5) 7.8° (9.2°) | (3.9) 6.9° (8.2°) | (3.5) 6.1° (7.3°) | (3.1) 5.4° (6.5°) | |
| -4.5 | not supported 4-pt supported | (9.1°) 9.1° (9.1°) | (10.8) 12.4° (12.4°) | (8.5) 15.4° (16.8°) | (7.0) 12.4° (14.0°) | (5.9) 10.4° (11.9°) | (5.0) 8.8° (10.3°) | (4.4) 7.7° (9.1°) | (3.8) 6.8° (8.0°) | (3.4) 6.0° (7.1°) | (3.1) 5.4° (6.1°) | |
| -6 | not supported 4-pt supported | (9.8°) 9.8° (9.8°) | (10.9) 12.7° (12.7°) | (8.4) 15.4° (16.1°) | (6.9) 12.3° (13.5°) | (5.8) 10.3° (11.5°) | (5.0) 8.8° (10.0°) | (4.3) 7.6° (8.7°) | (3.8) 6.7° (7.6°) | (3.4) 6.0° (6.6°) | (3.1) 5.5° (5.5°) | |
| -7.5 | not supported 4-pt supported | | (11.0) 13.2° (13.2°) | (8.5) 14.9° (14.9°) | (6.9) 12.4° (12.6°) | (5.8) 10.3° (10.9°) | (5.0) 8.8° (9.4°) | (4.3) 7.7° (8.2°) | (3.9) 6.8° (7.0°) | (3.5) 5.9° (5.9°) | | |
| -9 | not supported 4-pt supported | | | (8.7) 13.3° (13.3°) | (7.0) 11.4° (11.4°) | (5.9) 9.8° (9.8°) | (5.1) 8.5° (8.5°) | (4.4) 7.3° (7.3°) | | | | |

Fig. 20 Provisional carrying capacity table (22 m loading equipment cranked)

3.14 Work attachments

Documentation covering work attachments supplied by TEREX | Fuchs is part of the scope of supply of every work attachment.

It includes:

- Operating instructions
- Spare parts catalogue

3.14.1 Equipment (optional)

Engine

- Engine preheating
- Particulate filter
- Cyclone prefractorer

Hydraulics

- Preheating of hydraulic fluid
- Filter system for tools
- Ball valve quick-release coupling

Undercarriage

- Individually controlled 4-point outrigger
- Enlarged stabilizer plates
- Central lubrication system

Equipment

- Overload warning device
- Overload cut-off (special equipment)
- Close range shut-off system and limitations for loading height and reach

Cab

- Heated seat and passive air conditioning
- Protective grating
- Reinforced glass for windshield and sky-light
- Lexan glass for windshield
- Powder fire extinguisher
- Supplementary heating
- Dust & particulate filter with automatic re-generation
- Protective ventilation system
- Radio with accessories
- 12V socket
- Windshield wiper at bottom

Uppercarriage

- Electrical refueling pump
- Reversing fan for combined water/charge air cooler and hydraulic oil cooler
- Protective grating for headlamps
- Other headlamps (including Xenon)
- Other headlamps (including Xenon)
- Magnet system
- Vehicle reversing alarm
- Flashing beacon
- Float switch

ATTENTION

For details of additional accessories, please refer to the latest price/equipment list or contact the manufacturer.

ATTENTION



Changes to the design, additional equipment and work attachments of TEREX | Fuchs products which have not been approved may result in damage to the machine. Please note that changes must be approved in writing by the manufacturer. Failure to obtain written permission will invalidate both our warranty and product liability for any resulting consequential damages.

3.15 Fuels, lubricants and coolants

Conscientiously following the requirements for lubrication, level checks and changing fuels, lubricants and coolants will increase the reliability and service life of the machine.

It is particularly important to perform the various oil changes regularly and at the recommended intervals, as well as to observe the specified lubricant qualities.

| ⚠ CAUTION | |
|---|--|
|  | <p>Serious injury due to incorrect handling of fuels, lubricants and coolants and unsafe machine statuses</p> <ul style="list-style-type: none"> • Unless specified otherwise, all jobs on the loading machine must be performed on an even, solid surface and with the diesel engine turned off. • Before performing any task in the engine compartment, always secure the cover and side doors to stop them falling back or closing inadvertently. • Always turn the diesel engine off before refueling the machine. Do not smoke and avoid naked flames when refueling. • Turn off the battery isolator switch and remove the ignition key. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

Cleanliness is very important when changing engine oil, transmission oil or hydraulic fluid. Before removing screw couplings or filling covers clean them and the area around them.

Also clean filling and drain plugs when changing oil.

| ATTENTION |
|--|
| <i>If possible, oil should always be drained out at operating temperature.</i> |

| ATTENTION | |
|---|---|
|  | <p><i>Collect old oil and dispose of it, along with discarded oil filter cartridges, in an environmentally friendly manner.</i></p> |

Instructions for reducing contamination of hydraulic fluid in work and dust-intensive applications

If the loading machine is generally operated with a hydraulic hammer or under difficult conditions (frequent changing of work equipment, surroundings exposed to dust), there is a risk of increased contamination of the hydraulic fluid.

To avoid resulting premature wear of hydraulic components, reduce the time between oil changes (or reduce the time between taking oil samples).

We recommend using a filter system for tools as an option in such cases.

3.15.1 Filling quantities

| Designation | Filling quantity | Fluid | Remark |
|--|------------------------------|-------------------------------|---|
| Fuel tank | 900 l | Diesel | |
| Engine oil | 38 l | Engine oil | |
| Hydraulic fluid tank | 720 l | Hydraulic fluid | Change quantity |
| Front axle, cpl. | 43 l | Transmission oil | |
| per wheel hub | 4,5 l | Transmission oil | |
| Differential | 34 l | Transmission oil | |
| Rear axle, cpl. | 54 l | Transmission oil | |
| Transfer gear | 3 l | Transmission oil | |
| Swing gear | 14 l | Transmission oil | |
| Ring gear of slewing joint: supplied by central lubrication system | - | - | |
| Grease lubrication system | 4 kg | Multi-purpose grease | Central lubrication system for uppercarriage |
| | 2 kg | Multi-purpose grease | Central lubrication system for undercarriage (optional) |
| Service brake | Supplied by hydraulic system | | |
| Air conditioning system | 1,850 g | Coolant R134a | Check filling quantity on sight glass |
| | 10 ml | Refrigerant oil Reniso PAG100 | |
| Cooling system | 60 l | Coolant | Water + nitrite-, amine- and phosphate-free coolant (For composition see the diesel engine manufacturer's operating instructions) |
| Window washwipe system | 3.5 l | Water with window detergent | |

Attention

The filling quantities specified in the filling quantities table are only approximate values. The level must be checked in the corresponding assembly after every oil change or refill.

3.15.2 Specifications for fuels, lubricants and coolants

| Specified fuels, lubricants and coolants for Central Europe | | | |
|---|---|--|---|
| Application | Designation | Recommended product | Specification, standards, quality |
| Engine | Diesel fuel | Use of branded fuels with a sulfur content of < 0.05%. A higher sulfur content will affect the oil change intervals and service life of the engine. | DIN EN 590 ASTM D 975-88; 1-D/2-D Before using RME fuels (rape oil methyl ester), it is essential that you consult your responsible TEREX Fuchs dealer for further details. |
| Engine | Engine oil | Titan Cargo MC 10W-40 | DQC III ACEA-E4-99/E6-04 See also engine manufacturer's operating instructions |
| Cooling for engine | Coolant | Fricofin-35 | BASF G 48 Clean water and antifreeze based on ethylene glycol See also engine manufacturer's operating instructions |
| Hydraulic working circuits | Hydraulic fluid or hydraulic multigrade oil | Renolin B 15 or Renolin Xtrem | HLP or HVLP ISO VG 46 The following viscosity limit values must be observed (according to ASTM 445): at 100°C min. 7.0 mm ² /s (cSt) at -10°C < 1300 mm ² /s (cSt) |
| | Biodegradable hydraulic fluid on based on synthetic ester | PANOLIN HLP SYNTH 46 (Brand label on machine.) | HEES ISO VG 46 Filling according to customer specifications. Brand label on machine. Do not mix biodegradable oils from different manufacturers. The same viscosity specifications apply as for mineral hydraulic fluids. When changing from mineral to biodegradable hydraulic fluid, the tank and the hydraulic system must be completely drained, cleaned and flushed. Before changing oils, please ask your local TEREX Fuchs dealer for advice. |

| Specified fuels, lubricants and coolants for Central Europe | | | |
|---|----------------------|---|---|
| Application | Designation | Recommended product | Specification, standards, quality |
| Transfer boxes, swing gears, wheel hubs, axles, grab and magnet gears | Transmission oil | Titan Supergear SAE 80W-90 | SAE 80W-90 API GL-4/GL-5 ZF-TZ-MZ 02B, 05A, 07A, 12B, 16F, 17B |
| Cab door, lock | Special grease | Hadol LS-EP 5142; Klüber Isoflex Topas L32 | |
| Grease lubrication system, other lubricating points | Multi-purpose grease | Renolit Duraplex EP 2 (Can be used at temperatures down to -20°C.) | Lithium complex soap K P 2P-30 DIN 51 502 Alternative recommendation at lower operating temperatures down to -30°C: Renolit JP 1619 Molykote TTF 52 See also enclosed user information from Lincoln |
| Ring gear of slewing joint: supplied by central lubrication system | - | - | - |

3.15.3 Alternative recommendations for other temperature ranges

The ambient temperature is decisive when selecting the right hydraulic fluid. The temperature ranges listed in the graphic are approximate guides. Values above or below these limits are acceptable for short periods.

3.15.4 Biodegradable hydraulic fluid PANOLIN HLP SYNTH 46

We recommend biodegradable hydraulic fluids based on synthetic ester as an alternative to mineral oils. The same viscosity limit values apply as for mineral oils.

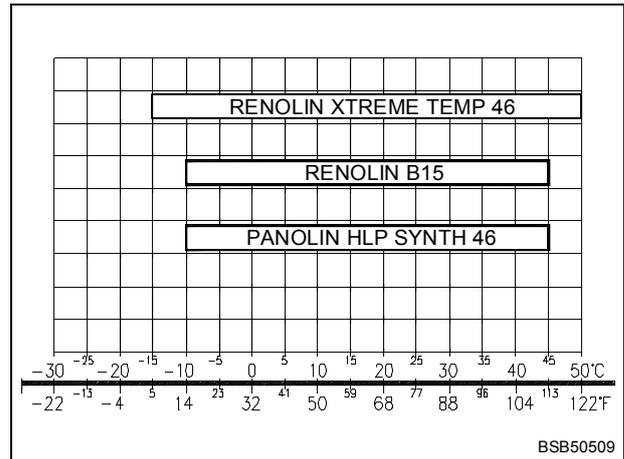


Fig. 21 Ambient temperature of hydraulic oil

ATTENTION



When changing from mineral to biodegradable hydraulic fluid, the tank and the hydraulic system must be completely drained, cleaned and flushed. Warranty conditions as well as the changeover guideline from KLEENOIL PANOLIN AG should be complied with.

Ester-based biodegradable hydraulic fluids must not be mixed with oils from different manufacturers or with mineral oil. Doing so may cause aggressive reactions which in turn could damage the hydraulic system.

Before changing oils, please ask your local TEREX | Fuchs dealer for advice.

Vegetable-based oils are not permitted because of their unsuitable temperature resistance.

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4 Display and control elements

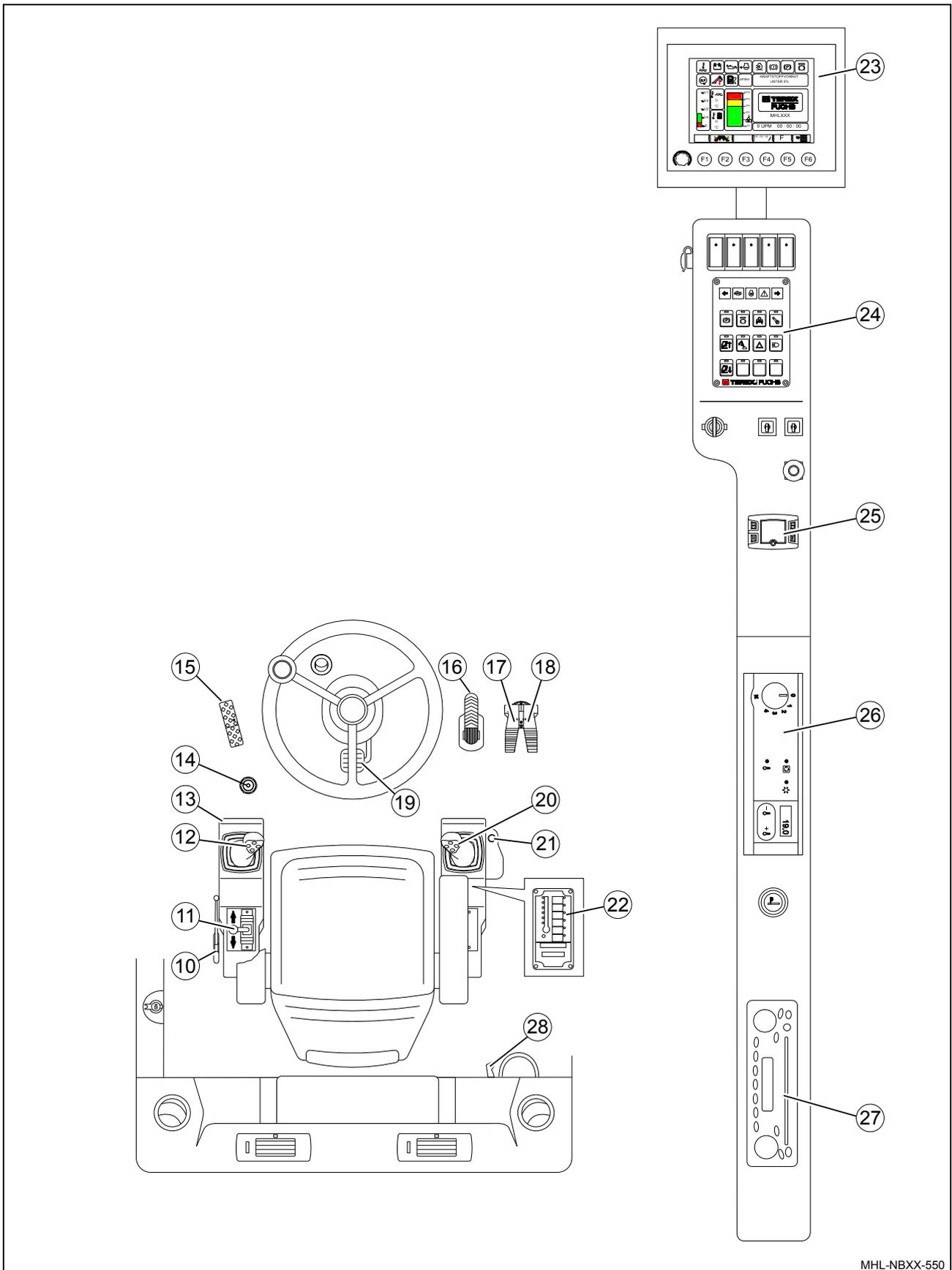
Before placing the machine into operation

If you are not yet familiar with the display and control elements of this machine, read this chapter carefully **before** operating the machine.

This chapter deals with all display and control elements.

Before putting the machine into motion and operation you must familiarize yourself thoroughly with the display elements and operator controls.

4.1 Overview of the display and control elements



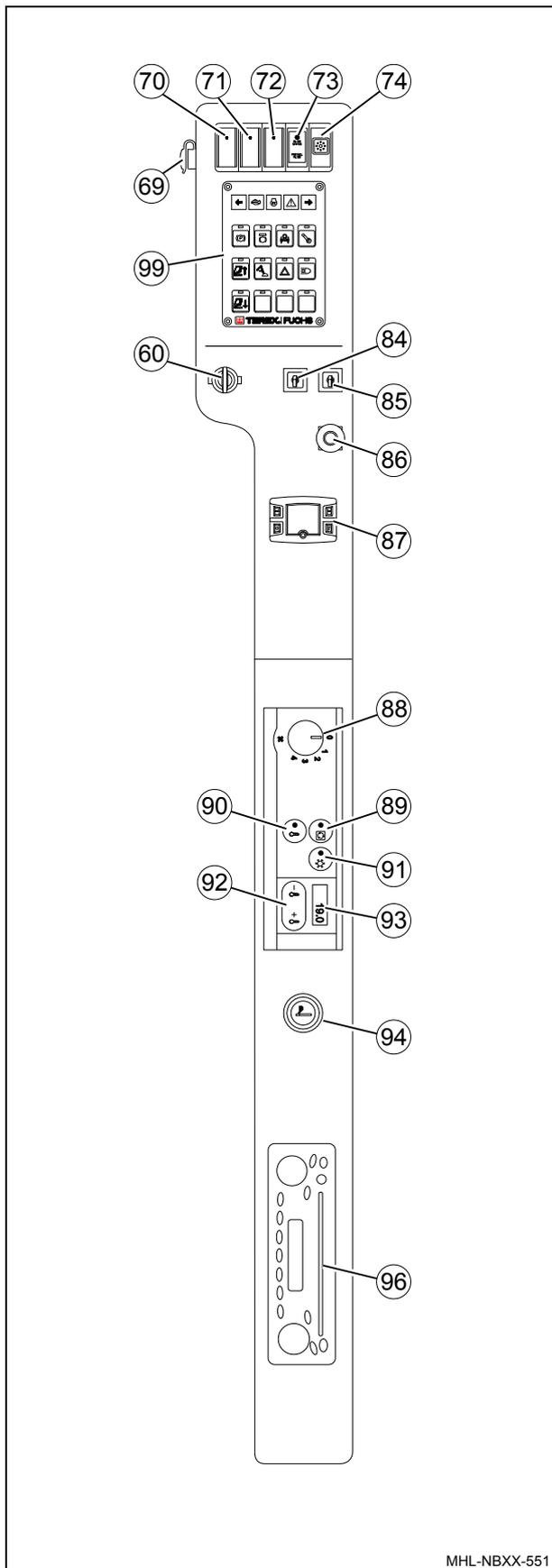
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Fig. 22 Display and control elements

Overview of the display and control elements

- 10 Emergency lowering of cab
- 11 Lever for extending/retracting 4-point outrigger
- 12 Four-way control lever (left)
- 13 Upward folding armrest with switch (work functions disabled)
- 14 Foot button for boom float function (optional)
- 15 Pedal for extending/retracting tilting cylinder (optional)
- 16 Service brake pedal, lockable
- 17 Forward accelerator pedal (**▲** Note alignment of uppercarriage/undercarriage!)
- 18 Reverse accelerator pedal (**▲** Note alignment of uppercarriage/undercarriage!)
- 19 Steering column adjustment (inclination angle)
- 20 Four-way control lever (right)
- 21 Multifunction button
- 22 Magnet system control device (optional)
- 23 Multifunction display
- 24 Control panel
- 25 Operator device for supplementary heating (optional)
- 26 Lever with controller for heater/air conditioning system
- 27 Radio, CD player (optional)
- 28 Cooling/heating system for lunchbox/bottle holder

4.1.1 Operator control panel



MHL-NBXX-551

Fig. 23 Control panel

- 60 Ignition lock
- 69 24 V socket
- 70 71 72 Not assigned
- 73 Clogged particulate filter indicator (optional)
- 74 Warning buzzer – sounds in the event of excess exhaust gas pressure as the result of a clogged particulate filter (optional)
- 84 Key switch (black) – deactivate overload warning device (optional)/overload cut-off (special equipment)
- 85 Key switch (blue) – reduce hydraulic oil pressure or enable work movements with the diesel engine stopped (function is only active as an option)
- 86 Pushbutton for EMERGENCY STOP (optional)
- 87 Supplementary heating lever (optional)
 Device manufacturer's operating instructions
- 88 4-stage-switch blower (heating and air conditioning system)
- 89 Button toggle for air flap
 Telltale on: circulating air
 Telltale off: external air (fresh air)
- 90 Button toggle for external temperature display
- 91 Button toggle for air conditioning system
 Telltale on: air conditioning system switched on
 Telltale off: air conditioning system switched off
- 92 Button toggle for temperature setting
- 93 Digital display of external temperature and operating status
- 94 Cigarette lighter
- 96 Radio, CD player (optional)
 Manufacturer's operating instructions
- 99 Control panel

Control panel

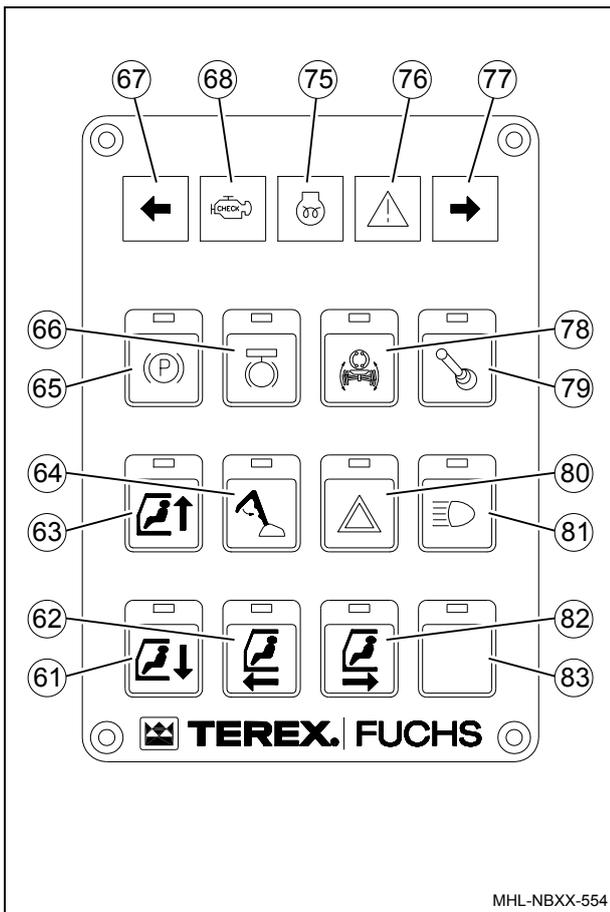


Fig. 24 Control panel

- 61 Pushbutton for lowering cab
- 62 Pushbutton for cab forward
- 63 Pushbutton for raising cab
- 64 Pushbutton for deactivating close range cut-off (dipperstick)
- 65 Pushbutton for parking brake
- 66 Pushbutton for swing brake
- 67 Flashing control indicator (left)
- 68 Error display for engine control system (Electronic Engine Control III)
- 75 Preheat display
- 76 Indicator – general warning/emergency operation active
- 77 Flashing control indicator (right)
- 78 Pushbutton for oscillating axle lock release
- 79 Pushbutton for travel and work functions
Pushbutton function: enable work functions (Pushbutton function: bypass cut-off of work functions (emergency))
- 80 Pushbutton for hazard warning lights
- 81 Pushbutton for side lights/headlamps
- 82 Pushbutton for cab backward
- 83 Not assigned

4.1.2 Control elements for switching functions

The switching functions can be operated using the components shown in Fig. 25.

- Multifunction display (25/1)

Compact display unit for text and graphics to display operating conditions, messages, switch symbols, diagnostic tools, etc. For menu navigation and for function switching, 6 function keys and one menu selection wheel (encoder) are available below the screen.

- Control panel (25/2)

5 LED light symbols and 12 short-stroke keys – each key with allocated LED function display for important and easily accessible switching functions.

- Multifunction button (25/3)

Operator device with the following elements:

- continuous rotary knob (encoder)
- pushbuttons
- X-Y cursor control

for navigating in menus that are shown on the display; for switching various functions and for changing settings, e.g. speed pre-setting for the diesel engine.

All functions can be navigated and triggered in at least two ways and most in three ways:

1. with the multifunction button
2. with the function keys on the display
3. with the menu selection wheel on the display

Rotate, click, double-click and hold down actions can be executed with the multifunction button as well as with the menu selection wheel.

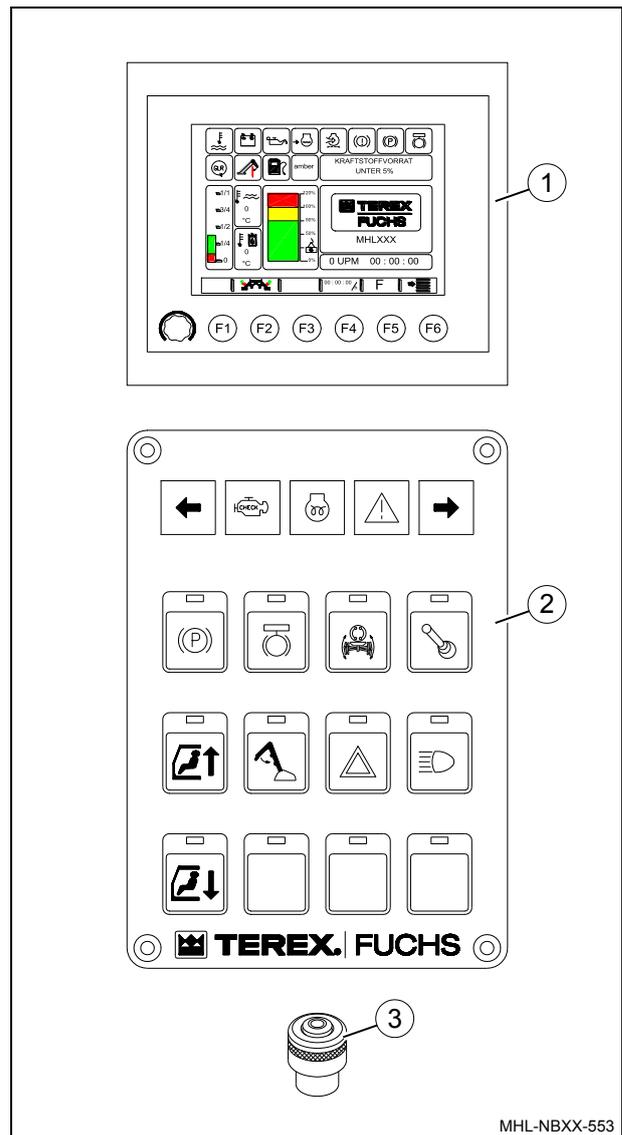


Fig. 25 Control elements for switching functions

4.2 Multifunction display

When the machine is switched on (see Fig. 26), the main control display appears on the multifunction display.

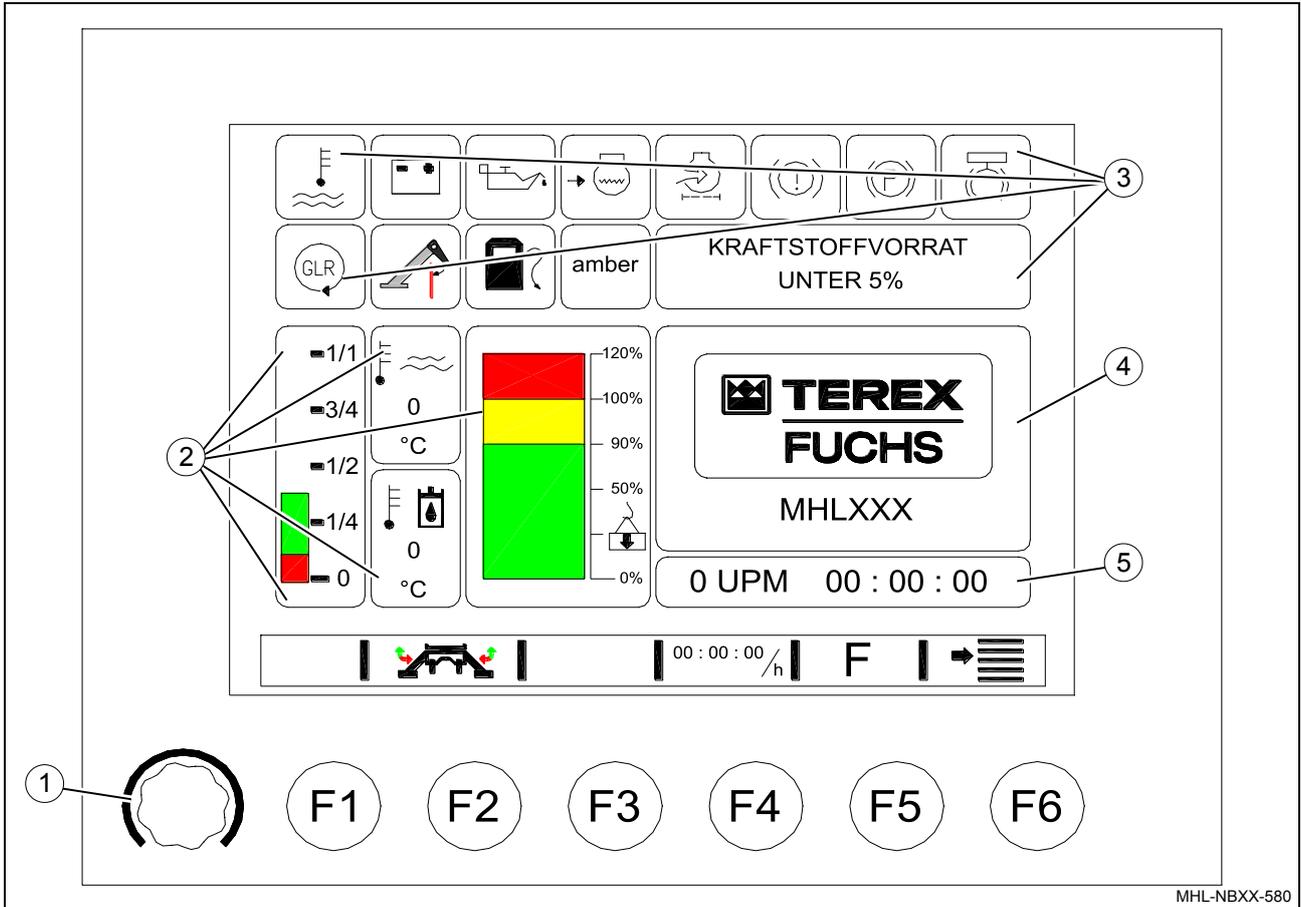


Fig. 26 Multifunction display

SYM field (symbols) see (26/3)

"Indicators" with the associated message text are displayed in the upper part of the main control display.

i Symbols in this field: Pages 4.9 – 4.11.

MESS field (measured value displays) see (26/2)

The MESS field displays fuel level, coolant temperature, hydraulic oil temperature, and the load (optional) in graphic/numeric form.

i Displays: Pages 4.11 and 4.12.

BA field (time/operating hours and current engine speed as an option) see (26/5)

Time of day/operating hours appear in this field, as well as (optionally) the current speed of the diesel engine.

FEH field (errors or option displays) see (26/4)

In this field, displays for certain options appear instead of the company logo, e.g., the status display for outrigger deselection when the outrigger is activated individually. Additionally, an error message is displayed here if there is an error, e.g., in the event of a sensor failure.

Navigation

The main control display remains on the screen until the operator calls up a menu with either the multifunction button, the menu selection wheel (26/1) or the function keys F 1 – F 6.

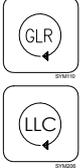
You can return to the main control display from any menu:

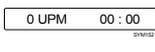
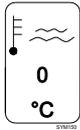
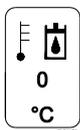
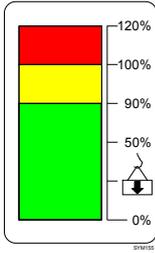
- by double-clicking (multifunction button/menu selection wheel)
- with ➡ ESC – (F 6)
- or by waiting for 10 seconds without making any other entries, which will take you back automatically

After the ignition is switched off, the display goes into "STANDBY" mode for 10 minutes. It then switches off automatically.

4.2.1 Symbols on the main control display

| Symbol | Item | Explanation of the function |
|---|------|---|
|  | 35 | Indicator (dual assignment): coolant temperature / hydraulic oil temperature (see also indicator 49 / 50) Illuminates to indicate high operating temperatures.  Chapter 4.7.2 Coolant temperature - Chapter 4.7.9 Hydraulic oil temperature |
|  | " | Indicator – charge air temperature Lights up to indicate high operating temperatures.  Chapter 4.7.5 Charge air temperature |
|  | 36 | Indicator – battery charge control Illuminates if the ignition key is moved to the contact position. Goes out as soon as the diesel engine is running. This indicator lights up during operation if the alternator causes a malfunction during battery charging. Switch off the diesel engine and correct the fault. |
|  | " | Indicator – height adjustment activation (dipperstick) (optional) Lights up when the boom is within the height adjustment limit and the work movement "Extend boom" is deactivated. |
|  | " | Indicator – height adjustment bypassed (dipperstick) (optional) Lights up when the boom is within the height adjustment limit and the work movement "Extend boom" is bypassed. |
|  | " | Indicator – boom float function – remote range (optional) Lights up when the machine is operating with float function at remote range. |
|  | " | Indicator – boom float function – close range (optional) Lights up when the machine is operating with the float function at close range. |
|  | 37 | Indicator – engine oil pressure Lights up when the engine oil pressure falls below a specified value during operation.  Chapter 4.7.4 Oil pressure |
|  | " | Indicator – water in fuel Lights up when the sensor in the fuel prefilter is triggered.  Chapter 4.7.8 Fuel pre-filter |
|  | 38 | Indicator (dual assignment): coolant level/hydraulic oil level Lights up when the coolant level or hydraulic oil level falls below the minimum required level  Chapter 4.7.3 Coolant level - Chapter 4.7.10 Hydraulic oil level |

| Symbol | Item | Explanation of the function |
|---|------|---|
|  | 39 | <p>Indicator (dual assignment): air cleaner clogging/return filter clogging</p> <p>If this indicator lights up and stays steady, the air cleaner needs to be maintained or the return filter replaced. The indicator may light up briefly, but this is circumstantial and is usually caused by the engine speed being increased too quickly.</p> <p> Chapter 4.7.6 Air filter differential pressure - Chapter 4.7.11 Hydraulic oil filter</p> |
|  | 40 | <p>Indicator – service brake</p> <p>Lights up when there is not enough reserve pressure. The warning buzzer sounds at the same time. The brake is not ready for operation. The indicator and warning buzzer are meant to go out/stop sounding approximately 10 seconds after the engine is started. If they do not, stop the machine immediately and check the brake system.</p> |
|  | 41 | <p>Indicator – parking brake</p> <p>Lights up when the parking brake is engaged or when the parking brake pressure falls below the triggering level.</p> |
|  | 42 | <p>Indicator – swing brake</p> <p>Lights up when the swing brake is locked.</p> |
|  | 43 | <p>Indicator - malfunction in load limit sensing control</p> <p>When the engine is running, the indicator should be off. If this indicator lights up, there is a fault in the load limit sensing control (LLC: Load Limit Control). Refer to the "LOAD LIMITER UNIT" diagnostics menu for a more detailed description of the error.</p> |
|  | ” | <p>Indicator – reversing fan mode (optional)</p> <p>When reversing fan mode is active, the "reversing fan mode" indicator (optional) lights up and the message "REVERSING FAN MODE" appears on the multifunction display.</p> |
| | ” | Not assigned |
|  | 44 | <p>Indicator – close range cut-off active (dipperstick)</p> <p>Lights up when the dipperstick is in close range and the work movement "Retract dipperstick" is deactivated.</p> |
|  | ” | <p>Indicator – close range cut-off bypassed (dipperstick)</p> <p>Lights up when the dipperstick is in close range and the work movement "Retract dipperstick" is bypassed (the safety distance from the cab is below the minimum level).</p> |
|  | ” | <p>Indicator – range limit activated (dipperstick) (optional)</p> <p>Lights up when the dipperstick is within the range limit and the work movement "Extend dipperstick" is deactivated.</p> |
|  | ” | <p>Indicator – range limit bypassed (dipperstick) (optional)</p> <p>Lights up when the dipperstick is within the range limit and the work movement "Extend dipperstick" is bypassed.</p> |

| Symbol | Item | Explanation of the function |
|---|------|--|
|  | 45 | Indicator – fuel level The "Fuel reserve" indicator lights up if the fuel in the diesel tank is less than the reserve volume of 5%. |
|  | " | Indicator – oscillating axle unlocked The "Oscillating axle unlocked" indicator lights up if the oscillating axle is unlocked. |
|  | 46 | Indicator – travel and work functions disabled Lights up when travel and work functions are disabled: <ul style="list-style-type: none"> • Pushbutton for travel and work functions disabled • Maintenance steps folded down • Left armrest folded up • Coolant, charge air or hydraulic fluid temperature above maximum • Hydraulic fluid level too low |
|  | 47 | Text output for the indicator displays |
|  | 48 | Display – time/operating hours and optionally the current engine speed Time of day/operating hours appear in this field, as well as (optionally) the current speed of the diesel engine. |
|  | 49 | Display – diesel engine coolant temperature (in °C) Indicates the coolant temperature of the diesel engine in numeric form. The background color of the symbol changes according to the coolant temperature. i Chapter 4.7.2 Coolant temperature |
|  | 50 | Hydraulic oil temperature (in °C) indicator A number that indicates the hydraulic oil temperature. i Chapter 4.7.9 Hydraulic oil temperature |
|  | 51 | Load display (optional) The bar display shows the current pressure generated in the main cylinders by the load (display as a percentage of the maximum permissible load pressure). If 90% of the permissible load pressure is exceeded, the color of the bar will change from green to yellow, and the message "OVERLOAD" will appear on a yellow background in the main control display. At the same time, the warning buzzer will sound in the cab. If 100% of the permissible load pressure is exceeded, the bar color will change from yellow to red. If the "Overload cut-off" special equipment is selected, the "OVERLOAD" message appears on the main control display against a red background. Depending on the various dynamic parameters, work functions that increase load may be disabled. |

| Symbol | Item | Explanation of the function |
|--------|------|--|
| | 52 | Display – fuel level The bar in the display indicates how much fuel there is in the diesel tank. When the tank is more than 5% full, the bar display is green. If the tank is below the reserve level, the bar turns red and the "Fuel reserve" indicator 45 also lights up. |
| | 53 | Status indicator for outrigger deselection (optional) |
| | F1 | Rear view camera |
| | F2 | Outrigger menu (optional) |
| | F3 | Reversing fan menu (optional) |
| | F4 | Switching the time/operating hours display |
| | F5 | Function menu |
| | F6 | Main menu |
| | | Move up menu arrow |
| | | Move down menu arrow |
| | | Confirm selection |

4.3 Multifunction button

4.3.1 Input options with the multifunction button

The multifunction button (see Fig. 27) is an all-purpose "operator device" that, together with the display, offers new possibilities for machine operation.

4.3.2 Operating principle

To operate a machine via the display and multifunction button, the machine functions are displayed in the form of lines of text (menu) or graphically in the form of pictograms. By displaying a certain text line or an individual pictogram with brightness/color highlighting or by means of a cursor, a certain function is highlighted – the highlighted function is in "focus". Use the pointing device (e.g. computer mouse, track ball, touchpad) to move the focus from function to function, i.e. to select a certain function. To execute the function, confirm the selection by either briefly pressing a button once (click), briefly pressing a button twice (double-click) or holding and pressing down a button.

The multifunction button can be moved along four axes. The following functions are allocated to the movement axes:

Turn button

During rotation, the rotary knob snaps into 20 positions per rotation. When the knob is turned forward or backward by one or more notch positions, the focus is moved forward or backward in individual steps, i.e., a function is selected or settings (numeric values) are changed, e.g., preset speed for the diesel engine.



Fig. 27 Multifunction button



Fig. 28 Turn button

Press button

Click once then release:

Selected "in focus" function is triggered and performed once (e.g., switch on headlamp).

Hold button down:

Selected function is triggered repeatedly until the button is released (e.g., raise cab).

Double-click:

Returns to the main control display from any lower menu level.

Slew navigation encoder

On top of the button, there is a small area with a "finger recess". Use your index finger to move at will in the X and Y directions. This is a digital encoder, which delivers values in the range of +/-100 %, proportionally to the deflection in the X and Y direction. The focus can therefore be "navigated" accurately in any direction toward the desired function. This allows a function (pictogram) to be selected quickly, particularly in the F5 function menu.

-  Chapter 4.4 Menu levels in the multifunction display



Fig. 29 Press button



Fig. 30 Slew navigation encoder

4.4 Menu levels in the multifunction display

4.4.1 Menu selection in the main control display

In the main control display, any +/- movement of the "navigation encoder" along the X axis will move the focus to one of six buttons (soft keys). With a single click, the selected menu will appear.

When exiting a menu, the focus will automatically jump to the **F** soft key (function menu). This allows rapid access to all switching functions in the function menu, i.e., if no selection is made, a single click will take you directly to the function menu.

Double-clicking (with multifunction button/menu selection wheel) takes you back to the main control display from any menu level. Alternatively, it is possible to return to the main control display by pressing the function keys F4, F5, F6.

Speed and FINE MODE menu

The speed of the diesel engine can be set on the main control display by turning the multifunction button clockwise or counterclockwise. In doing so, the display switches to the "Speed and FINE MODE" menu.

In the "Speed and FINE MODE" menu, the speed of the diesel engine can be adjusted from idling to "Full throttle" (0 % to 100 %). The pump capacity of the hydraulic pump can be adjusted from maximum to a reduced amount (FINE MODE 0% to 100%) using the "load limit sensing control" function.

When calling the "Speed and FINE MODE" menu, the focus is always on the speed adjustment (black-on-white display) – the FINE MODE adjustment is displayed in white on a blue background (not selected).

Turn the multifunction button clockwise to increase the speed of the diesel engine in 10 notch steps from the lowest idle speed to the highest idle speed. Regardless of the set and displayed gas position (0%...100%), it is not possible to start the diesel engine other than in idle mode!

i Chapter 4.6.8.1 FINE MODE adjustment

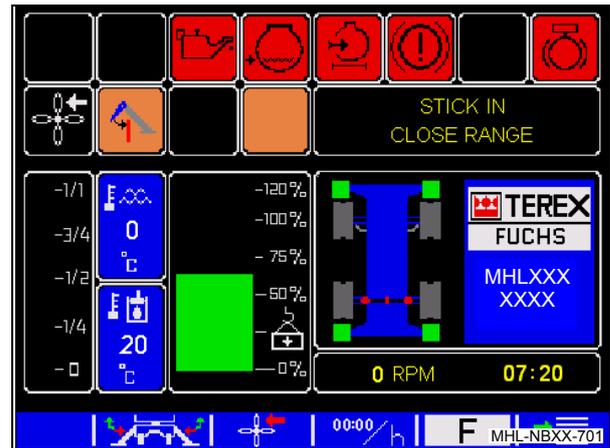


Fig. 31 Main control display

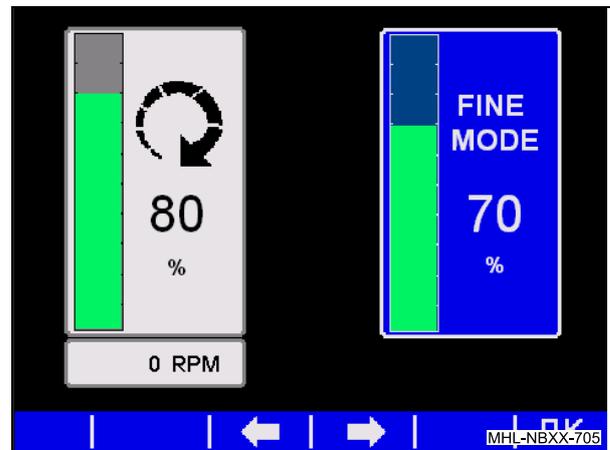


Fig. 32 Speed and FINE MODE menu

F 1 display change for camera image (optional)

 Chapter 4.13.1 Rear view camera (optional)

F2 Outrigger menu (optional)

In the F2 outrigger menu, the status indicator for outrigger deselection is displayed. In this menu, each of the four outriggers can be deselected individually.

F3 Reversing fan menu (optional)

The user can press and hold down the F3 function key to switch to the reversing fan menu. The interval between reversing phases can be set to any value between 15 and 60 minutes in the reversing fan menu.



Fig. 33 Camera image

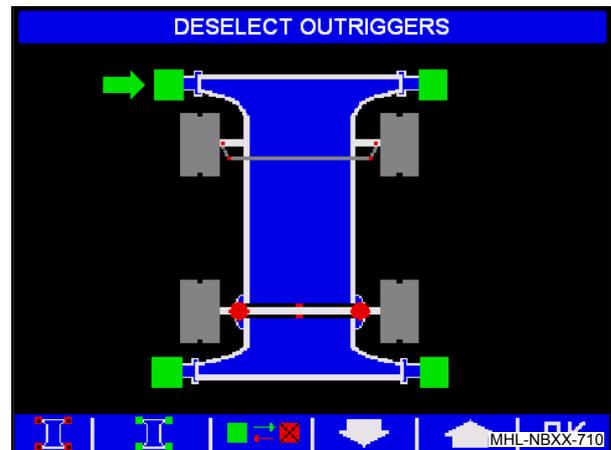


Fig. 34 Outrigger menu



Fig. 35 Reversing fan menu

F4 Time/operating hours

The F4 function key displays the operating hours instead of the time of day for a period of 10 seconds.

F5 Function menu

In the function menu, up to 24 pushbutton and switching functions are displayed in the form of pictograms. The currently selected function, i.e. the function that is currently "in focus", is highlighted and displayed in black on a white background. All other pictograms are displayed in white on a blue background. Activated functions are displayed inside an orange border.

To move the focus, either turn the multifunction button/menu selection wheel gradually clockwise or counterclockwise to jump from function to function or move the navigation encoder in the +/-X-Y direction and even diagonally to "navigate" to the desired function.

Switching functions such as "Headlamp", "Auto-idling system" and "Flashing beacon" are activated by a single short click and deactivated by another single short click.

Pushbutton functions such as "Additional lubrication pulse" are activated with a single click and then run automatically.

Pushbutton hold functions, e.g. "Raise/lower cab" are performed for as long as the multifunction button is pressed.

In the main menu the function keys F1 to F6 are allocated to the six functions of the lower series of switches:

- F1: Not assigned
- F2: Not assigned
- F3: Raise cab
- F4: Lower cab
- F5: Not assigned
- F6: Return to main control display

This allows direct and rapid access to the cab travel functions from the main control display after the function menu has been selected.

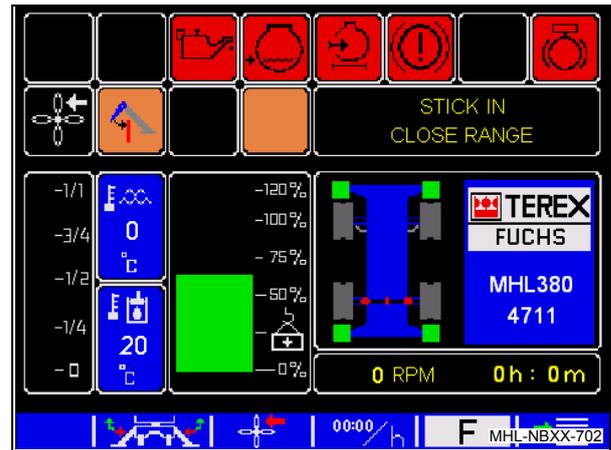


Fig. 36 Main control display

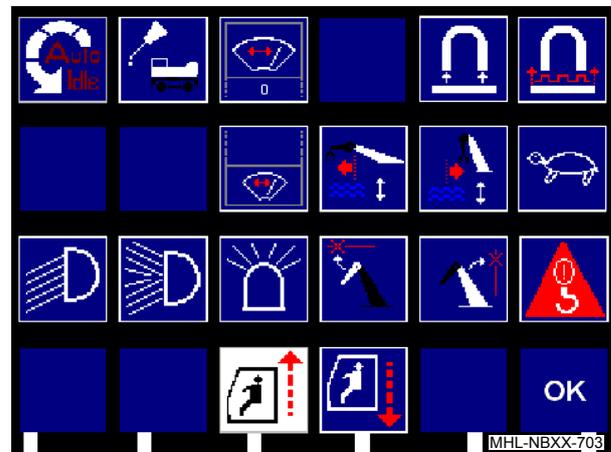


Fig. 37 Function menu

F6 Main menu

In the main menu, you can call up to 9 sub-menus such as "DISPLAY ADJUSTMENT", "SERVICE MENU", "DIAGNOSTICS MENU", and "SYSTEM INFORMATION".

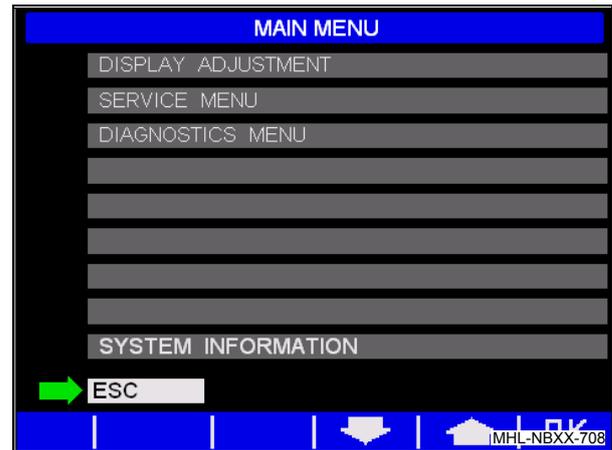


Fig. 38 Main menu

4.4.2 Sub-menus in the main menu

Display settings

In the "Display settings" menu, you can set the overall brightness of the display and the menu language as well as the time and date on the multifunction display. The modified settings remain saved permanently after exiting the menu.

Service menu

A 6-digit access code is required to access the service menu. The service menu is accessible only to trained dealer or service personnel. Access to the service menu is denied if the code is not entered correctly.

Press "ESC" to abort the entry (if you wish to exit code entry and make another menu selection).

Select "<" to delete the last number entered.



Fig. 39 Display settings



Fig. 40 Enter code

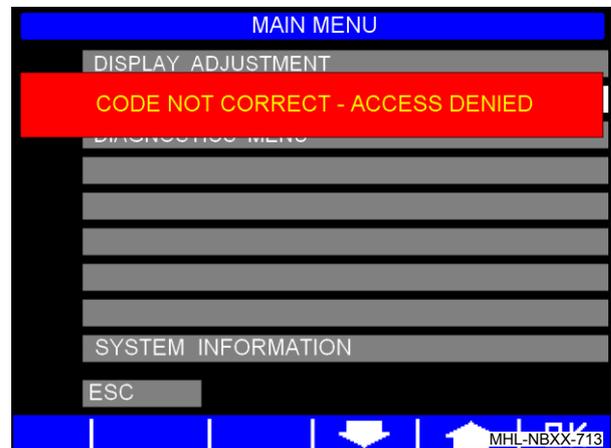


Fig. 41 Code not correct

Diagnostics menu

Data for various components is displayed in the diagnostics menu, currently:

- „CANopen DIAGNOSTICS"
- "ELECTRONIC ENGINE CONTROL DIAGNOSTICS"
- "SYSTEM DIAGNOSTICS 1 – DIGITAL I/O"
- "SYSTEM DIAGNOSTICS 2 – ANALOG I/O"

System information

The system information shows the current software versions of the control components.



Fig. 42 Diagnostics menu

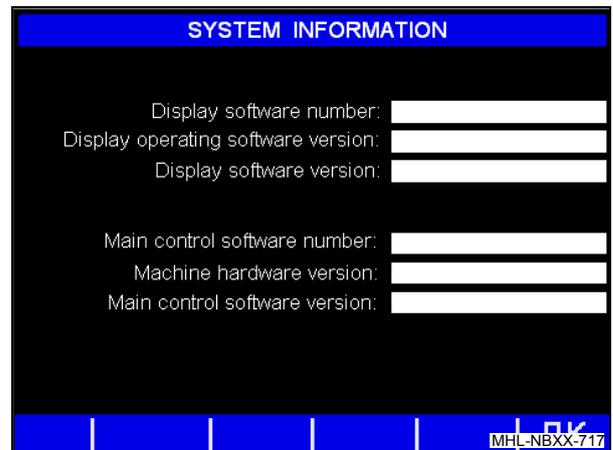


Fig. 43 System information

4.4.3 Sub-menus in the diagnostics menu

CANopen INFORMATION

This menu runs a quick status diagnostics test of the components connected to the CANopen bus.

"EEC" DIAGNOSTICS

This menu displays the current data of the EEC3 engine control unit.

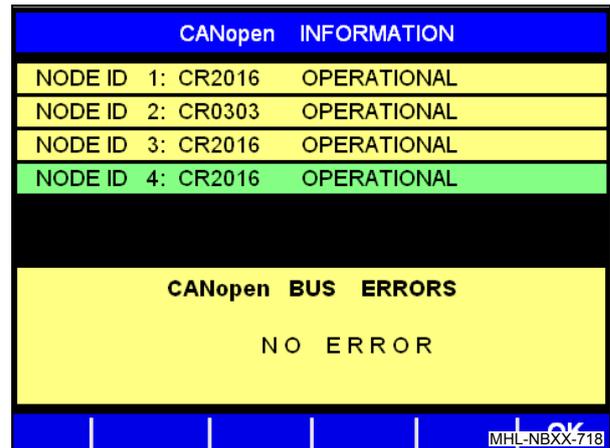


Fig. 44 CANopen information

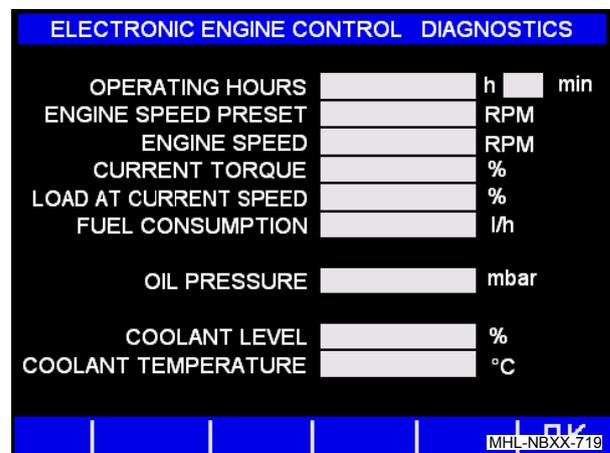


Fig. 45 "EMR" engine diagnostics

SYSTEM DIAGNOSTICS 1 – DIGITAL I/O - B35 (CR0020)

The current states (HIGH = green, LOW = grey) of the digital inputs and outputs of the main control -B35 (CR0020) are displayed in this menu.

SYSTEM DIAGNOSTICS 1 – DIGITAL I/O - B68 (CR2016-1/ZE)

The current states (HIGH = green, LOW = grey) of the digital inputs and outputs of the first I/O extension -B68 (CR2016-1/ZE) are displayed in this menu.

SYSTEM DIAGNOSTICS 1 – DIGITAL I/O - B74 (CR2016-2/ZE)

The current states (HIGH = green, LOW = grey) of the digital inputs and outputs of the second I/O extension -B74 (CR2016-2/ZE) are displayed in this menu.

| SYSTEM DIAGNOSTICS - DIGITAL I/O -B35 (CR0020) | |
|--|--|
| DIGITAL INPUTS | DIGITAL OUTPUTS |
| <input type="checkbox"/> S65 Ausleger im Arbeitsber. | <input type="checkbox"/> Y4 Fahren freigeben |
| <input type="checkbox"/> S64 Stiel im Arbeitsber. | <input type="checkbox"/> Y5 Arbeitshydr. freigeben |
| <input type="checkbox"/> S14 Wartungsaufst. geschl. | <input type="checkbox"/> B4 Hupe EIN |
| <input type="checkbox"/> Fehlermeldg. Y43 Lenkventil | <input type="checkbox"/> Y58 Ausleger heben freigeb. |
| <input type="checkbox"/> S43 Steuerdruck niedrig | <input type="checkbox"/> Y56 Stiel ausfahren freig. |
| <input type="checkbox"/> S6 Feststellbremse arretiert | <input type="checkbox"/> Y42 Feststellbremse lösen |
| <input type="checkbox"/> S30b Fahr. / S80 Greif. inaktiv | <input type="checkbox"/> Y6 Stiel einfahren freigeben |
| <input type="checkbox"/> S30a Fahren inaktiv | <input type="checkbox"/> Y59 Schwenkarret. lösen |
| <input type="checkbox"/> S84 Hydr. Rueckfilt. sauber | <input type="checkbox"/> Y2 Pendelachse entriegeln |
| <input type="checkbox"/> S83 Hydr. Füllstand OK | <input checked="" type="checkbox"/> K84 Anlasser 50a freigeben |
| <input type="checkbox"/> S15 Stiel ausserh. Nahber. | <input type="checkbox"/> S135 NotAus Vorsteu. +Fahr. |
| <input type="checkbox"/> S171 Hd.Filt. schw. sauber | <input type="checkbox"/> H26 Fahrscheinw. rechts EIN |
| <input type="checkbox"/> S178 Notbetrieb EIN | <input checked="" type="checkbox"/> K8 Freigabe Gebläse Klima* |
| | <input type="checkbox"/> H23+H44 Arbschw. Stiel EIN |
| | <input type="checkbox"/> H45+H46 Arbschw. Ausl. EIN |
| | <input type="checkbox"/> Y48 Ausleger senken freig. |
| | <input type="checkbox"/> M15 Fettschmieranl. OW EIN |

Fig. 46 System diagnostics

| SYSTEM DIAGNOSTICS - DIGITAL I/O -B68 (CR2016-1 / ZE) | |
|---|---|
| DIGITAL INPUTS | DIGITAL OUTPUTS |
| <input type="checkbox"/> Reserve B68 Digital IN01 | <input type="checkbox"/> Reserve B68 Digital Out01 |
| <input type="checkbox"/> Reserve B68 Digital IN02 | <input type="checkbox"/> Reserve B68 Digital Out02 |
| <input type="checkbox"/> Reserve B68 Digital IN03 | <input type="checkbox"/> Reserve B68 Digital Out03 |
| <input type="checkbox"/> Reserve B68 Digital IN04 | <input type="checkbox"/> Y12 Bypass Greifer Kabine |
| <input type="checkbox"/> S154 Kolbdet. Fettschm. OW | <input type="checkbox"/> Y33 Kabine vor |
| <input type="checkbox"/> S107 Abstützung einfahren | <input type="checkbox"/> Y34 Kabine zurueck |
| <input type="checkbox"/> S182 Abstützung ausfahren | <input type="checkbox"/> Y9 Kabine heben |
| <input type="checkbox"/> Reserve B68 Digital IN08 | <input type="checkbox"/> Y8 Kabine senken |
| <input type="checkbox"/> Reserve B68 Digital IN09 | <input type="checkbox"/> Y145 Raeumschild ab |
| <input type="checkbox"/> Reserve B68 Digital IN10 | <input type="checkbox"/> Y146 Raeumschild auf |
| <input type="checkbox"/> Reserve B68 Digital IN11 | <input type="checkbox"/> B21 Fahrwarner Ein |
| <input type="checkbox"/> Reserve B68 Digital IN12 | <input type="checkbox"/> Y54 Schwim. Ausl. heb. EIN |
| | <input type="checkbox"/> Y55 Schwim. Ausl. heb. AUS |
| | <input type="checkbox"/> Y10 Greifer drehen links |
| | <input type="checkbox"/> Y11 Greifer drehen rechts |
| | <input type="checkbox"/> Y15 Druckhochschaltung EIN |

Fig. 47 System diagnostics

| SYSTEM DIAGNOSTICS - DIGITAL I/O -B74 (CR2016-2 / ZE) | |
|---|---|
| DIGITAL INPUTS | DIGITAL INPUTS |
| <input type="checkbox"/> S105 QC Riegel geschlossen | <input type="checkbox"/> Reserve B74 Digital Out01 |
| <input type="checkbox"/> S165 QC Riegel offen | <input type="checkbox"/> Reserve B74 Digital Out02 |
| <input type="checkbox"/> S114 QC Werkzeugkennung link | <input type="checkbox"/> Reserve B74 Digital Out03 |
| <input type="checkbox"/> S115 QC Werkzeugkennung re | <input type="checkbox"/> Reserve B74 Digital Out04 |
| <input type="checkbox"/> S116 QC Gabel im Kupplungst | <input type="checkbox"/> Reserve B74 Digital Out05 |
| <input type="checkbox"/> S137 QC Ausleger im zul Bere | <input type="checkbox"/> Y60 QC Riegel oeffnen |
| <input type="checkbox"/> S136 QC Stiel im zul Bereich | <input type="checkbox"/> Y96 QC DruckLOSschaltung |
| <input type="checkbox"/> S166 QC Werkzeugfilter OK | <input type="checkbox"/> Y97 QC DruckHOCHschaltung |
| <input type="checkbox"/> Reserve B74 Digital IN09 | <input type="checkbox"/> M14 Kompressor Umkehrl. |
| <input type="checkbox"/> Reserve B74 Digital IN10 | <input type="checkbox"/> Y74 LL-Kühler Drehrichtung |
| <input type="checkbox"/> Reserve B74 Digital IN11 | <input type="checkbox"/> Y75 Hydr. Oelkühler Drehr. |
| <input type="checkbox"/> Reserve B74 Digital IN12 | <input type="checkbox"/> Y61 Y62 QC Greiferbetrieb |
| | <input type="checkbox"/> Y63 Y64 QC Fahrped. umsch. |
| | <input type="checkbox"/> Y65 Y66 QC Sortiergreiferbetr. |
| | <input type="checkbox"/> Y67 Y68 QC Scherenbetrieb |
| | <input type="checkbox"/> Y69 Y70 QC Schere- Sortiergr. |

Fig. 48 System diagnostics

SYSTEM DIAGNOSTICS 1 – DIGITAL I/O - B1 (CR0303)

The current states (HIGH = green, LOW = grey) of the digital inputs and outputs of the cab control -B1 (CR0303) are displayed in this menu.

SYSTEM DIAGNOSTICS 1 – DIGITAL I/O - B47 (CR2016/UW)

The current states (HIGH = green, LOW = grey) of the digital inputs and outputs of the I/O extension in the undercarriage -B47 (CR2016/UW) are displayed in this menu.

SYSTEM DIAGNOSTICS 2 – ANALOG I/O - B35 (CR0020)

The current states of the analog inputs and outputs of the main control -B35 (CR0020) are displayed in this menu.

| SYSTEM DIAGNOSTICS - DIGITAL I/O -B1 (CR0303) | |
|---|---|
| DIGITAL INPUTS | DIGITAL INPUTS |
| <input type="checkbox"/> S34 Magnet EIN | <input type="checkbox"/> M2 Waschp. Hauptf. EIN |
| <input type="checkbox"/> S34 Blinken links EIN | <input type="checkbox"/> M9 Waschp. unten EIN |
| <input type="checkbox"/> S34 Blinken rechts EIN | <input checked="" type="checkbox"/> B3 Warnsummer EIN |
| <input type="checkbox"/> S16 Raeumschild AB | <input type="checkbox"/> M3 Wischer Hauptf. EIN |
| <input type="checkbox"/> S16 Raeumschild AUF | <input type="checkbox"/> M8 Wischer unten EIN |
| <input type="checkbox"/> S16 Greifer links drehen | <input type="checkbox"/> Reserve B1 Digital OUT05 |
| <input type="checkbox"/> S16 Greifer rechts drehen | <input type="checkbox"/> Reserve B1 Digital OUT06 |
| <input type="checkbox"/> S16 Druckhochschaltung EIN | <input type="checkbox"/> B55 Magnetanlage Impuls |
| <input type="checkbox"/> S156 Arb.hydr. freig. Italpak. | <input type="checkbox"/> B55 Magnetanl. betr.bereit |
| <input type="checkbox"/> S164 Ueberlastfunkt. deaktiv. | <input type="checkbox"/> B55 Magnetanl. Tippbetr. EIN |
| <input type="checkbox"/> S13 Armllehne geschlossen | <input type="checkbox"/> Reserve B1 Digital OUT11 |
| <input type="checkbox"/> S2 Bremsdruck vorhanden | <input type="checkbox"/> H51 Rundumleuchte EIN |
| <input type="checkbox"/> S167 Fusstaster Schwenkbr. | <input type="checkbox"/> H13 H14 Blinker links EIN |
| <input type="checkbox"/> S50 Fusstaster Schwirrmst. | <input type="checkbox"/> H15 H16 Blinker rechts EIN |
| <input type="checkbox"/> S34 Hupe EIN | <input type="checkbox"/> H25 Fahrscheinw. links EIN |
| <input type="checkbox"/> B34 Standheizung EIN | <input type="checkbox"/> H47, H48 Scheinw. Dach V EIN |
| | <input type="checkbox"/> H49, H50 Scheinw. Dach H EIN |

Fig. 49 System diagnostics

| SYSTEM DIAGNOSTICS - DIGITAL I/O -B47 (CR2016 / UW) | |
|--|--|
| DIGITAL INPUTS | DIGITAL OUTPUTS |
| <input type="checkbox"/> S155 Kolddet. Fettschm. UW | <input type="checkbox"/> Y16 Abst. VL abgewählt |
| <input type="checkbox"/> Reserve B47 Digital IN02 | <input type="checkbox"/> Y17 Abst. HL abgewählt |
| <input type="checkbox"/> Reserve B47 Digital IN03 | <input type="checkbox"/> Y18 Abst. VR abgewählt |
| <input type="checkbox"/> Reserve B47 Digital IN04 | <input type="checkbox"/> Y19 Abst. HR abgewählt |
| <input type="checkbox"/> S96 Abst. VL im zul.Bereich | <input type="checkbox"/> Y139 Allradl. L.ausgl. links |
| <input type="checkbox"/> S97 Abst. HL im zul.Bereich | <input type="checkbox"/> M16 Fettschm. UW EIN |
| <input type="checkbox"/> S98 Abst. VR im zul.Bereich | <input type="checkbox"/> Y140 Allradl. L.ausgl. rechts |
| <input type="checkbox"/> S95 Abst. HR im zul.Bereich | |
| <input type="checkbox"/> S101 Abst. VL ausgefahren | |
| <input type="checkbox"/> S102 Abst. HL ausgefahren | |
| <input type="checkbox"/> S103 Abst. VR ausgefahren | |
| <input type="checkbox"/> S100 Abst. HR ausgefahren. | |

Fig. 50 System diagnostics

| SYSTEM DIAGNOSTICS - ANALOG I/O -B35 (CR0020) | |
|---|--|
| ANALOG INPUTS | |
| 25203 | [mV] G3 Ladespannung |
| 0 | [mV] B9 Dieseltank Füllstand |
| 0 | [mV] B29 Hydraulikoeltanktemperatur |
| 0 | [uA] B28 Auslegerdruck |
| 0 | [uA] B43 Steuerdruck Leerlaufautomatik |

Fig. 51 System diagnostics

SYSTEM DIAGNOSTICS 2 – ANALOG I/O - B1 (CR0303)

The current states of the analog inputs and outputs of the cab control -B1 (CR0303) are displayed in this menu.

| SYSTEM DIAGNOSTICS - ANALOG I/O -B1 (CR0303) | | | |
|--|-------|---|-------------------------|
| ANALOG INPUTS | | | |
| 4504 | [mV] | Joystick_lenken_Bahn_1 | (0..10000 mV) |
| 0 | [mV] | Joystick_lenken_Bahn_2 | (0..10000 mV) |
| 500 | [mV] | Joystick_fahren_Bahn_1 | (0..10000 mV) |
| 0 | [mV] | Joystick_fahren_Bahn_2 | (0..10000 mV) |
| 0 | [mV] | S34_Schwenkbr.Totrn.JOYlinksREXvorneCALsens | |
| ANALOG (PWM) OUTPUTS | | | |
| 0 | [mA] | Y93 Fahren vorw. | 0 [%] Y43 Lenken rechts |
| 0 | [mA] | Y94 Fahren rückw. | 0 [%] Y43 Lenken links |
| 600 | [RPM] | Diesel-Solldrehz. | 70 [%] GLR-FineMode |

Fig. 52 System diagnostics

4.5 Four-way control lever

Four-way control lever (left)

- 1 Pushbutton for magnet system (optional)
- 2 Pushbutton for indicator (left)
- 3 Pushbutton for indicator (right)
- 4 Pushbutton for horn
- 5 Pushbutton for swing brake or dead man's button (optional)

Machines for the Italian market must be equipped with a dead man's button. All hydraulically controlled work movements (raise/lower boom, extend/retract dipperstick, rotate upper-carriage, extend/retract outrigger) are only enabled if the dead man's button toggle is pressed.

| ATTENTION | |
|--|--|
|  | <p><i>The swing brake is not a dynamic brake. Activate the "Swing brake" pushbutton only with the swing assembly at standstill!</i></p> |

Four-way control lever (right)

- 1 Pushbutton for lowering dozer blade (optional) or boom float function – switchover between close/remote range (optional)
- 2 Pushbutton for grab rotation (left)
- 3 Pushbutton for grab rotation (right)
- 4 Pushbutton for raising dozer blade (optional)
- 5 Pushbutton for increasing the operating pressure

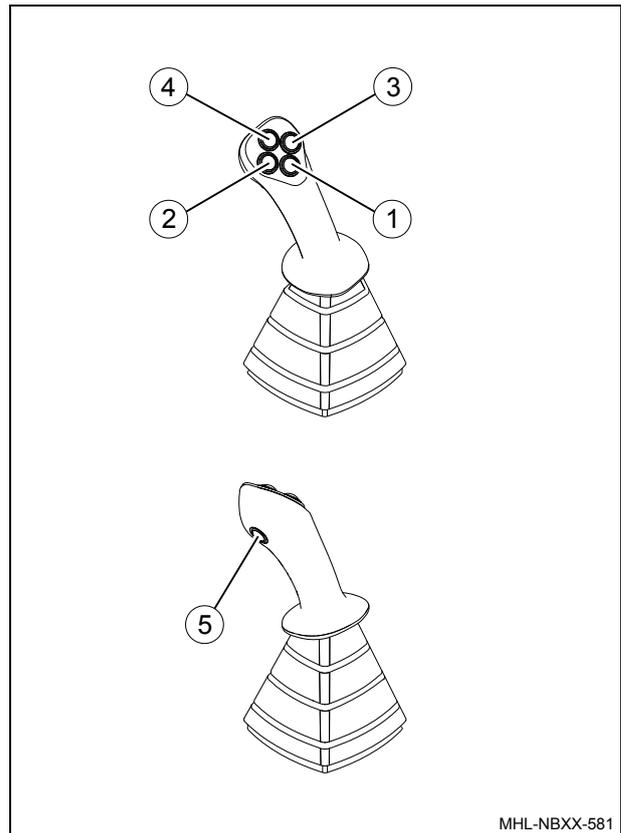


Fig. 53 Four-way control lever, left/right

MHL-NBXX-581

4.6 Diesel engine

|  WARNING | |
|--|--|
|  | <p>Serious injuries to bystanders due to machine movements</p> <ul style="list-style-type: none"> • Before starting the diesel engine, make certain there is no-one in the machine's danger zone. <p>In an emergency: Switch off machine, administer first aid, seek treatment from a doctor</p> |

| ATTENTION |
|--|
| <p><i>Before putting the machine into operation, the prescribed inspections must be performed.</i></p> <p> Chapter 7.6 Jobs before putting the machine into operation</p> |

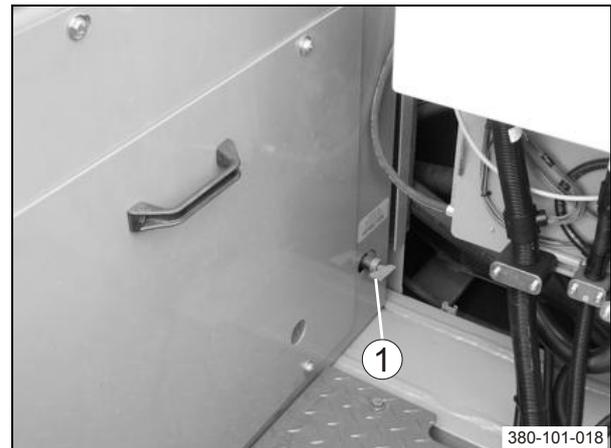


Fig. 54 Battery isolator switch

4.6.1 Battery isolator switch

Before starting the diesel engine, the battery isolator switch (54/1) must be switched on. The battery isolator switch of the machine is located in the service section of the engine compartment panel.

| ATTENTION | |
|---|--|
|  | <p><i>The battery isolator switch should only be used once the ignition has been switched off for at least 15 seconds.</i></p> <p><i>If optional devices (such as supplementary heating) or additional equipment are installed and are supplied with an electrical current even when the ignition is switched off, these should be switched off or shut down beforehand as required.</i></p> <p><i>Failure to comply with this instruction may result in damage!</i></p> <p> Chapter 4.9.2 Supplementary heating (optional)</p> |

4.6.2 Starting the diesel engine

A buzzer will sound when starting the ignition (55/60) in position I and the service brake indicator (55/40) will light up if the available brake pressure is not sufficient.

Once the diesel engine is running and the brake pressure has built up, the buzzer will sound and the indicator (55/40) will go out.

4.6.2.1 Cold start (normal start)

- ▶ Set all gearshift levers to neutral.
- ▶ Insert the ignition key into the ignition lock (55/60) and turn it to position I. The pre-heat indicator (55/75) lights up for a few seconds. **Wait for approx. 5 - 10 seconds for the machine control unit to start, until the indicators (55/36), (55/37), (55/49), and (55/50) appear on the display.**
- ▶ When the preheat indicator goes out and the indicators (55/36), (55/37), (55/49), and (55/50) are displayed, turn the ignition key through position II to position III → Diesel engine starts.
- ▶ As soon as the diesel engine is running, let go of the ignition key. It will automatically return to position I. The indicators for battery charge control (55/36) and for engine oil pressure (55/37) should go out.

ATTENTION

If, after a maximum of 15 seconds, the diesel engine does not start up, move the ignition key to 0 and, after waiting for at least 30 seconds, repeat the start-up procedure.

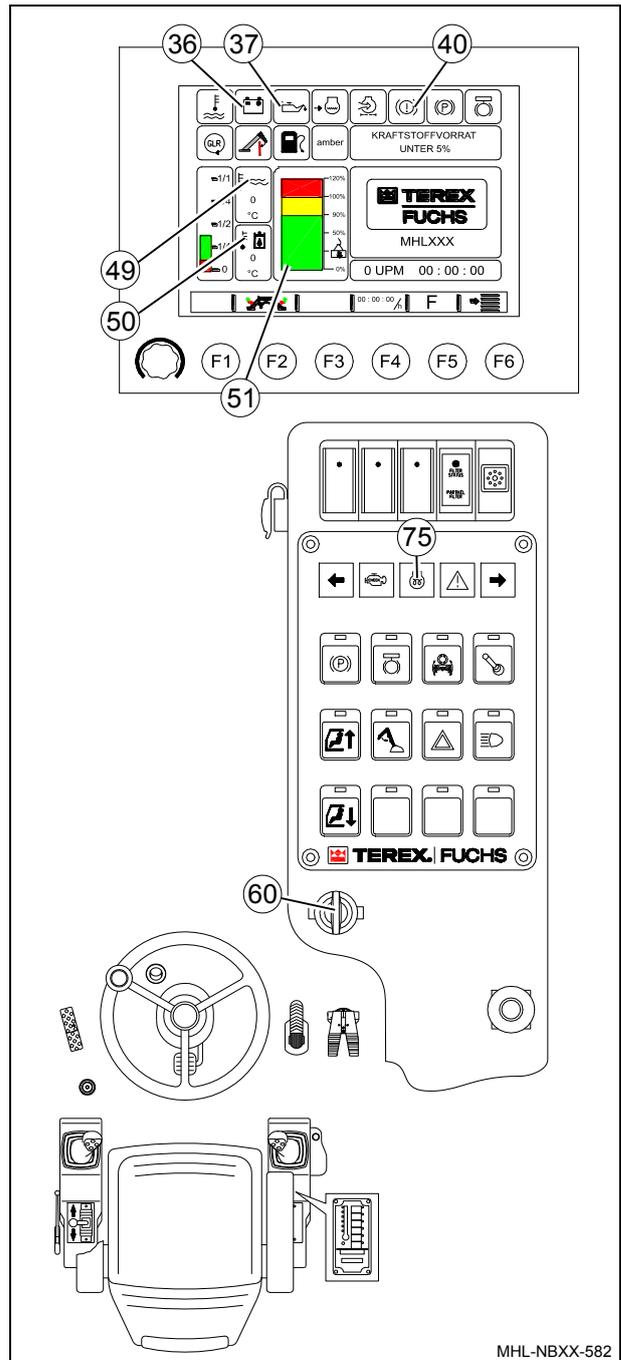


Fig. 55 Starting the diesel engine

ATTENTION

To prevent damage to the engine, do not drive at full power just after starting. Drive with restraint until the machine reaches operating temperature.

ATTENTION

After switching on the ignition, the speed is always set to the lower idle speed (0%). This means that the diesel engine can only be started in lower idle mode!

When starting at temperatures below -18°C, we recommend equipping the machine with a DEUTZ cold start auxiliary device.

4.6.2.2 Warm start

- ▶ Set all gearshift levers to neutral.
- ▶ Insert the ignition key into the ignition lock (55/60) and turn it to position I. If the engine is warm, the preheat indicator (55/75) will only light up briefly. **Wait for approx. 5 - 10 seconds for the machine control unit to start, until the indicators (55/36), (55/37), (55/49), and (55/50) appear on the display.**
- ▶ When the indicators (55/36), (55/37), (55/49), and (55/50) are displayed, turn the ignition key through position II to position III → Diesel engine starts.
- ▶ As soon as the diesel engine is running, let go of the ignition key. It will automatically return to position I. The indicators for battery charge control (55/36) and for engine oil pressure (55/37) should go out.

4.6.3 Switching off the diesel engine

ATTENTION

Do not switch off the diesel engine when running at full throttle. Allow it to run for a short time at no load.

- ▶ Turn the ignition key (55/60) to the "0" position.
- ▶ The diesel engine turns off automatically.

ATTENTION



After switching off the ignition and turning off the diesel engine, wait at least 30 seconds before switching the ignition on again!

4.6.4 Warming up the loading machine

If the operating temperature has not yet been reached, the machine control unit does not yet enable full power. The loading machine is to be operated at medium diesel engine speed and with reduced loading. The main control display indicates the temperature of the coolant for the diesel engine and the hydraulic oil.

| | |
|--|---|
| | <p>Coolant Temperature Operating temperature has been reached if background color (1) is black</p> |
| | <p>Hydraulic fluid temperature Operating temperature has been reached if background color (1) is black</p> |

- Chapter 4.7.2 Coolant temperature
- Chapter 4.7.9 Hydraulic oil temperature

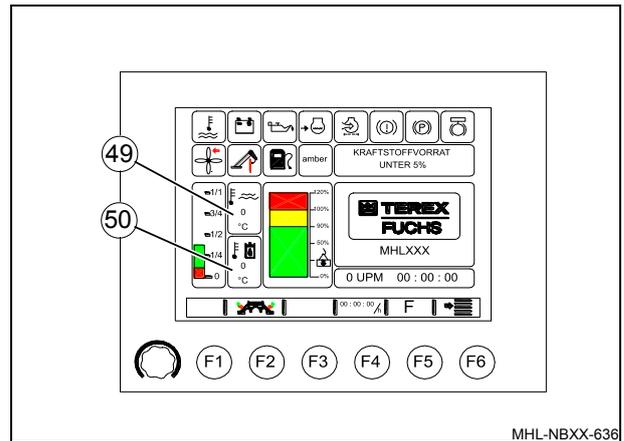


Fig. 56 Temperature display

4.6.5 Particulate filter (optional)

The particulate filter is a device that reduces the number of particles present in the exhaust gas produced by diesel engines.

Electronic filter monitoring

The clogged particulate filter indicator (57/73) displays readiness for operation, system errors and any malfunctions affecting the filter system. The specific alarm states can be found in the operating instructions provided by the manufacturer of the particulate filter.

ATTENTION

A dirty particulate filter can have an adverse effect on the exhaust gas discharged by the diesel engine.

The filter must be cleaned by the particulate filter manufacturer or an authorized service centre equipped with an appropriate "filter cleaning system".

Back-pressure monitoring

Electronic back-pressure monitoring automatically warns the machine operator when the exhaust back-pressure is too high, with a pre-alarm sounding at a back-pressure > 180 mbar and the main alarm sounding at a back-pressure > 200 mbar.

The pre-alarm is indicated by the status indicator (57/73) flashing orange. The main alarm is indicated by the status indicator (57/73) flashing red. The warning buzzer (57/74) sounds at the same time.

If the main alarm is triggered, shut down the machine immediately to prevent damage to the diesel engine. Then contact the dealer or a TEREX | Fuchs service engineer.

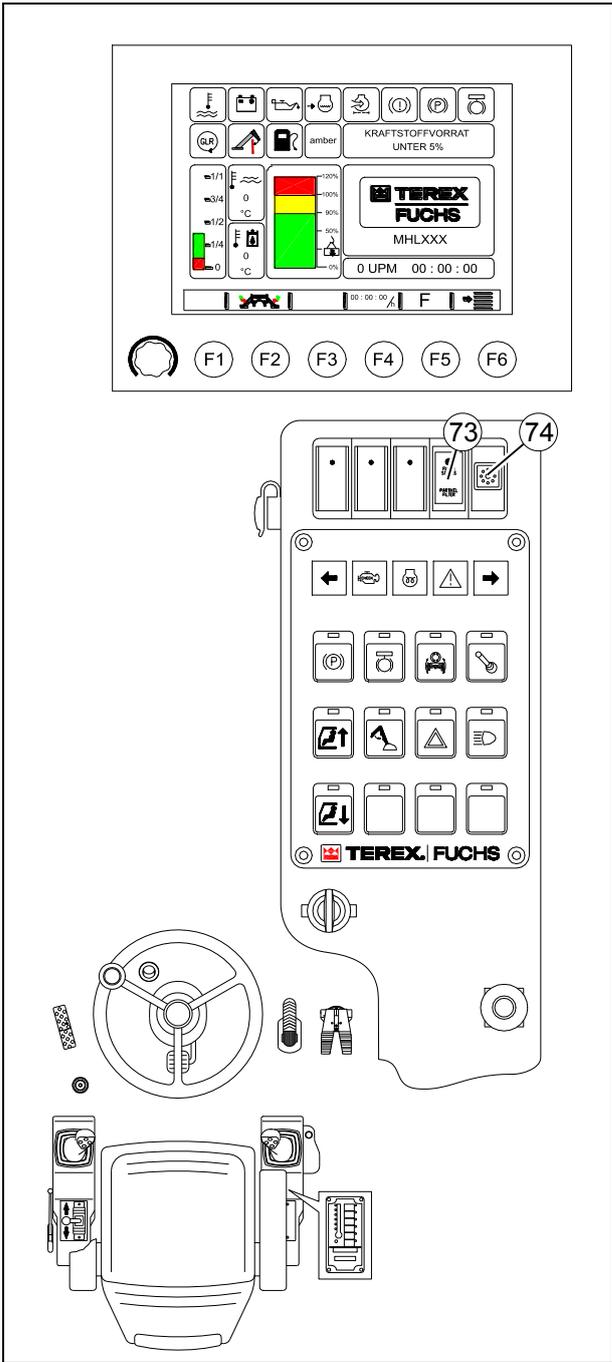


Fig. 57 Particulate contamination indicator

4.6.6 Reversing fan mode (optional)

Depending on the operating conditions of the machine, the cooling system,

- water/charge air cooler
- and hydraulic fluid cooler

can be equipped with reversing fan mode as an option.

The air flow can be reversed from the machine control unit, allowing the fan to blow freely without interrupting operation. Loose impurities are eliminated and the required cleaning cycles, which are essential for proper functionality of the cooling system, are extended to 24 hours depending on usage conditions.

Fan reversing mode can be switched on by briefly pressing the F3 function key on the multifunction display. The fan icon (58/43) appears against a green background with a black arrow pointing forward. The time remaining until the next reversing phase also appears in the green fan icon. The reversing function starts automatically when the preset interval time is reached. When reversing fan mode is active, the background of the fan icon (58/43) lights up yellow with a red arrow pointing backward. The text message (58/47) "REVERSING FAN MODE" appears.

The reversing fan menu can be accessed by pressing and holding down the F3 function key (see Fig. 59). The interval between reversing phases can be set to any value between 15 and 60 minutes in the reversing fan menu.

The reversing fan function can be turned off by briefly pressing the F3 function key. Then the fan icon (58/43) appears against a black background.

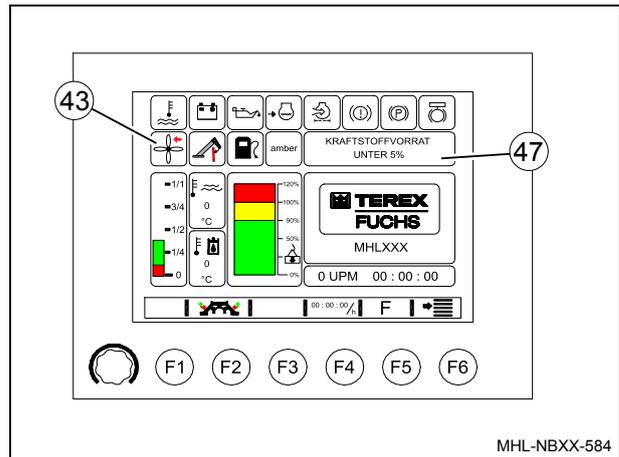


Fig. 58 Reversing fan mode



Fig. 59 Reversing fan menu

4.6.7 Auto-idling system

This device automatically reduces the engine speed to lower idling speed after about 5 seconds if no hydraulic function is activated by the four-way control lever or pedals. This saves fuel and reduces noise.

In the function menu, the switching function "Auto-idling system" (60/100) is displayed in the form of a pictogram.

The auto-idling system (60/100) is activated with the switching function in the function menu by a single short click with the multifunction button (60/21).

The auto-idling system can be switched off again with another single short click with the multifunction button (60/21).

Whenever a hydraulic function is controlled, the speed is automatically adjusted from what it was before by the electrical speed adjustment system.

The speed setting (0%...100%) is maintained if the ignition (the diesel engine) is switched off when automatic idle mode is active.

| ⚠ WARNING | |
|---|--|
|  | <p>Serious injury due to machine collision</p> <ul style="list-style-type: none"> • Hydraulic pressure that is too low can result in dangerous operating modes. • The auto-idling system must be turned off when driving on inclines. <p>In an emergency: Safety braking.</p> |

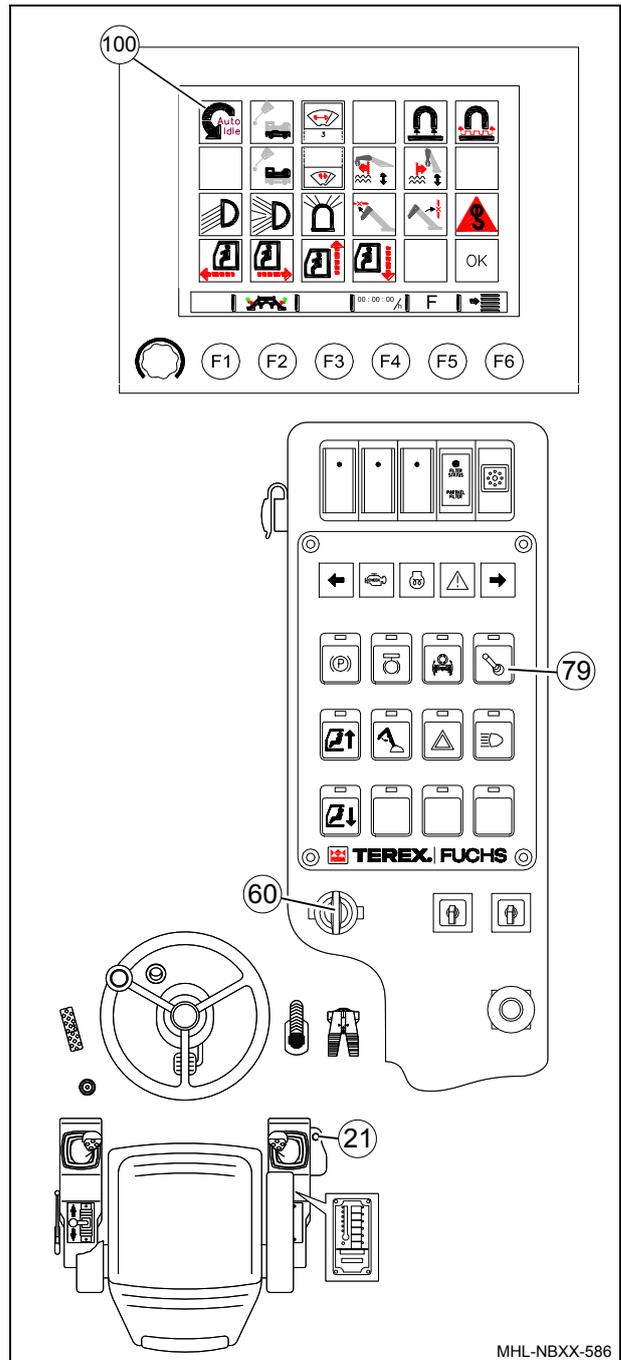


Fig. 60 Switching off the diesel engine

4.6.8 Load limit sensing control

The machine is equipped with a load limit sensing control. The control includes:

- an electronic control for the hydraulic pump
- a means of fine-tuning the response characteristic of the main drive functions (FINE MODE)

Load limit sensing control protects the diesel engine against excessive reductions in speed, and thus against overloads, at each engine speed selected.

As such, load limit sensing control optimizes the use of the available engine power.

-  For possible malfunctions in the load limit sensing control, please read Chapter 8.7 Malfunctions in the load limit sensing control.

4.6.8.1 FINE MODE adjustment

When calling the "Speed and FINE MODE" menu (Fig. 61) by turning the multifunction button (60/21) on the main control display clockwise or counterclockwise, the focus can be placed on "FINE MODE" adjustment (display in black on a white background) by means of the navigation encoder or the F4 key – now, the speed adjustment is displayed in white on a blue background (not selected).

The maximum pump capacity of the hydraulic pump can be adjusted by turning the multifunction button (60/21) or the menu selection wheel clockwise or counterclockwise.

- In 0% FINE MODE, the work movements are performed at maximum speed.
- In 100% FINE MODE, the speed of the movement will be reduced, while the deflection of the control levers remains the same. In doing so, the movements can be executed delicately and with high precision.

After the ignition is switched off, the FINE MODE setting remains saved.

ATTENTION

During normal work operations, the FINE MODE must be set to "0%".

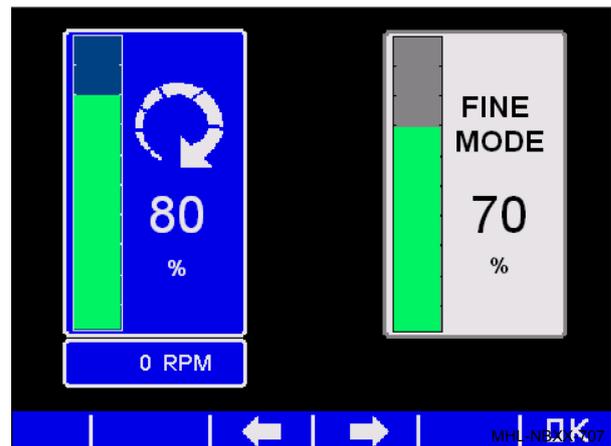


Fig. 61 Speed and FINE MODE menu

4.6.9 Electronic engine control (EEC)

4.6.9.1 Electronic engine control's (EEC) engine protection function

The EEC protects the diesel engine against damage by monitoring compliance with important limit values during operation.

Depending on the severity of an error that has been detected, the diesel engine can continue to run with some limitations (possibly at reduced output, in which case the indicator (62/68) will light up and remain lit) or the diesel engine is turned off, in which case the indicator (62/68) will flash. As soon as the error is no longer present, the indicator (62/68) goes out.

If the EEC has switched over to emergency speed, the diesel engine must be turned off with the ignition key (62/60) for at least 30 seconds to allow the indicator (62/68) to go out.

Errors that have been corrected or are no longer current still remain stored in the error memory of the control unit. They can be read or deleted with the DEUTZ diagnostics software program SERDIA.

ATTENTION

To avoid damage to the control device, the three plug connections (63/1) on the engine controller as well as the positive cable of the battery must be disconnected before performing welding jobs on the machine! The positive cable of the battery must be connected to the adjacent grounding bolts. The battery isolator switch should be switched off.

In the event of malfunctions affecting the system, please contact customer service.

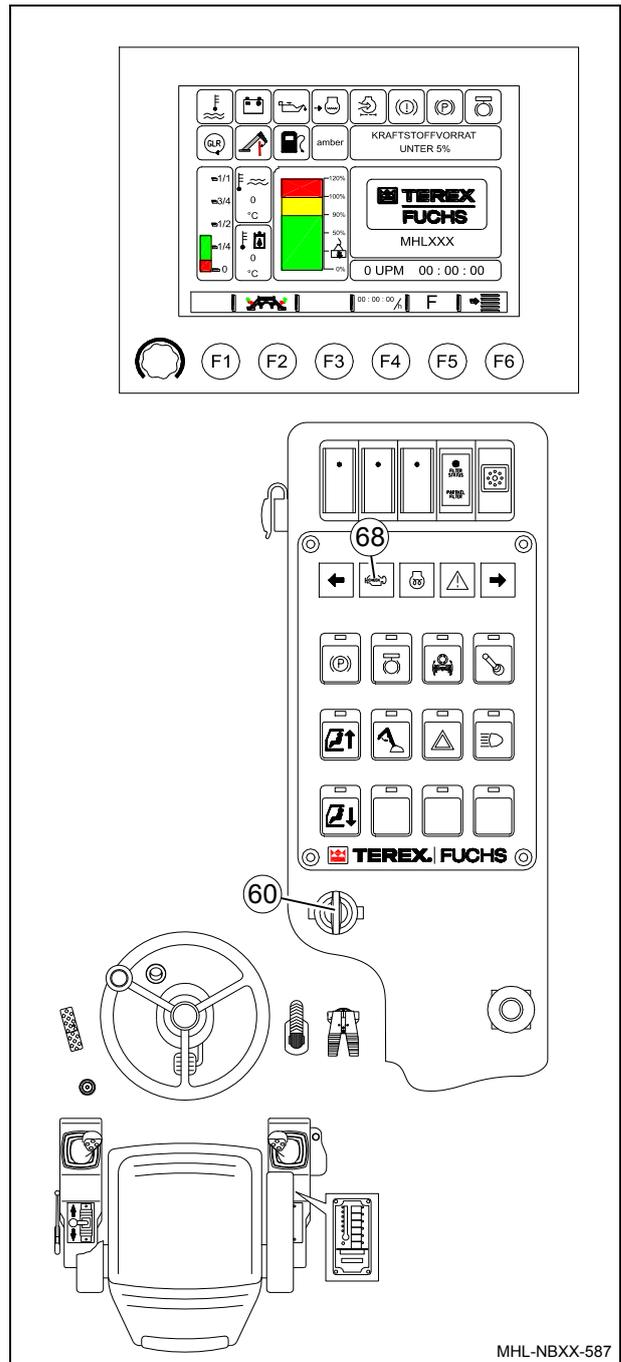


Fig. 62 Electronic engine control

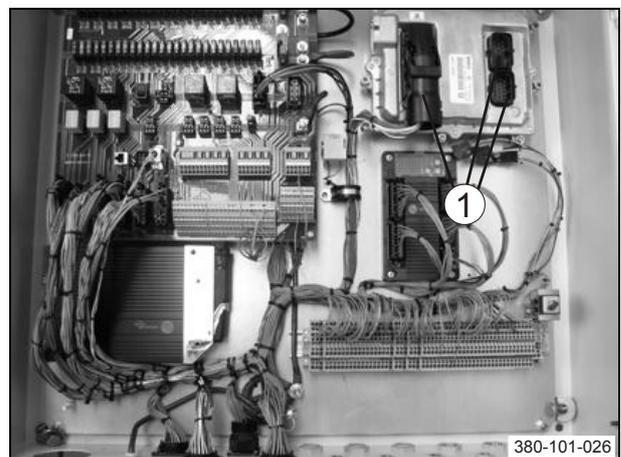


Fig. 63 Connectors on the engine control unit

4.6.10 Notes for use in winter

Observe the following points and instructions in the diesel engine operating instructions for use in winter:

4.6.10.1 Hydraulic fluid

If the machine is not used for prolonged periods at temperatures around and below freezing, warm up the engine by running at medium engine speed.

| Temperature in °C | Warming-up time in minutes |
|-------------------|----------------------------|
| 0°C and above | approx. 15 mins |
| -18°C to 0°C | approx. 30 mins |
| below -18°C | more than 30 mins |

 Chapter 4.6.4 Warming up the loading machine

4.6.10.2 Engine oil

The viscosity class (SAE class) of the engine oil should be selected according to the ambient temperature at the machine’s place of operation.

 Chapter 3.15 Fuels, lubricants and coolants

4.6.10.3 Coolant

Before the cold time of the year begins, the level of antifreeze protection must be checked and if necessary adapted to the ambient temperature (for the mixing ratio see the diesel engine manufacturer’s operating instructions). The antifreeze level is factory-set to approx. -35°C.

4.6.10.4 Note on options

Coolant, engine oil and hydraulic fluid can be preheated with electrical heaters or maintained at temperature (supplementary heating).

The result of preheating is to shorten the cold starting phase of the diesel engine, especially at lower temperatures. This reduces wear on the diesel engine and fuel consumption.

4.6.10.5 Battery

Preheating the battery makes it possible to facilitate a cold start.

4.6.10.6 Fuel

Use only standard commercial brand diesel fuel with a sulfur content lower than 0.05%. A higher sulfur content will affect the oil change intervals and service life of the engine.

 Chapter 3.15 Fuels, lubricants and coolants

Diesel fuel releases paraffin crystals as outside temperatures fall. These crystals increase flow resistance in the fuel filter to such an extent that an adequate fuel supply to the diesel engine is no longer ensured.

If the cold-flow behavior of the diesel fuel is not adequate or if outside temperatures are lower than -20°C, we recommend using a fuel filter heater.

Special diesel fuels are available for arctic climates.

Mixing petroleum and gasoline is prohibited for safety and technical reasons (cavitation affecting the fuel injection system)!

4.7 Monitoring the machine during operation

4.7.1 Monitoring strategy

After switching on, controller components monitor various diesel engine and hydraulic system parameters (Fig. 64).

Warning levels are defined for individual parameters to prevent damage to the machine. If the current machine data exceeds or drops below these levels, the controller components take action. This may involve:

- Optical warnings in the main control display
- Acoustic warnings via the warning buzzer
- Machine actions being disabled or enabled

The following priority applies when multiple warnings occur at the same time:

- 1 Oil pressure
- 2 Coolant level
- 3 Coolant temperature
- 4 Charge air temperature

ATTENTION



To prevent uncontrolled machine movements, the diesel engine is not switched off. If warnings occur, make the machine safe and switch it off as quickly as possible. To prevent damage to the machine, determine and rectify the cause. Only after doing this may you start the diesel engine and machine back up.

If the battery charge indicator (64/36) or the engine oil pressure indicator (64/37.1) respond, shut down the diesel engine immediately.

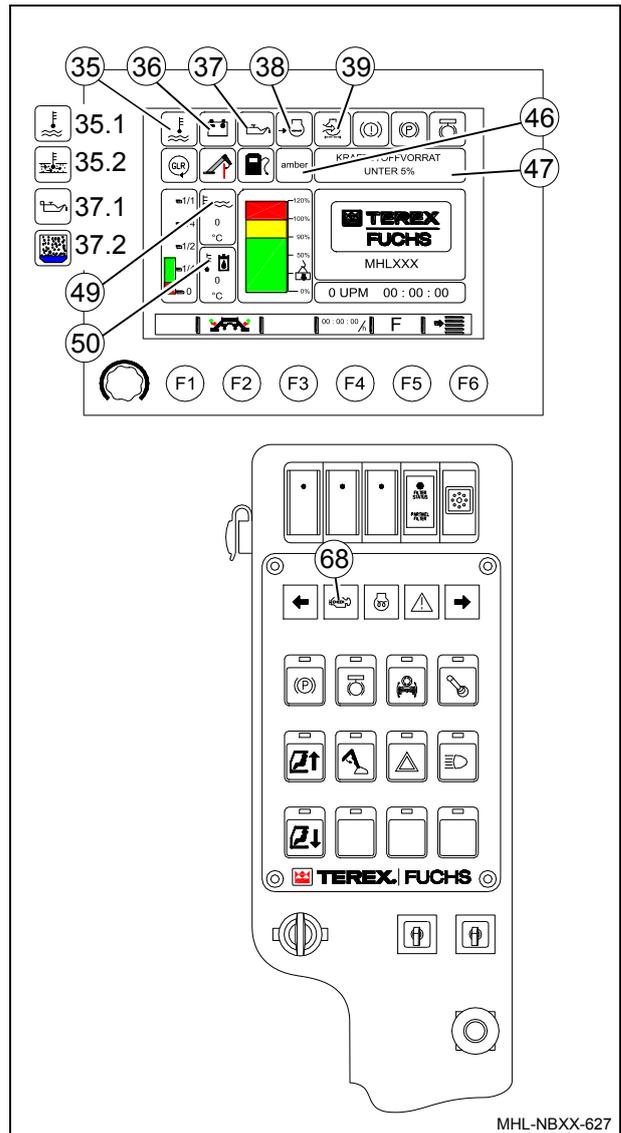


Fig. 64 Monitored parameters

- 35 1: Coolant temperature or hydraulic oil temperature indicator
- 35 2: Charge air temperature indicator
- 36 Battery charge indicator
- 37 1: Engine oil pressure indicator
- 37 2: Water in fuel indicator
- 38 Coolant level or hydraulic oil level indicator
- 39 Air filter, return filter, or hydraulic oil filter contamination indicator
- 46 Travel and work functions disabled indicator
- 47 Text output for the indicator displays
- 49 Diesel engine coolant temperature display in °C and warning levels based on background color
- 50 Hydraulic oil temperature display in °C and warning levels based on background color

4.7.2 Coolant temperature

| Temp. (°C) | Actions |
|------------|---|
| Below 50 | Background (65/49): blue ⓘ During operation, the background must be black. First warm up the machine to operating temperature. |
| 50 - 99 | Background (65/49): black |
| Above 100 | <i>Start of the warning levels</i> Background (65/49): red Warning buzzer sounds at intervals of one second Indicator (65/35) and following text issued (65/47): „COOLANT" "TEMPERATURE" |
| Above 104 | Reduction of diesel engine output according to temperature by up to 70%. Indicator (65/68) flashes. |
| Above 108 | Continuous warning buzzer Indicator (65/46) and following text issued (65/47): "WORK HYDRAULICS" "DISABLED" Disable the travel and work functions Start up at the upper idle speed |
| Below 101 | <i>Warning levels are reset</i> Engine output enabled again |
| Below 91 | Travel and work functions enabled again Optical and acoustic warnings cancelled again |

Measures to be taken when a warning occurs

- ▶ Stop work immediately. Leave the diesel engine to cool at a high idle.
- ▶ If the engine fails to cool down, open the engine hood. Leave the diesel engine to cool at a high idle.
- ▶ If after 60 seconds the warning message is still present, slow the diesel engine to its lower idle speed. Allow it to idle for 3 to 5 minutes. Then switch off. Check the water/charge cooler for contamination. Clean if necessary.
- ▶ If the warning message persists, call for service personnel.

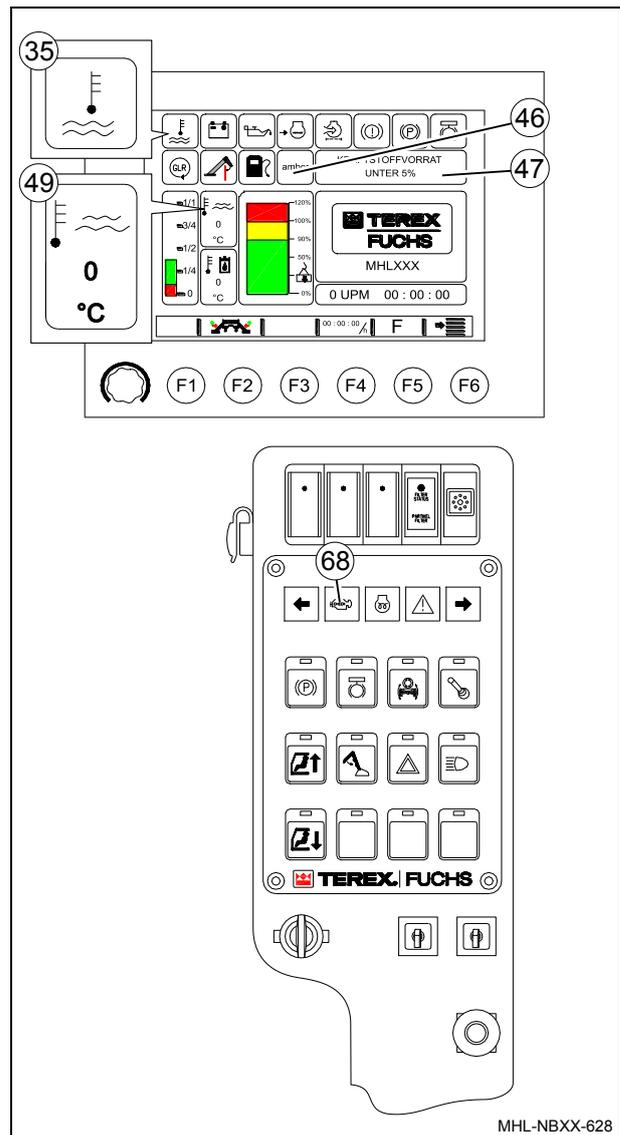


Fig. 65 Monitoring the coolant temperature

- 35 Coolant temperature indicator
- 46 Travel and work functions disabled indicator
- 47 Text output for the indicator displays
- 49 Diesel engine coolant temperature display in °C and warning levels based on background color
- 68 Engine control system fault display

4.7.3 Coolant level

| ⚠ WARNING | |
|---|---|
|  | <p>Risk of scalding by hot coolant. Risk of burns due to hot machine parts</p> <ul style="list-style-type: none"> Do not top up coolant unless the diesel engine has cooled down <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

| Filling level | Actions |
|---------------------------|--|
| Too low | Indicator (66/68) |
| Too low, after 10 seconds | Start of the warning levels |
| | Warning buzzer sounds at intervals of one second Indicator (66/38) and following text issued (66/47): „COOLANT" "FILLING LEVEL" |
| Too low, after 20 seconds | Continuous warning buzzer for 10 seconds |
| Too low, after 30 seconds | Indicator (66/46) and following text issued (66/47): "WORK HYDRAULICS" "DISABLED" Disable the travel and work functions |
| Sufficient | Warning levels are reset Travel and work functions enabled again Optical and acoustic warnings cancelled again |

Measures to be taken when a warning occurs

- ▶ Switch off the diesel engine as quickly as possible.
- ▶ Visual inspection for potential leaks.
- ▶ Top up coolant.
- ▶ If the warning message persists, call for service personnel.

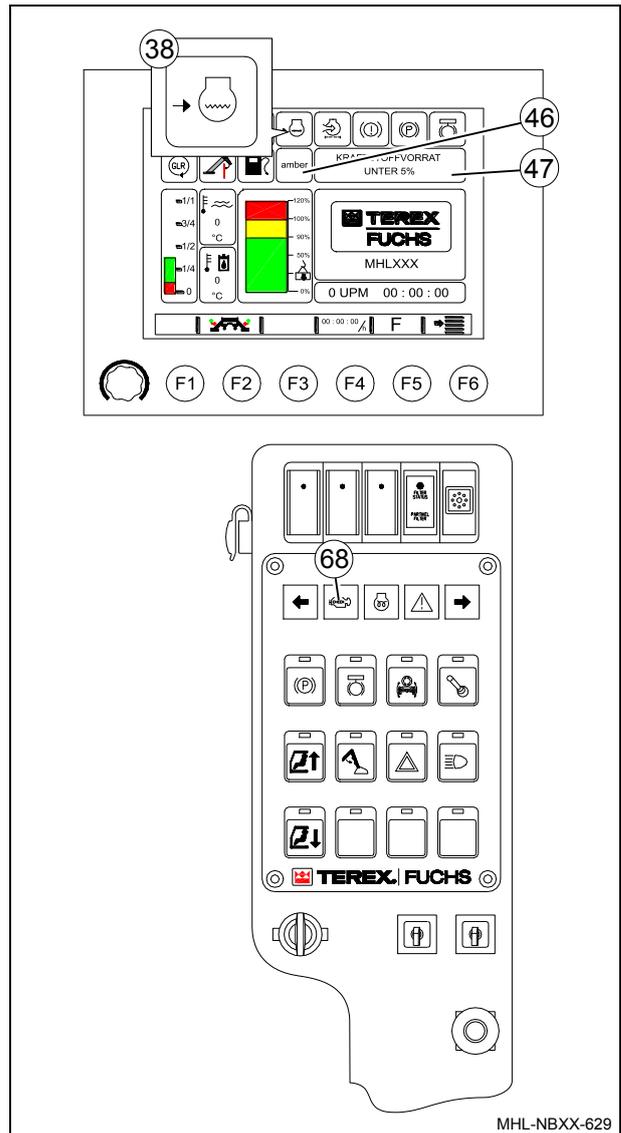


Fig. 66 Monitoring the coolant level
 38 Coolant level or hydraulic oil level indicator
 46 Travel and work functions disabled indicator
 47 Text output for the indicator displays
 68 Engine control system fault display

4.7.4 Oil pressure

| ⚠ WARNING | |
|------------------|--|
| | Risk of burns due to hot machine parts |
| | <ul style="list-style-type: none"> Do not top up engine oil until the diesel engine has cooled down In an emergency: Administer first aid, seek treatment from a doctor |

| Pressure | Actions |
|---------------|--|
| Too low | Start of warning levels (brief delay following engine start) Continuous warning buzzer Indicator (67/37) and following text issued (67/47): "ENGINE OIL PRESSURE" "TOO LOW" Start up at the lower idle speed (only when the magnet system is not switched on) |
| Drops further | Indicator (67/46) and following text issued (67/47): "WORK HYDRAULICS" "DISABLED" Disable the travel and work functions |
| Drops further | Indicator (67/68) Reduction of diesel engine output to 70% |
| Sufficient | Warning levels are reset (after a brief delay) Travel and work functions enabled again Optical and acoustic warnings cancelled again Engine output enabled again |

Measures to be taken when a warning occurs

- ▶ Switch off the diesel engine as quickly as possible.
- ▶ Visual inspection for potential leaks.
- ▶ Top up engine oil.
- ▶ If the warning message persists, call for service personnel.

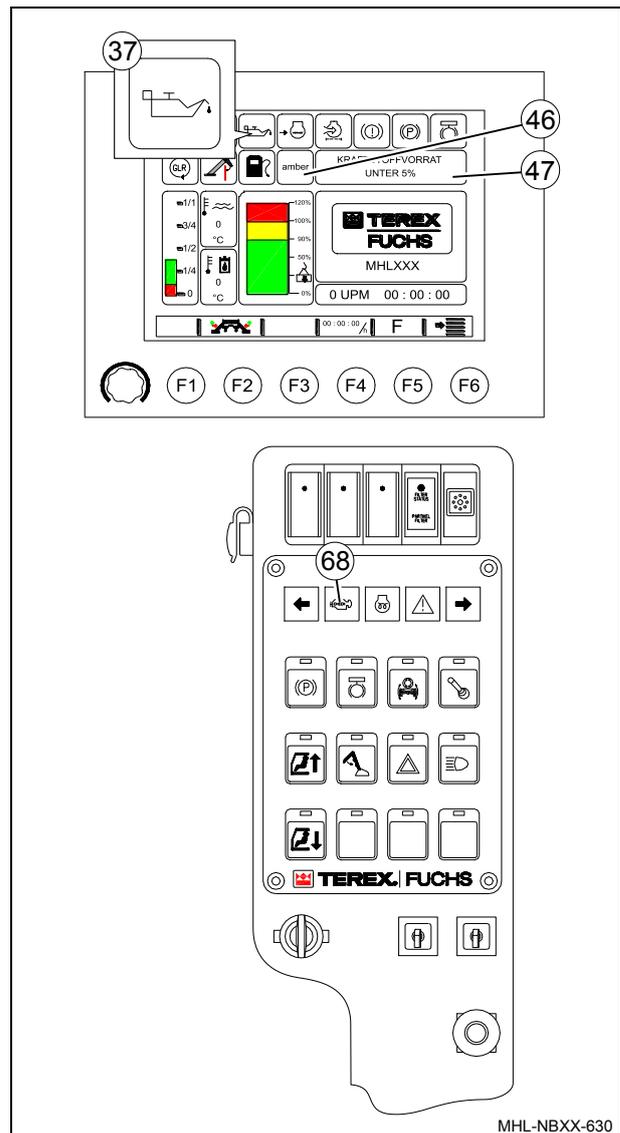


Fig. 67 Monitoring the oil pressure
 37 Engine oil pressure indicator
 46 Travel and work functions disabled indicator
 47 Text output for the indicator displays
 68 Engine control system fault display

4.7.5 Charge air temperature

| Temp. (°C) | Actions |
|---------------------|--|
| Above 80 | <p><i>Start of the warning levels</i></p> <p>Warning buzzer sounds at intervals of one second</p> <p>Indicator (68/35) and following text issued (68/47): "CHARGE AIR" "TEMPERATURE"</p> |
| After a brief delay | <p>Reduction of diesel engine output according to temperature by up to 70%. Indicator (68/68) flashes.</p> |
| Above 85 | <p>Continuous warning buzzer</p> <p>Indicator (68/46) and following text issued (68/47): "WORK HYDRAULICS" "DISABLED"</p> <p>Disable the travel and work functions</p> <p>Start up at the upper idle speed</p> |
| Below 76 | <p><i>Warning levels are reset</i></p> <p>Travel and work functions enabled again</p> <p>Optical and acoustic warnings cancelled again</p> |
| Below 66 | <p>Engine output enabled again</p> |

Measures to be taken when a warning occurs

- ▶ Switch off the diesel engine as quickly as possible.
- ▶ Check the water/charge cooler for contamination. Clean if necessary.
- ▶ If the warning message persists, call for service personnel.

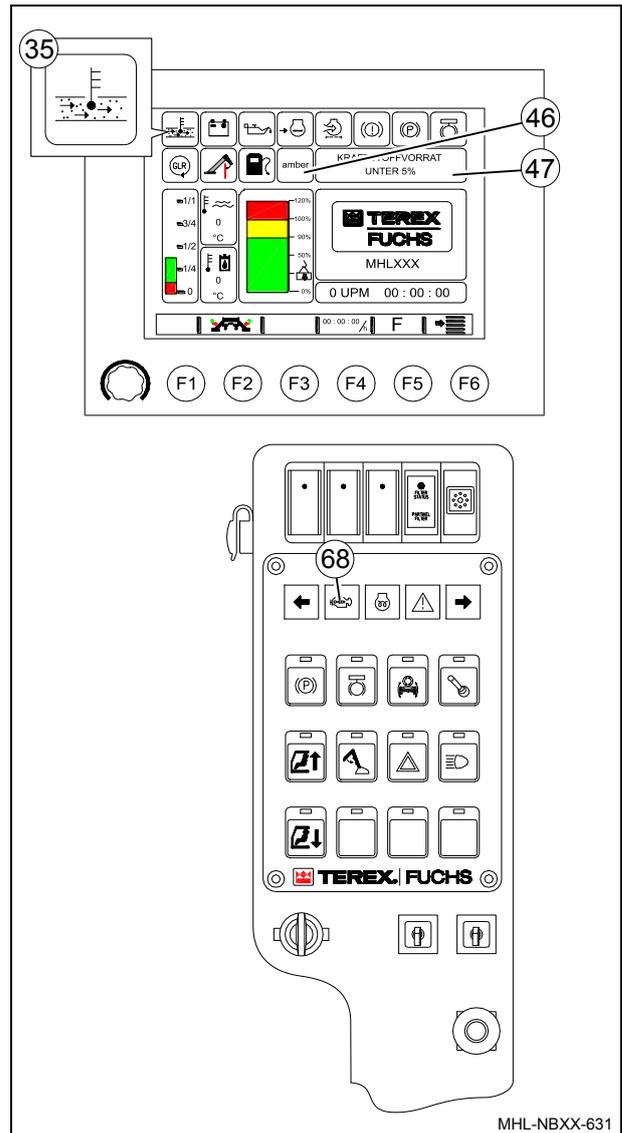


Fig. 68 Monitoring the charge air temperature
 35 Charge air temperature indicator
 46 Travel and work functions disabled indicator
 47 Text output for the indicator displays
 68 Engine control system fault display

4.7.6 Air filter differential pressure

| Vacuum pressure | Actions |
|-----------------|---|
| Too high | Warning levels start Indicator (69/39) and following text issued (69/47): "AIR FILTER" "CONTAMINATION" |
| Low | Warning level is reset Visual warnings cancelled again |

Measures to be taken when a warning occurs

- ▶ Switch off the diesel engine as quickly as possible.
- ▶ Clean the air filter.
- ▶ If the warning message persists, call for service personnel.

4.7.7 Charge pressure

| Charge pressure | Actions |
|-----------------|---|
| Too high | Warning levels start Indicator (69/68) Reduction of the diesel engine output to 70% |
| Normal | Warning level is reset Optical warning cancelled again Engine output enabled again |

Measures to be taken when a warning occurs

- ▶ Switch off the diesel engine as quickly as possible. Call for service personnel.

4.7.8 Fuel pre-filter

| Water content | Actions |
|---------------|--|
| Too high | Warning levels start Indicator (70/37) and following text issued (70/47): „WATER" "IN FUEL" |
| Low | Warning level is reset Visual warnings cancelled again |

Measures to be taken when a warning occurs

- ▶ Switch off the diesel engine as quickly as possible.
- ▶ Drain the fuel pre-filter.
- ▶ If the warning message persists, call for service personnel.

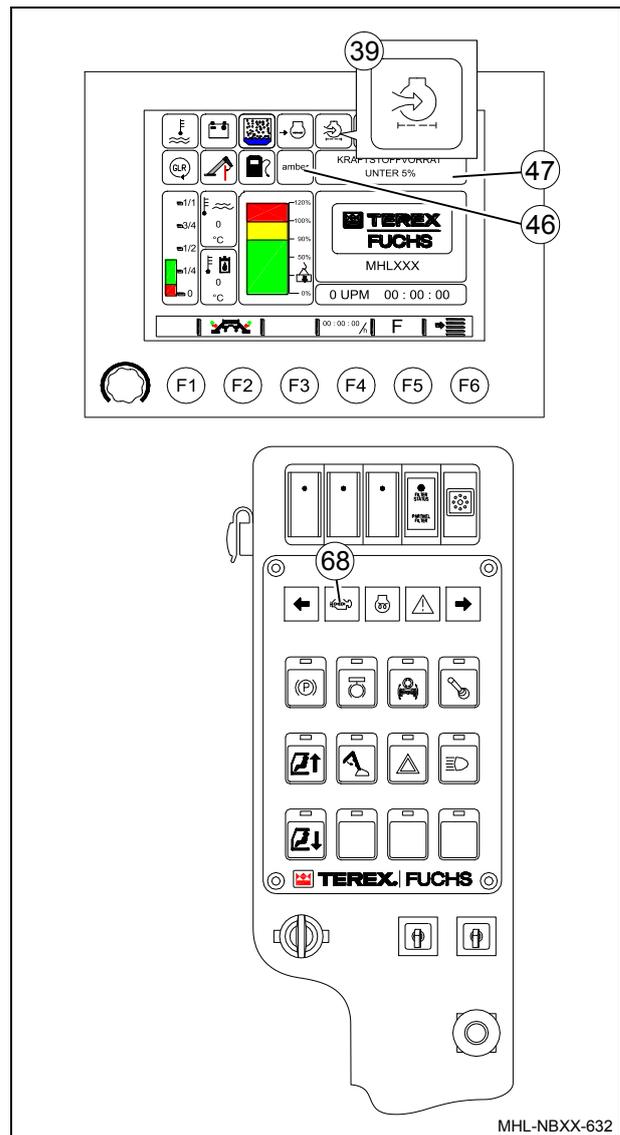


Fig. 69 Monitoring the air filter differential pressure
39 Air filter differential pressure indicator
46 Travel and work functions disabled indicator
47 Text output for the indicator displays

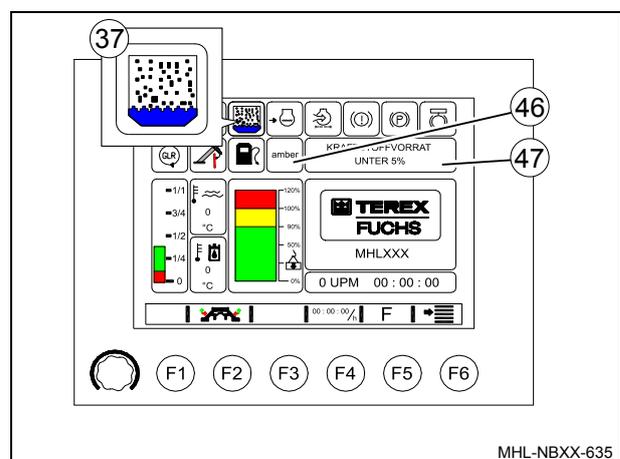


Fig. 70 Monitoring the fuel pre-filter
37 Water in fuel indicator
46 Travel and work functions disabled indicator
47 Text output for the indicator displays

4.7.9 Hydraulic oil temperature

| Temp. (°C) | Actions |
|------------|--|
| Below 15 | <p><i>Start of the bottom warning level</i></p> <p>Background (71/50): blue</p> <p>Reduced working speed (FINE MODE)</p> <p>i During operation, the background must be black. First warm up the machine to operating temperature.</p> |
| 15 - 80 | <p><i>The lower warning level is reset</i></p> <p>Background (71/50): black</p> <p>i Working speed enabled again</p> |
| Above 80 | <p><i>Start of the top warning levels</i></p> <p>Background (71/50): orange</p> <p>Indicator (71/35)</p> <p>Reduced working speed (FINE MODE)</p> |
| Above 95 | <p>Background (71/50): red</p> <p>Indicator (71/46) and following text issued (71/47): "WORK HYDRAULICS" "DISABLED"</p> <p>Disable the travel and work functions</p> |
| Below 95 | <p><i>The upper warning levels are reset</i></p> <p>Travel and work functions enabled again</p> |
| Below 80 | <p>Visual warnings cancelled again</p> <p>Working speed enabled again</p> |

Measures to be taken when a warning occurs

- ▶ Stop work immediately and allow the diesel engine to continue running at its upper idle speed.
- ▶ If the engine fails to cool down, switch off the diesel engine as quickly as possible.
- ▶ Check the hydraulic oil cooler for contamination. Clean if necessary.
- ▶ If the warning message persists, call for service personnel.

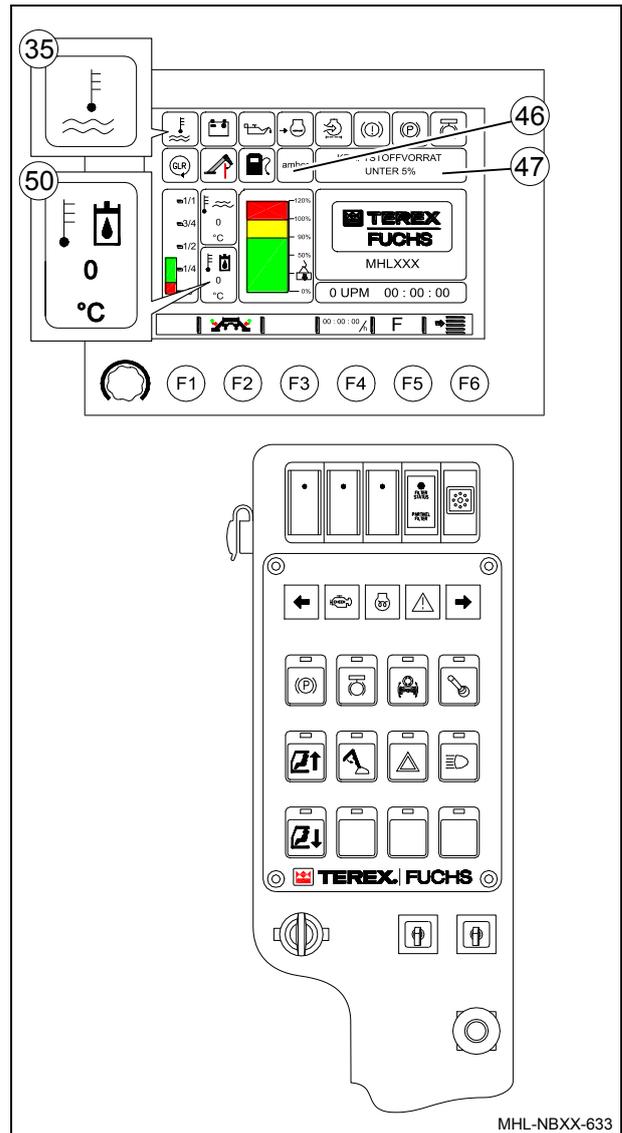


Fig. 71 Monitoring the hydraulic oil temperature
 35 Hydraulic oil temperature indicator
 46 Travel and work functions disabled indicator
 47 Text output for the indicator displays
 50 Hydraulic oil temperature display in °C and warning levels based on background color

4.7.10 Hydraulic oil level

| ⚠ WARNING | |
|---|--|
|  | <p>Risk of burns due to hot machine parts</p> <ul style="list-style-type: none"> Only top up hydraulic oil when the loading machine has cooled down <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

| Filling level | Actions |
|---------------|--|
| Too low | <p><i>Start of the warning levels</i></p> <p>Continuous warning buzzer</p> <p>Indicator (72/38) and following text issued (72/47): „HYDRAULIC OIL" "FILLING LEVEL"</p> <p>Indicator (72/46) and following text issued (72/47): "WORK HYDRAULICS" "DISABLED"</p> <p>Disable the travel and work functions</p> |
| Sufficient | <p><i>Warning levels are reset</i></p> <p>Optical and acoustic warnings cancelled again</p> <p>Travel and work functions enabled again</p> |

Measures to be taken when a warning occurs

- ▶ Switch off the diesel engine as quickly as possible.
- ▶ Visual inspection for potential leaks.
- ▶ Top up hydraulic oil.
- ▶ If the warning message persists, call for service personnel.

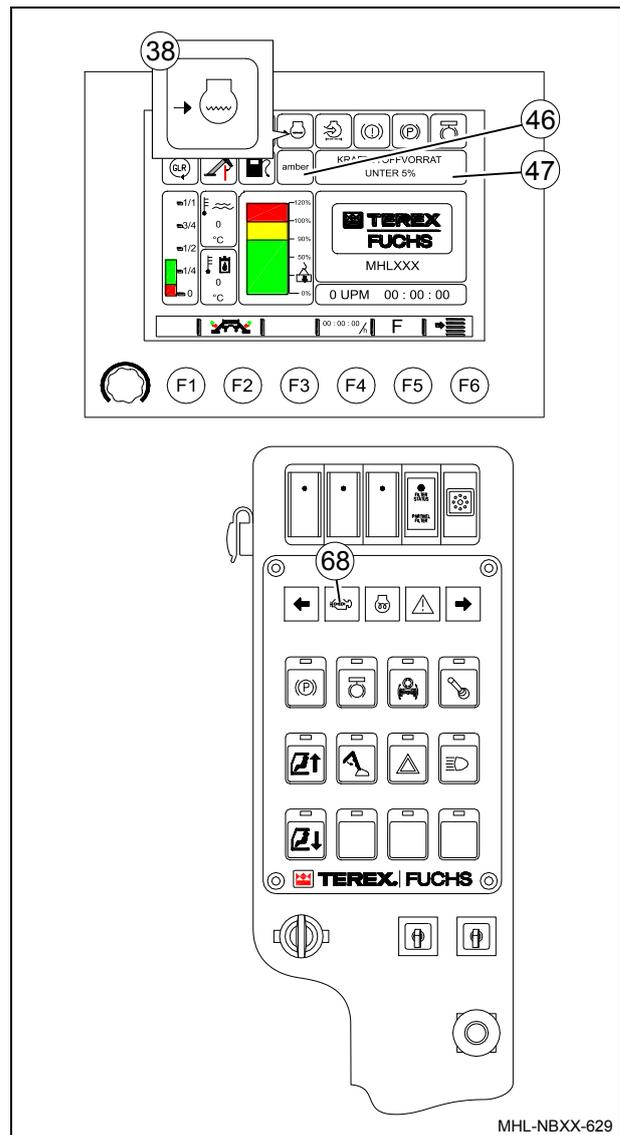


Fig. 72 Monitoring the hydraulic oil level
 38 Hydraulic oil level indicator
 46 Travel and work functions disabled indicator
 47 Text output for the indicator displays

4.7.11 Hydraulic oil filter (main and auxiliary circuits)

| Flow | Actions |
|------------|--|
| Too low | Start of the warning levels (above hydraulic oil temperature of 15°C) Indicator (73/39) and following text issued (73/47): "FILTER NAME" "CONTAMINATION" |
| Sufficient | Warning levels are reset Optical warning cancelled again |

Measures to be taken when a warning occurs

- i The machine can continue to be operated for a short time.
- ▶ Perform an oil filter change as quickly as possible.

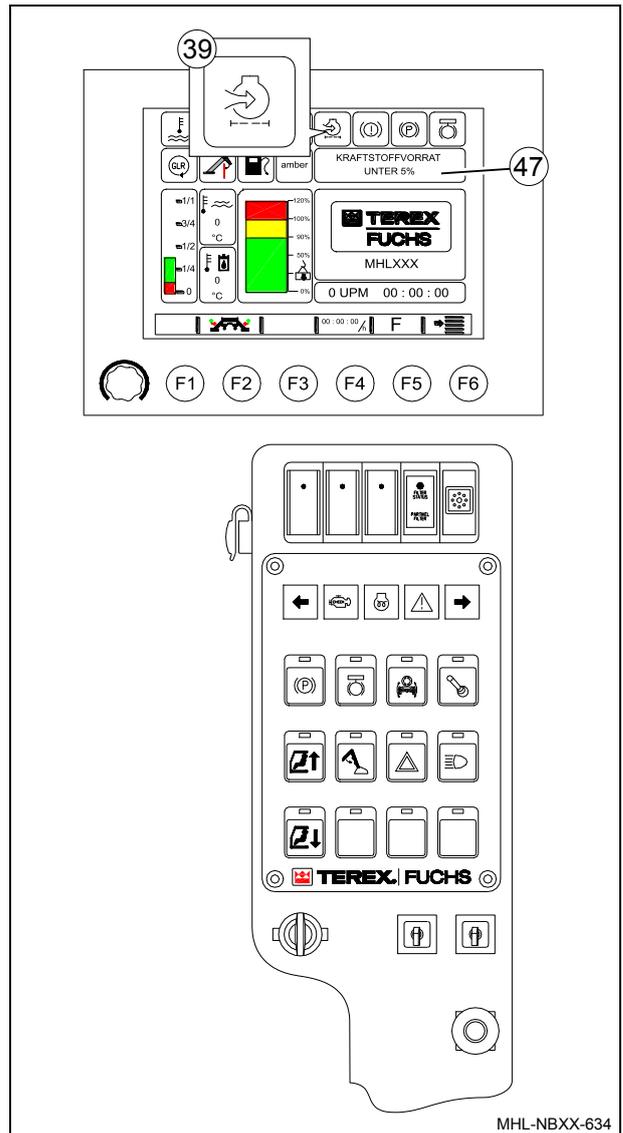


Fig. 73 Monitoring the hydraulic oil filter
 39 Return filter or hydraulic oil filter contamination indicator
 47 Text output for the indicator displays

4.7.12 Bypassing the shutdown function

The pushbutton (74/79) bypasses a shutdown, allowing the machine to continue running and the loading equipment to be moved.

ATTENTION



To avoid damaging the diesel engine, the machine may only be moved short distances during bypassing.

Protection is bypassed only for as long as the pushbutton (74/79) is held down.

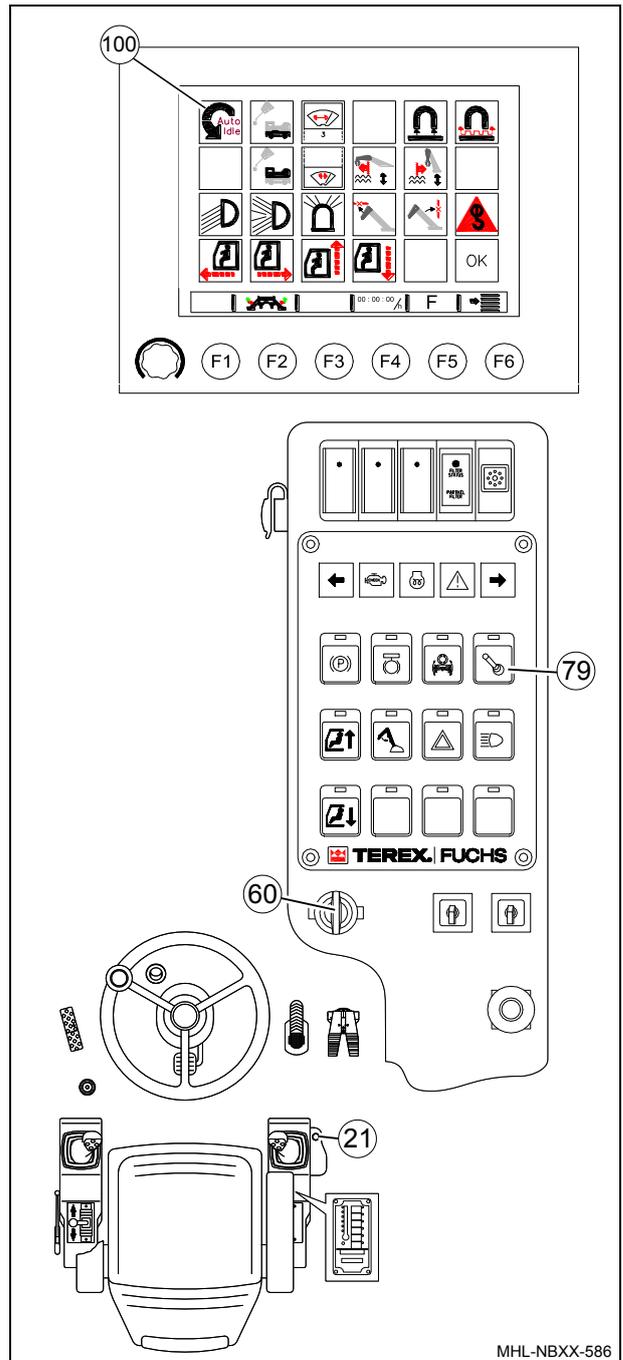


Fig. 74 Bypassing the shutdown function

4.8 Operator's stand

4.8.1 Comfort driver's seat

|  WARNING | |
|--|--|
|  | <p>Serious injury due to unintentional machine movements</p> <ul style="list-style-type: none"> • The driver's seat should be adjusted before the diesel engine is started. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

The comfort seat has a positive impact on health and prevents fatigue during work. The key characteristics are:

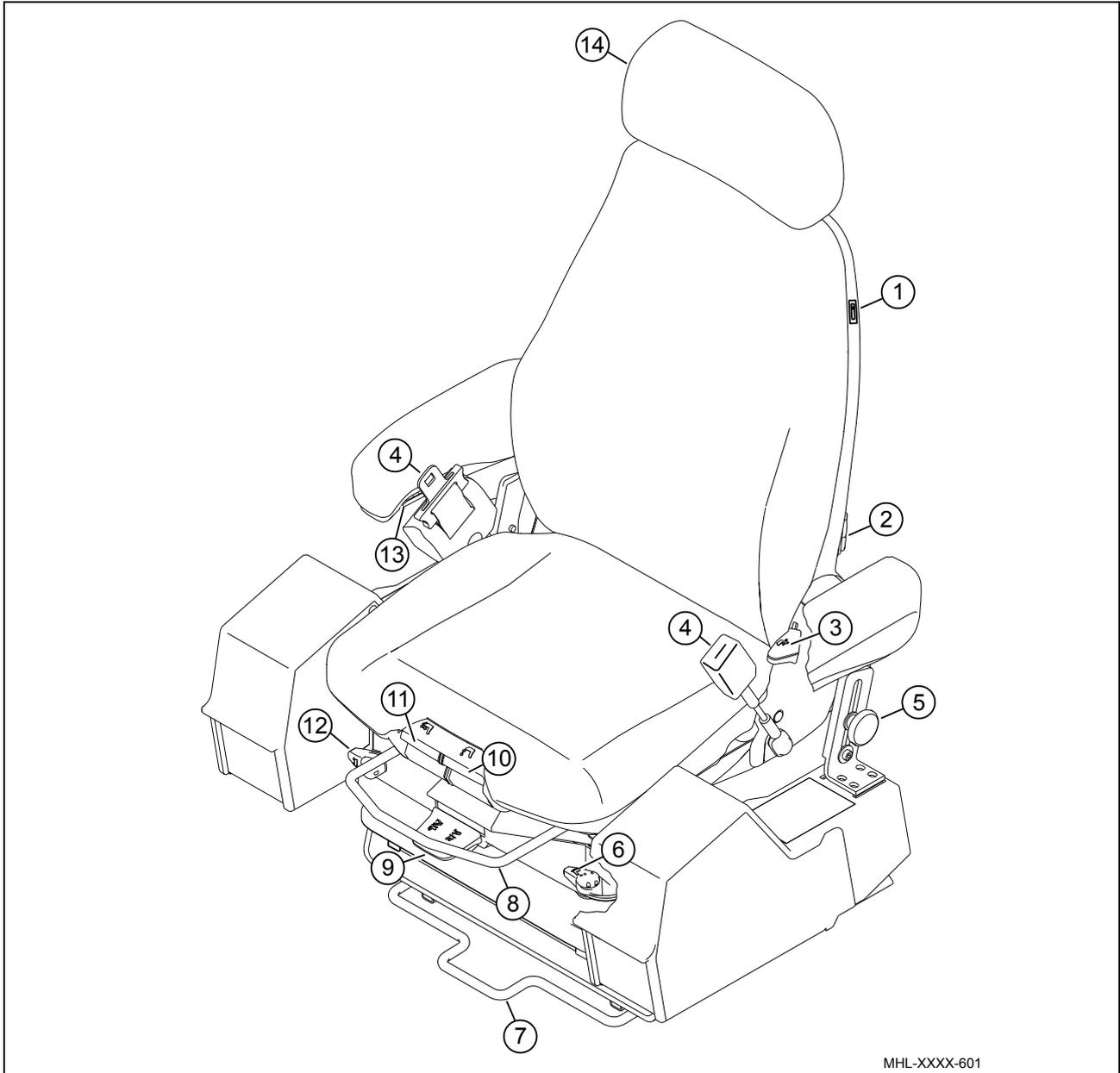
- Air suspension
- Ride control
- Low frequency suspension
- Heated seat and passive air conditioning (optional)

|  WARNING | |
|---|--|
|  | <p>Back injuries due to incorrectly adjusted seat</p> <ul style="list-style-type: none"> • Before commissioning the machine or changing drivers, adjust the individual driver's weight setting. <p>In an emergency: Seek treatment from a doctor</p> |

Safety belt

|  WARNING | |
|--|--|
|  | <p>Occupants are thrown from the machine in an accident and collide with the cab equipment</p> <ul style="list-style-type: none"> • Fasten the safety belt before putting the machine into operation. Check that the safety belt is not twisted when you fasten it. • To ensure safety, check the condition, functioning and mounting of the belt regularly and replace damaged parts immediately. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

Control elements for driver's seat



MHL-XXXX-601

Fig. 75 Comfort driver's seat

- | | |
|---|--|
| <p>1 Rocker switch for heated seat (optional) The heated seat switches off automatically when the temperature is reached.</p> <p>2 Rocker switch for upper and lower lumbar support tilt forward: lumbar part round; tilt backward: lumbar part straight</p> <p>3 Handle for backrest adjustment (tilt)</p> <p>4 Two point safety belt</p> <p>5 Hand wheel for armrest height</p> <p>6 Stop lever for horizontal spring system (reduces horizontal vibrations in direction of travel) Lever locked in place backward: seat locked in place Lever set forward: seat not locked in place</p> <p>7 Handle for longitudinal adjustment of entire seat</p> | <p>8 Handle for longitudinal adjustment of seat (upper part)</p> <p>9 Handle for combined height and body weight adjustment Press handle briefly: weight is adjusted automatically Raise or press handle: adjust height</p> <p>10 Handle for seat cushion adjustment (tilt)</p> <p>11 Handle for seat depth adjustment (leg rest)</p> <p>12 Handle for shock absorber Turn lever towards cab door: hard Turn lever upwards: medium Turn lever away from seat: soft</p> <p>13 Armrest tilt</p> <p>14 Headrest</p> |
|---|--|

4.8.2 Steering Wheel

4.8.2.1 Adjusting the steering column

⚠ WARNING

Serious injury due to uncontrolled steering movements

- Only adjust steering column when the loading machine is stationary.

In an emergency: Administer first aid, seek treatment from a doctor

The steering column can be adjusted to change the position of the steering wheel relative to the body.

Adjusting the height:

- ▶ Hold the steering wheel firmly.
- ▶ Unscrew the locking device (76/1) and lift the steering wheel to the desired height.
- ▶ Screw the locking device (76/1) tight once the desired height is reached.

Adjusting the inclination:

- ▶ Hold the steering wheel firmly.
- ▶ Depress the pedal (76/19) with your foot and adjust the inclination angle as desired.
- ▶ When you let go of the pedal (76/19) and the steering wheel the steering column should snap into position.

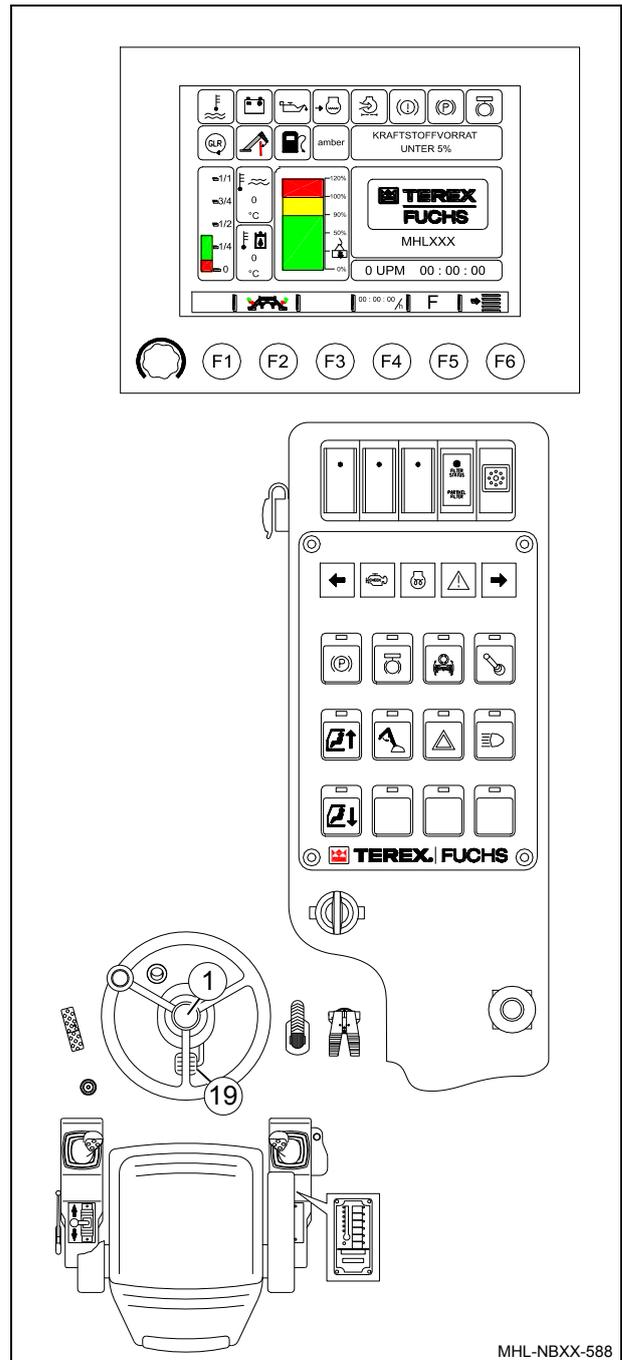


Fig. 76 Adjusting the steering column

4.9 Heating and air conditioning

The cab is equipped as standard with a heating and air conditioning system. The cab can be heated, cooled and vented.

ATTENTION

To prevent overloading the starter and battery, do not turn on the air conditioning system until the diesel engine has been started.

Digital display

The digital display (77/93) indicates the outside temperature and operating status.

If the button toggle is pressed and held (77/90), the digital display is switched from °C to Fahrenheit (F) or vice versa after 20 seconds.

Blower control

The blower speed can be set between 0 = switched off and 4 = high speed with the 4-speed-switch (77/88).

Air guiding system

The air flow is regulated via adjustable and closable vents. They are located in the front part of the cab (77/1), on the seat consoles (77/2), on the side wall of the control panel (77/3) and behind the driver's seat (77/4).

Circulating air and outside air

The heating and air conditioning system can be operated with a circulating air or outside air supply.

WARNING



Fatigue due to used air

- Only select circulating air mode for a short period of time. Ensure a fresh air supply for longer operation

In an emergency: Switch off the loading machine. Open the side windows.

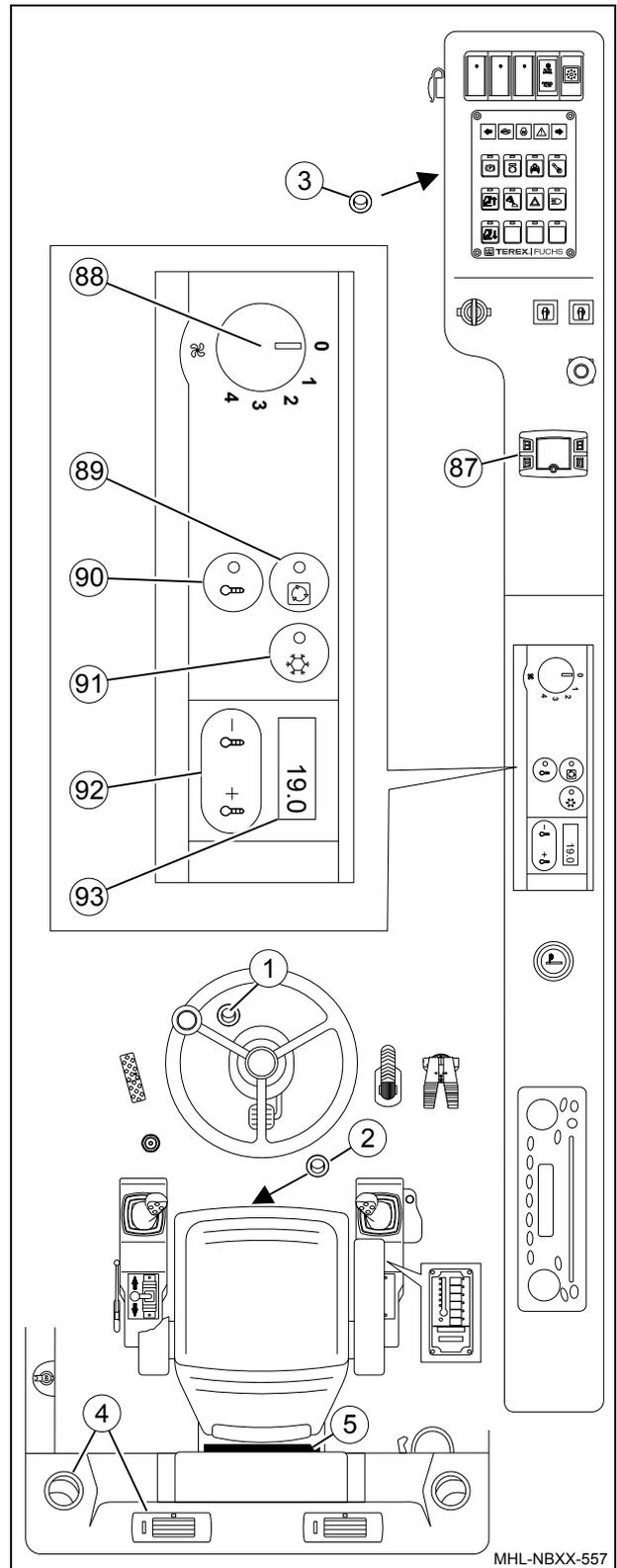


Fig. 77 Heating and ventilation

The outside air is drawn into the housing of the heating and air conditioning system through the rear wall of the cab (78/1). A housing opening (77/5) is located behind the driver's seat to allow circulating air to enter. Do not block it! An electrically driven flap closes the opening for circulating air and therefore enables the opening for outside air and vice versa.

The flap is operated using the button toggle (77/89). The function display on the side indicates the status. If the function display lights up on the button toggle (77/89), the outside air is closed. The system works in circulating air mode. In circulating air mode, the cab windows can mist up. If this happens, switch off circulating air mode.

Air filter

In order to prevent the heater from becoming contaminated, the circulating air/fresh air is drawn in through the air filter (behind the driver's seat).

ATTENTION

In dusty ambient conditions, the air cleaner fleece should be cleaned or changed every 100 operating hours.

i Chapter 7.8.3 Maintenance and inspection plan

- ▶ Release the quick closures (79/1) on the cover plate (79/1) and fold away the cover plate.
- ▶ Remove the frame (80/1), clean or if necessary replace the fleece (80/2).

When inserting the fleece, ensure that the blue side of the fleece is facing the rear wall of the cab.

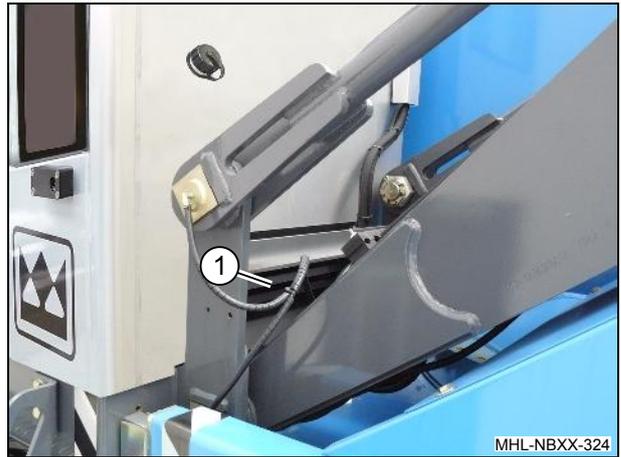


Fig. 78 Outside air supply

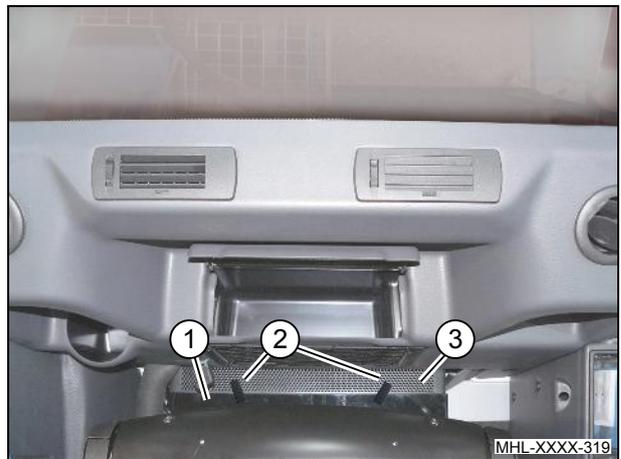


Fig. 79 Cover plate

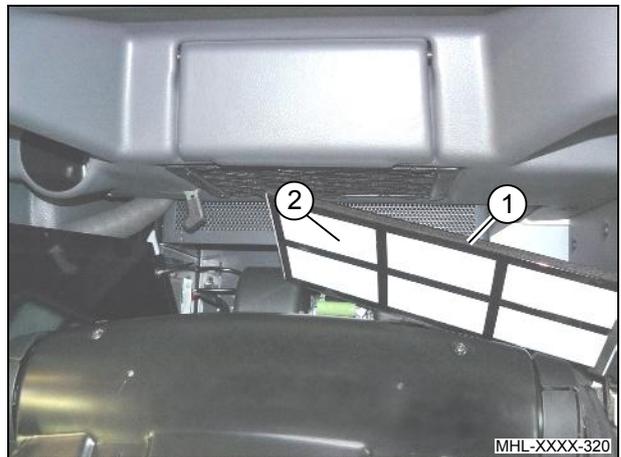


Fig. 80 Fleece

4.9.1 Heating mode

The cab heating is dependent upon the engine coolant temperature. The blower air flow is routed through a heat exchanger whose temperature is controlled by the flow rate of the coolant.

Heating without reheat function

- ▶ Switch off the air conditioning system with the button toggle (81/91). The function display on the button toggle (77/91) must not light up.
- ▶ The button toggles (81/92) on the digital display (81/93) can be used to adjust the displayed temperature as required.
- ▶ The 4-speed switch (77/88) can be used to adjust the blower speed as required.
- ▶ The vents (77/1-4) can be used to adjust the air distribution as required.

Heating with reheat function

The reheat function firstly cools the air and then warms it. The ejected air is thereby drier and does not steam up the windows.

- ▶ Switch on the air conditioning system with the button toggle (81/91). The function display on the button toggle (77/91) must light up.
- ▶ Adjust the heating level, blower and air distribution as described above.

Switching the heater controller off

- ▶ The temperature indicated on the digital display (81/93) should be lowered with the minus button toggle (81/92) until the value "lo" is displayed.

- ▶ Lower again.

The controller is switched off.

Switching the heater controller on

- ▶ The controller is switched back on with the plus button toggle (81/92).

The digital display (81/93) indicates the value "lo".

- ▶ Set the desired temperature.

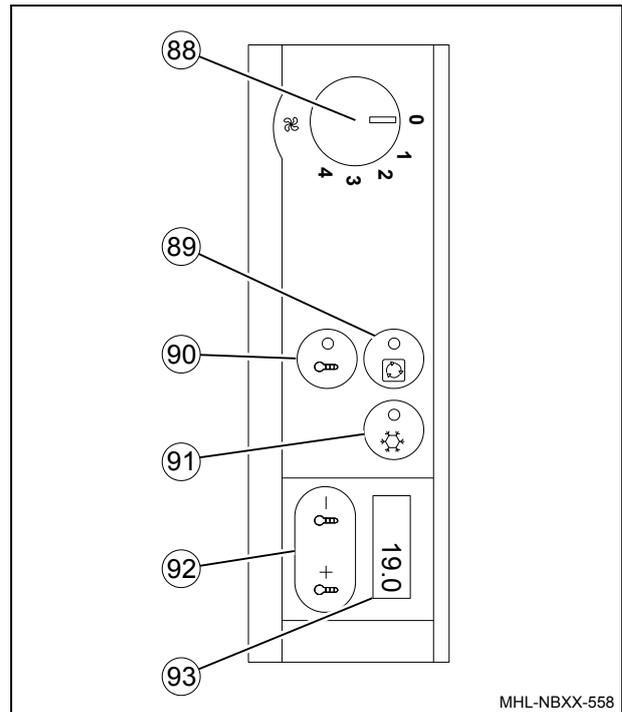


Fig. 81 Lever for heating/air conditioning system

4.9.2 Supplementary heating (optional)

The supplementary heating (83/1) is located on the left of the driver's cab. It heats the cab. Any other use of the supplementary heating and of the associated timer is not permitted.

The supplementary heating is connected directly to the fuel system, so that it can be operated independently of the drive motor.

The supplementary heating system is operated with the operator device (77/87). The operating instructions provided by the heater manufacturer contain information about the functions and the operation of the supplementary heating.

ATTENTION

The blower for the air conditioning system is switched off automatically when the supplementary heating system is switched on. To prevent heat accumulation, the ejector (77/3) cannot be closed in a cab with supplementary heating.

ATTENTION

The combustion air is drawn in through the air filter (rear of cab). In the event of high exposure to dust, the air filter element should be changed every 100 operating hours.

i Chapter 7.8.3 Maintenance and inspection plan

⚠ WARNING

Burns from igniting fuels, lubricants and coolants

- The supplementary heating must always be switched off when refueling.
- Remove escaped fuel before switching on.

In an emergency: Switch off machine and supplementary heating. Administer first aid, seek treatment from a doctor

⚠ WARNING

Poisoning and suffocation from exhaust gases

- The heater must not be operated in enclosed spaces.

In an emergency: Switch heating off. Move into fresh air immediately. Seek treatment from a doctor.

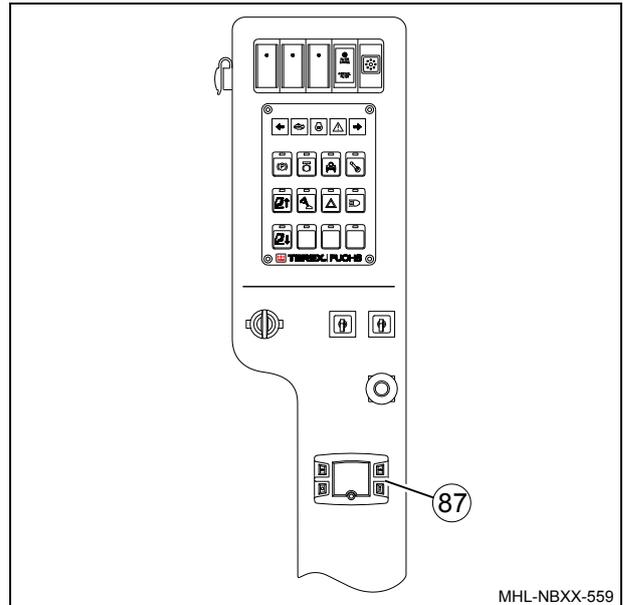


Fig. 82 Control panel for supplementary heating



Fig. 83 Supplementary heating

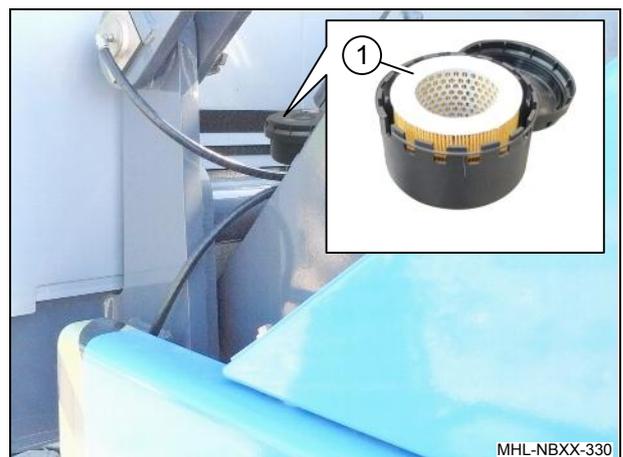


Fig. 84 Air filter for supplementary heating

The following maintenance work must be carried out before each heating period:

- ▶ Check glow plug (85/1) for burn-off and replace if necessary.
- ▶ Examine the fuel filter for clogging and replace if necessary.
- ▶ Check that electrical connections are securely fastened.
- ▶ Check that fuel lines and connections are not leaking.
- ▶ Check the air filter element for dirt.

If the heating does not come on, proceed as follows:

- ▶ Switch heating off.
- ▶ Check fuses.
- ▶ Switch heating on.

If the **heating still does not function when switched on for a third time**, please contact Eberspächer Customer Service. If you continue attempting to switch on the heating, the system will be completely cut off and it will not be possible to switch it back on again.

If the heating overheats:

Possible causes may be that the vents are covered up or the suction intake grate is dirty.

- ▶ Switch heating off.
- ▶ Uncover vents.
- ▶ Switch heating on.

Other malfunctions which cannot be remedied by the operator must be checked and repaired by Customer Service only.



Fig. 85 Supplementary heating

Battery isolator switch

|  WARNING | |
|--|---|
|  | <p>Burns from igniting machine parts</p> <ul style="list-style-type: none"> • The battery isolator switch must not be turned off until about 5 minutes after the heating has been switched off, as cooling down of the heating would be interrupted <p>In an emergency: Extinguish fire. Administer first aid, seek treatment from a doctor</p> |

If the battery isolator switch is removed, the timer must be reactivated:

- ▶ Insert battery isolator switch.
- ▶ Reproduce factory settings (see manufacturer's documentation).
- ▶ Remove fuse for timer in the central electrical system and reinsert.
- ▶ Perform initial commissioning (see manufacturer's documentation).

4.9.3 Air conditioning mode

ATTENTION

You should switch the air conditioning system on at least once a month for a short time to lubricate the compressor.

- ▶ The air conditioning only works when the diesel engine is running. Start diesel engine.
- ▶ Switch on the air conditioning system with the button toggle (86/91). The function display on the button toggle (86/91) must light up.
- ▶ Set the blower speed to position 1 at least with the 4-stage switch (86/88). If the blower is switched off, the air conditioning system does not start. If the cooling output is high, the blower speed should also be set high.
- ▶ The button toggles (86/92) on the digital display (86/93) can be used to adjust the displayed temperature as required. The room temperature in the cab falls.
- ▶ The ejectors (77/1-4) can be used to adjust the air distribution as required.

For maximum cooling:

- ▶ The temperature indicated on the digital display (86/93) should be lowered with the minus button toggle (86/91) until the value "lo" is displayed.
- ▶ Set the blower speed to position 4 with the 4-stage switch (86/88).
- ▶ Close the outside air flap with the button toggle (86/89). The function display on the button toggle (86/89) must light up.
- ▶ Keep the cab closed.

If the diesel engine is running and the air conditioning system is set to high output, the refrigerant flows into the sight glass (87/1) without bubbles. If bubbles appear in the sight glass, get an authorized specialist to check the system for leaks and fill.

⚠ WARNING

Danger of injury due to refrigerant

- Maintenance work on the air conditioning system must only be carried out by trained specialists.

In an emergency: Administer first aid, seek treatment from a doctor

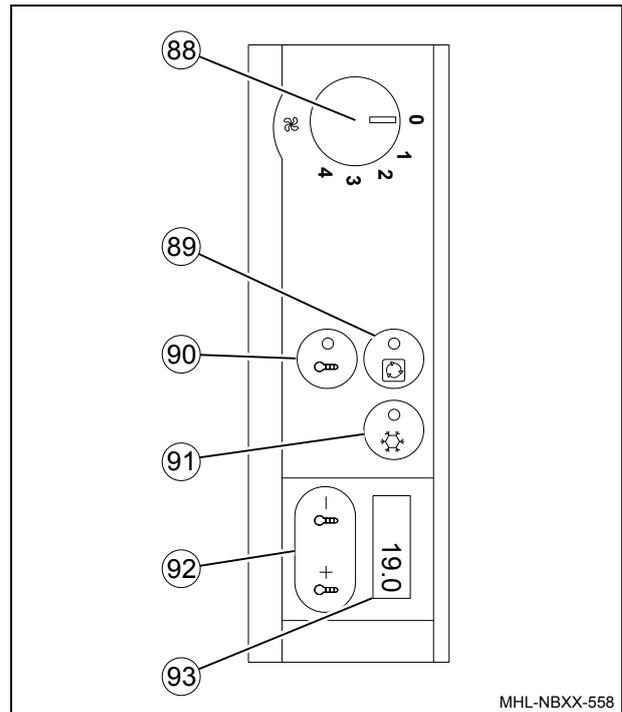


Fig. 86 Lever for air conditioning system

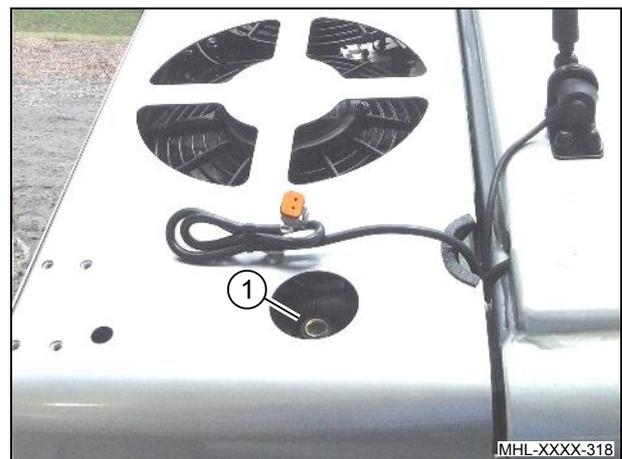


Fig. 87 Sight glass

4.10 Cab

4.10.1 Safety

The structural design of the cab provides a high degree of safety. It cannot however guarantee complete protection.

Operating staff are responsible for ensuring that they buckle themselves in, observe the safe working loads, operate the machine only on solid, level ground, and move the loading machine in such a way that no hazardous situations arise.

Additional safety measures are required if material to be loaded can fall in the area of the cab or if a toppling loading machine can roll over the cab due to slopes in the terrain.

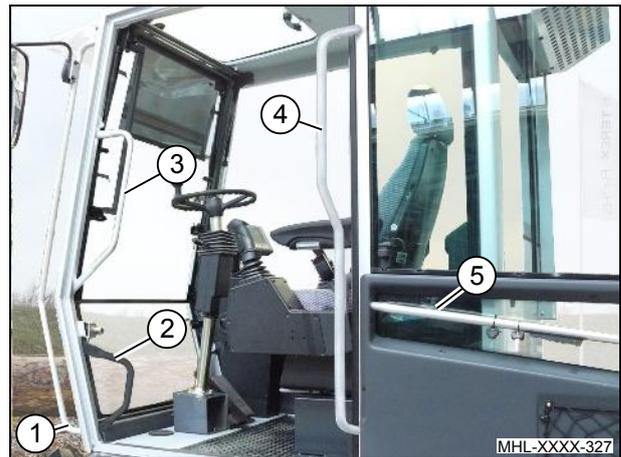


Fig. 88 Handles

ATTENTION

Damage may impair the structural safety of the cab. Damaged cab parts may only be replaced by original parts from the machine manufacturer. Damage to the steel structure (cracks, buckles, distortion) must not be repaired. The cab should be replaced with an original cab from the machine manufacturer.

4.10.2 Handles

Handles in the cab are arranged such that anyone entering or leaving the cab can hold on at three points.

- ▶ Use the handles (88/1-4) when entering and exiting.
- ▶ The cab door must only be opened and closed from the driver's seat. First, use the upper part of the handle (88/4) and then the handle (88/5).

i Chapter 2.5 Cab which can be raised and moved forwards

4.10.3 Opening/closing the windscreen

The windscreen can only be opened completely. It is not possible to open it in stages. The cab is available with reinforced glass or Lexan glazing (windshield and skylight) as an option. The windshield and skylight cannot be opened if they are made of reinforced glass.

⚠ CAUTION



Injuries due to sagging windshield

- It must be ensured that the windshield is locked in the end positions

In an emergency: Administer first aid, seek treatment from a doctor

Opening the windshield

- ▶ Swing in both locking levers (89/1)

The windshield is unlocked.

- ▶ Use the two unlocking levers to slide the windshield up (89/2) and back (89/3) under the cab roof as far as the two locking devices (89/4).
- ▶ Unfold both unlocking levers (90/1) such that the locking bolts (90/2) snap into the holders (90/3).

The windshield is locked.

Closing the windshield

- ▶ Swing in both unlocking levers (89/1).

The windshield is unlocked.

- ▶ Use the two unlocking levers to move the windshield forward and lower it into the end position.
- ▶ Unfold both unlocking levers (91/1) such that the locking bolts (91/2) snap into the holders (91/3).

The windshield is locked.

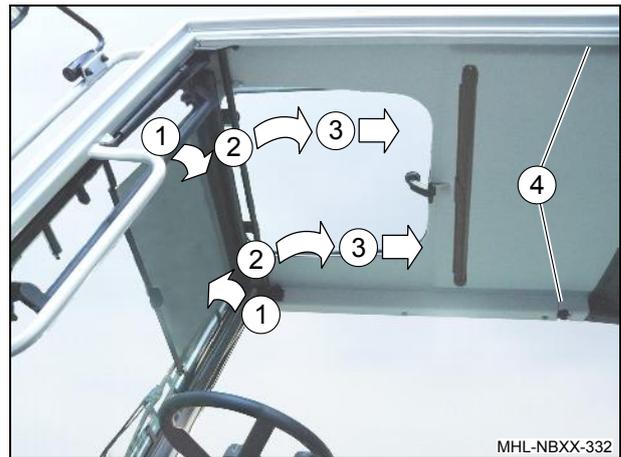


Fig. 89 Opening the windshield

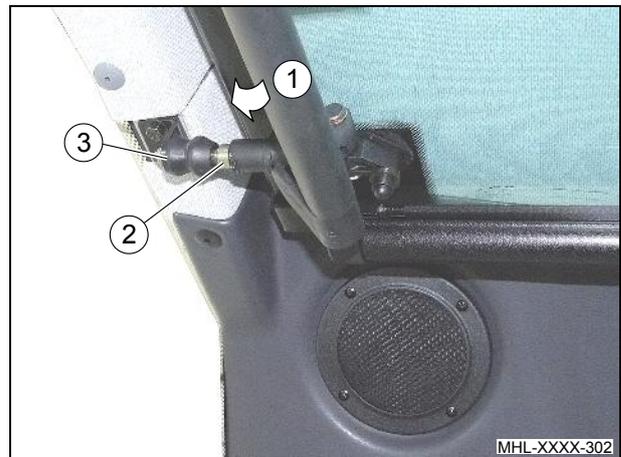


Fig. 90 Windshield swung up

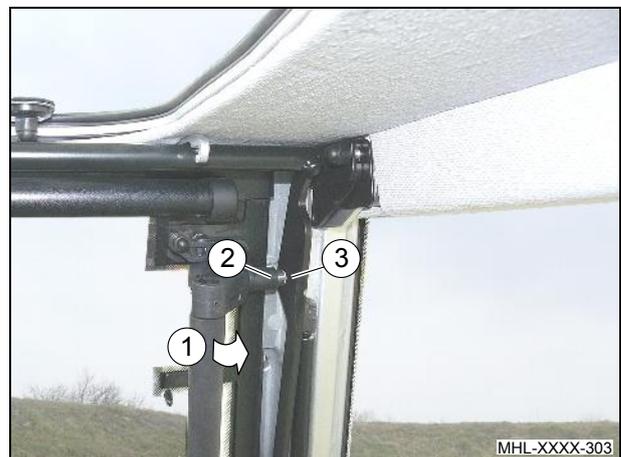


Fig. 91 Windshield swung down

4.10.4 Adjusting the sunblind

The cab is equipped with two sunblinds, one on the windscreen and one on the glass pane on the roof of the cab.

Windscreen

- ▶ Pull the sunblind down using the handle (92/2) and hook it into the brackets (92/1) in the desired position.

Skylight

- ▶ Pull the sunblind forward using handle (92/4) and hook it onto the brackets (92/3) in the desired position.

The springs will pull the sunblind back up. When rolling the sunblind up, take hold of it by the handle (92/2) or (92/4) and guide it back.

4.10.5 Skylight

- ▶ To ventilate the cab, open or close the skylight by slewing the handle (93/1).

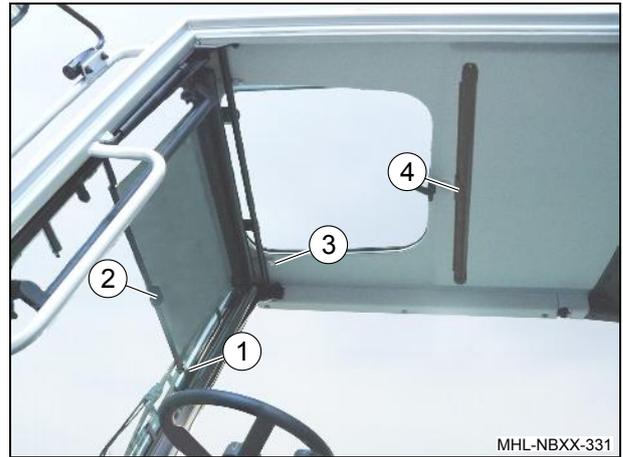


Fig. 92 Adjusting the sunblind

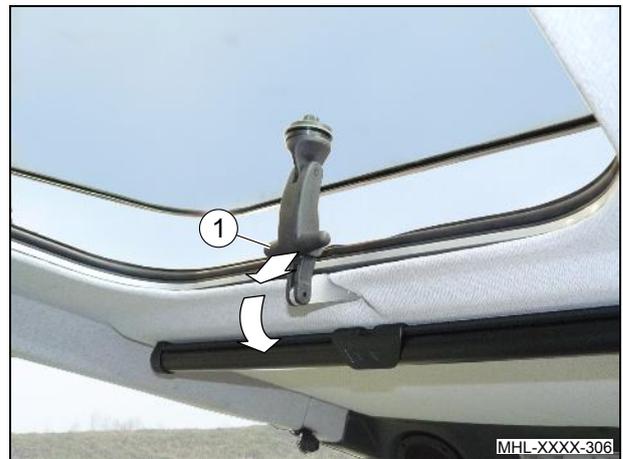


Fig. 93 Closing the skylight

4.10.6 Cab door

⚠ WARNING



Serious injury due to falling

- Only open the cab door for entering and leaving. Ensure that the cab door is closed while working, adjusting and traveling with the cab.
- An open cab door can swing. Prior to entering and leaving, ensure that the cab door is supported by the locking device.

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION

To ensure that the door can be opened in all weather conditions, the door seals must be brushed with talcum or silicone oil at least every two months or more frequently if required. Grease the door hinges and door locks regularly. It is essential to wear safety goggles and suitable protective clothing during maintenance work.

Opening the cab door

- ▶ Push the handle (94/1) up and open the cab door.
- ▶ Swing the cab door until the latch (95/1) is secured in the latching device (95/2).

Closing the cab door

- ▶ The cab door is unlocked with the lever (94/2).

4.10.7 Side window

The front and rear side window can be opened in various positions.

- ▶ Slide locking device (961) upwards.
- ▶ Use the handle (96/1) to slide the side window to the desired catch (96/2).
- ▶ Snap in locking device (96/3).



Fig. 94 Opening the cab door



Fig. 95 Locking the cab door

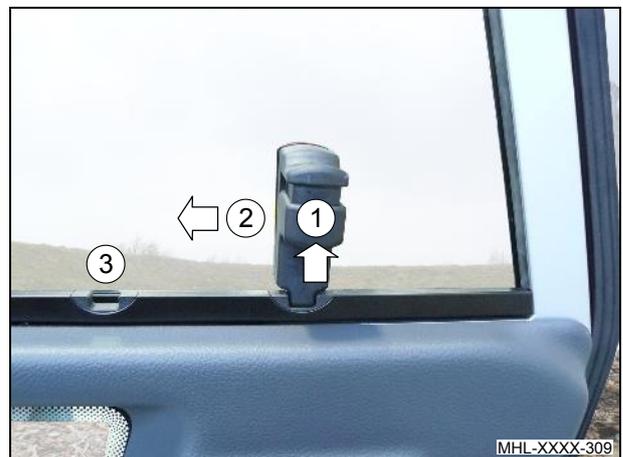


Fig. 96 Opening the side window

4.10.8 Interior lighting

The interior lamp (97/2) can be used to light the cab. An adjustable reading lamp (97/1) is available for reading the operating instructions.

- ▶ Switch the desired light on or off with the button toggle (97/3).

4.10.9 Emergency hammer

The emergency hammer (97/4) is located in the operator's cab on the right window pillar.

The rear windshield acts as an emergency exit. In case of an emergency:

- ▶ If possible, move the loading machine into the parking position and switch off.
- ▶ Move the seat as far forward as possible.
- ▶ Fold in the backrest.
- ▶ Completely remove the rear windshield with the emergency hammer.
- ▶ Exit.

4.10.10 Fire extinguisher (optional)

The fire extinguisher (max. 4 kg) is located in the driver's cab on the left window pillar.

| |
|--|
| ATTENTION |
| <i>Note the manufacturer's information on the fire extinguisher.</i> |

In case of an emergency:

- ▶ Open holder (98/1).
- ▶ Press in safety button (98/2).
- ▶ Press thrust button (98/3).



Fig. 97 Emergency hammer/lamp glass



Fig. 98 Fire extinguisher

4.10.11 Windshield wiper/Intermittent wiping

ATTENTION

The windshield wiper only works if the windshield is closed.

In the function menu, the switching function "Windscreen wiper/intermittent wiping (upper window section)" (99/102) or "Windscreen wiper (lower section)" (99/108) (option) is displayed in the form of a pictogram.

The windscreen wiper is switched on in the function menu with a single short click with the multifunction button (99/21) when the symbol is "in focus".

The windscreen wiper is switched off again with another single short click with the multifunction button (99/21).

The interval for windscreen wiper movement can be adjusted in the main window using the menu selection wheel on the display. It can be set between 3 and 15 seconds at intervals of 1 second. The set wiper movement interval is displayed in the symbol (99/102) for the main windscreen wiper. A wiper movement interval of "0" means that the windscreen wiper is working continuously.

The interval for wiper movement can only be adjusted if the focus has been navigated to the windscreen wiper symbol using the multifunction button. If the focus has been moved to the windscreen wiper symbol in the function menu using the menu selection wheel, the interval for wiper movement will be reset to "0".

After the ignition is switched off, the set interval for wiper movement remains saved.

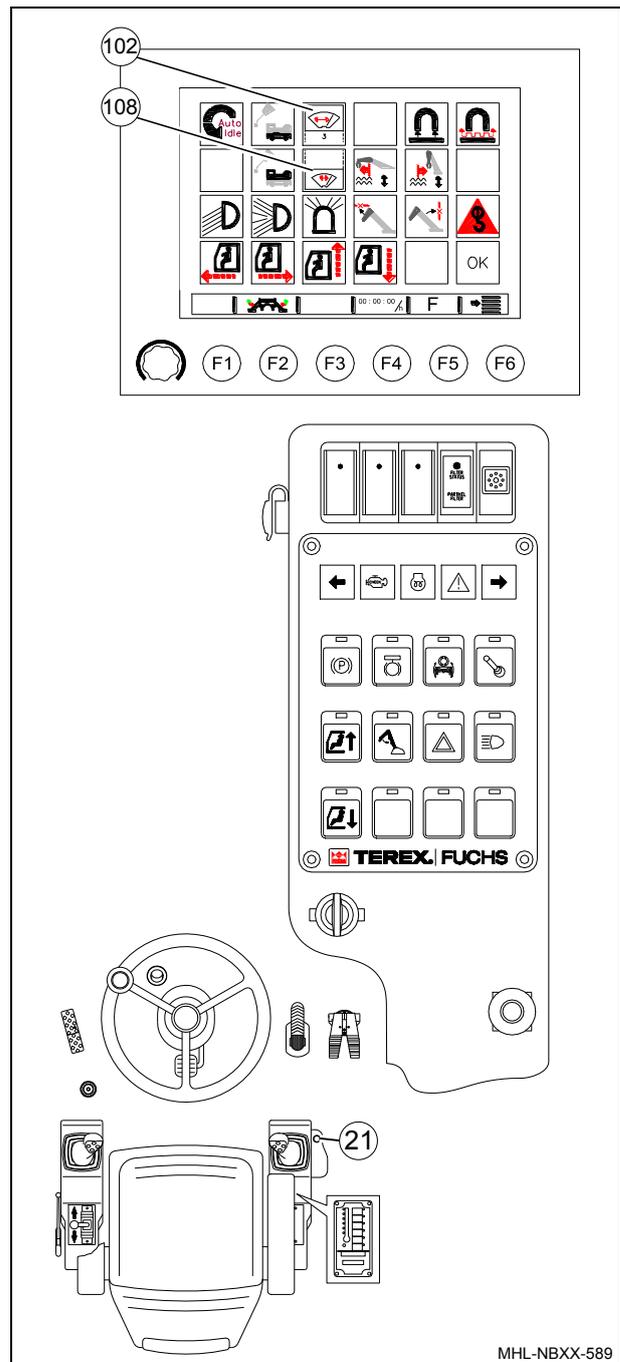


Fig. 99 Windshield wiper/intermittent wiping

4.10.12 Wiper water pump

In wiper mode, the windows are sprayed by outlet nozzles (100/1) and (100/4) with wiper water.

The "Wiper water pump (upper windshield)" and/or optional "Wiper water pump (lower windshield)" functions are performed when the focus is on the symbol (99/102) and/or (99/108) (washing water is sprayed through the outlet nozzles) throughout the entire time that the multi-function button (99/21) is pressed.

After the multifunction button (99/21) has been released, the windscreen wiper will continue to run for approximately 4 seconds.

In the end position, the windshield wiper is kept in its position (100/3) such that it does not flap into the cab when the windshield is opened.

The wiper blade is fitted to the wiper arm (100/3). A worn wiper blade should be replaced from inside the cab. To do this, slide the windshield up and lock it.

The filler neck of the fluid container (101/1) for the windshield washer is located on the rear of the cab. The reservoir holds approx. 3.5 liters. We recommend that you always add window cleaner containing antifreeze to the water.



Fig. 100 Upper windshield wiper

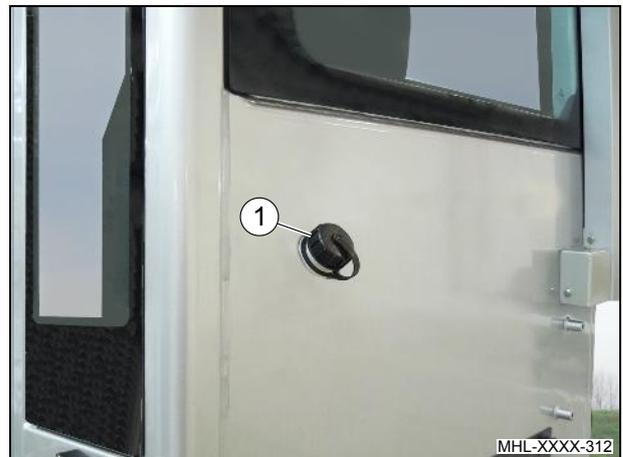


Fig. 101 Filler neck for fluid container

4.10.13 Sockets

A 24 V socket (102/1) is available on the control panel. A 12 V socket (103/1) is located in the side lining behind the cab door as an option.

Devices to be connected must be suited to the loading machine and be safe and free from damage. They must be mounted such that the field of vision is not restricted, all control elements remain easy to access and they cannot come loose when the machine is in use.

i Chapter 2.6.2 Additional devices (wireless, mobile, radio)

4.10.14 Bottle holder and lunchbox

A lunchbox (104/1) and bottle holder (104/2) are located behind the driver's seat. Both are connected to the heating and air conditioning system via a controllable vent. The amount and temperature of ejected air corresponds to the setting for cab air on the lever of the heating/air conditioning system.

The lever (104/3) opens, meters or seals a vent on the heating and air conditioning system.

Temperature control

- ▶ Set the heating and air conditioning system to the desired temperature.

i Chapter 4.9 Heating and air conditioning

- ▶ For maximum temperature control, slew the lever (104/3) as far left as it will go. For lower temperature control, slew to an intermediate point.

No temperature control

- ▶ If cooling or heating is not wanted, slew the lever (104/3) as far right as it will go.



Fig. 102 24 V socket



Fig. 103 12 V socket (optional)



Fig. 104 Bottle holder and lunchbox

4.10.15 Radio, CD player (optional)

The loading machine can be equipped with an audio device (radio, CD). Refer to the device manufacturer's documentation for operational details.

|  WARNING | |
|--|---|
|  | <p>Danger of injury from too loud a setting</p> <ul style="list-style-type: none"> • Adapt volume to the working situation: <ul style="list-style-type: none"> - to protect hearing - to hear important signals or noises in the loading machine and surrounding area <p>In an emergency: Switch off machine, seek treatment from a doctor</p> |

| ATTENTION | |
|--|--|
|  | <p><i>The supply voltage of the loading machine is 24 V. When connecting an audio device with 12 V, a potential transformer is required.</i></p> <p> <i>Please contact your dealer for further information.</i></p> |

 Chapter 2.6.2 Additional devices (wireless, mobile, radio)

4.11 Cab which can be raised and moved forward hydraulically

The can can be variably elevated steplessly up to a viewing height of 6.20 and independently moveable by 2.20 m.

4.11.1 Before putting the machine into operation

The cab's lifting equipment must undergo a function test every day.

|  WARNING | |
|--|--|
|  | <p>Serious injury due to sagging cab</p> <ul style="list-style-type: none"> • The cab may only be repaired whilst in the elevated position if the lift frame is adequately supported. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

A sleeve may be affixed to the piston rod of the lift frame cylinder to support the cab. This support sleeve can be obtained from TEREX | Fuchs.

4.11.2 During operation

Only enter or leave the cab when it is in the home position. The cab must not be moved. The steps must only be used to enter and exit the cab, and not as a platform. Machine operators must always take care to ensure that any and all movements of the cab will not put themselves or others at risk.

|  WARNING | |
|--|---|
|  | <p>Serious injury due to electric shock</p> <ul style="list-style-type: none"> • When working with the cab elevated, special care must be taken to avoid contact with overhead power lines. <p>In an emergency: If the machine touches an overhead power line, it must only be exited or touched by persons standing outside the cab when it is certain that the machine is no longer in contact with the power line or the electricity supply has been switched off.</p> <p> Chapter 2.2.6 Safe working with the machine</p> |

|  WARNING | |
|--|--|
|  | <p>Serious injury due to collision</p> <ul style="list-style-type: none"> • When close range cut-off (dipperstick) is deactivated, please note that the distance between the cab and the work attachment decreases. • When loading long and thin parts which protrude from the loading grab, these parts may break into the cab if the grab swings out violently or if the close range shut-off system is activated. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

4.11.3 Driving with the cab elevated

|  WARNING | |
|--|--|
|  | <p>Danger of injury due to machine toppling over.</p> <p>The loading machine must be driven with the cab lowered. If this is not possible, attention must be paid to the following points:</p> <ul style="list-style-type: none"> • Do not drive the machine with the cab elevated if there are obstructions on the routes to be taken or if they are on an incline. • The cab must only be adjusted when the machine is stopped. • Keep the cab door closed and remain seated with your safety belt fastened. • Ensure no persons are in the danger zone of the machine during the adjustment process. • When driving with the cab elevated, check that the entrance heights to work bays and other premises are sufficient. In the event of a collision the operator is exposed to an increased risk of injury. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

4.11.4 Parking the machine

The cab must be returned to the home position.

|  WARNING | |
|--|---|
|  | <p>Danger of injury due to inaccessible steps</p> <ul style="list-style-type: none"> • If using enlarged stabilizer plates (optional), place these on the floor. • Before leaving the cab, check that you can descend safely. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

4.11.5 Positioning the cab

The cab can be variably moved hydraulically.

⚠ WARNING



Danger of injury due to falling

- When the cab is being adjusted, and during driving and working, the left-hand armrest must be folded down, the cab door shut and the safety belt fastened.

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION

As long as the "Raise/lower cab" function is active, the engine speed will be increased automatically to 70% of nominal speed if the pre-selected speed is less than 70% of nominal speed.

Adjust the cab height as follows:

The cab can be raised/lowered in two ways:

- ▶ By pressing and holding down the pushbutton (105/63) until the cab reaches the desired working height.
- ▶ Pressing and holding down the pushbutton (105/61) lowers the cab.

Alternatively, in the function menu, where the "Raise cab" (105/120) or "Lower cab" (105/121) function is displayed in the form of a pictogram.

The cab is raised or lowered when the respective symbol is "in focus" and the multifunction button (105/21) is pressed and held down.

Alternatively, it is possible to "raise/lower" the cab by pressing and holding down the F3/F4 keys.

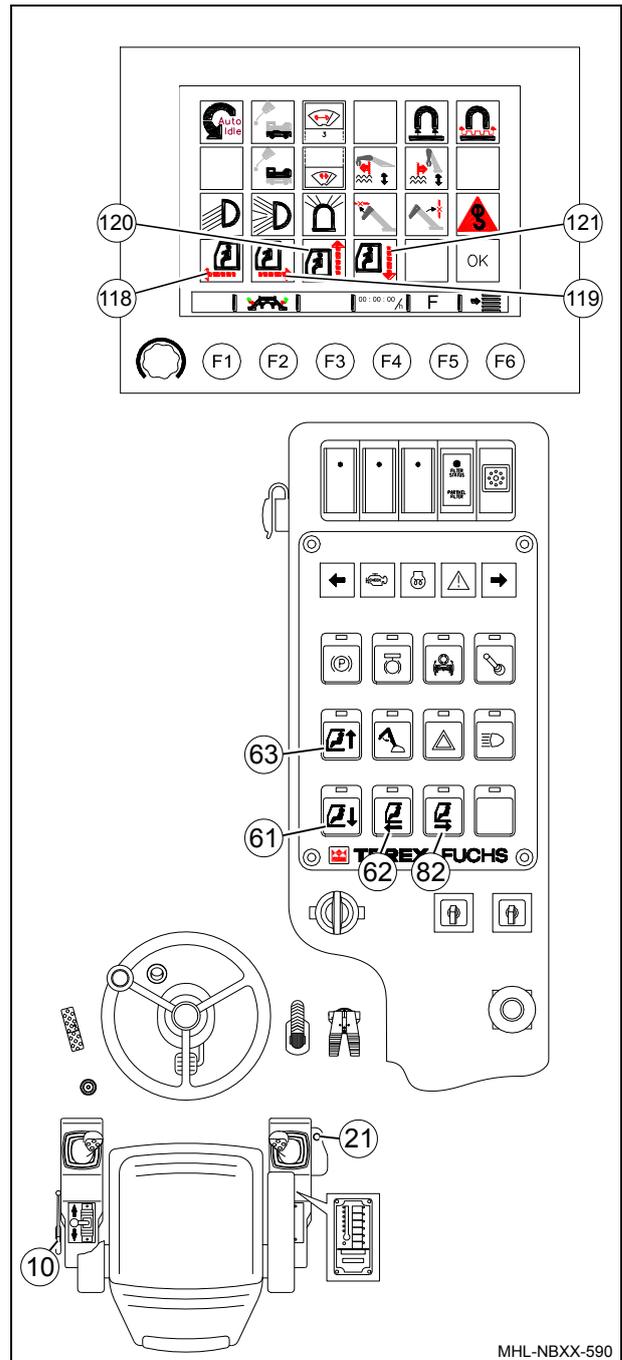


Fig. 105 Positioning the cab

MHL-NBXX-590

Move the cab in a longitudinal direction as follows:

The cab can be moved forward/backward in two ways:

- ▶ By pressing and holding down the pushbutton (105/62) until the cab reaches the desired position.
- ▶ Pressing and holding down the pushbutton (105/82) moves the cab back.

Alternatively, in the function menu, the function "Cab forward" (105/118) or "Cab backward" (105/119) is displayed in the form of a pictogram.

The cab is moved forward or backward when the respective symbol is "in focus" and the multifunction button (105/19) is pressed and held down.

Alternatively, it is possible to move the cab "forward/backward" by pressing and holding down the F1/F2 keys.

The cab can be moved "up/forward" at the same time by simultaneously pressing and holding the keys (105/120) and (105/118). And the cab can be moved "down/backward" at the same time by simultaneously pressing and holding the keys (105/121) and (105/119).

4.11.6 Emergency lowering of cab

If the control for the elevating cab fails due to a malfunction in the diesel engine or because of some other fault, it can be lowered with the emergency cab lowering function.

Emergency cab lowering can be carried out in two ways:

- ▶ From inside, the cab can be lowered with the ball valve (107/10).
- ▶ From outside, the cab can be lowered with the ball valve (106/1).

In order to raise the cab again after lowering, the ball valves (107/10) and (106/1) must be returned to the shut-off position.

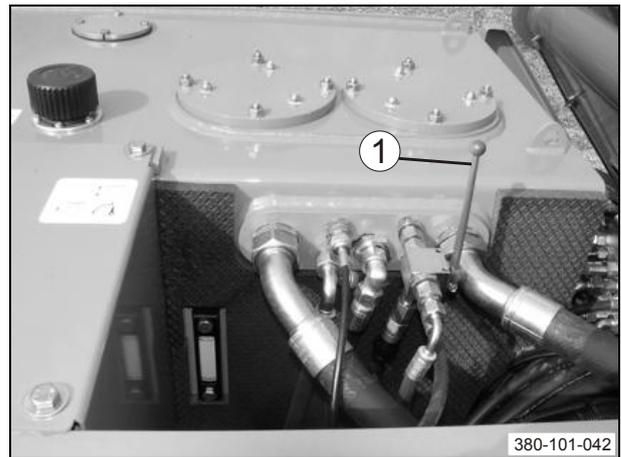


Fig. 106 Emergency lowering of cab

⚠ WARNING

Risk of crushing when cab is moving

- There is a risk of being crushed by the lift frame due to the movement of the cab, since the operator in the cab cannot see all areas fully.
- Make certain there is no one in the area around the lift frame.

In an emergency: Administer first aid, seek treatment from a doctor

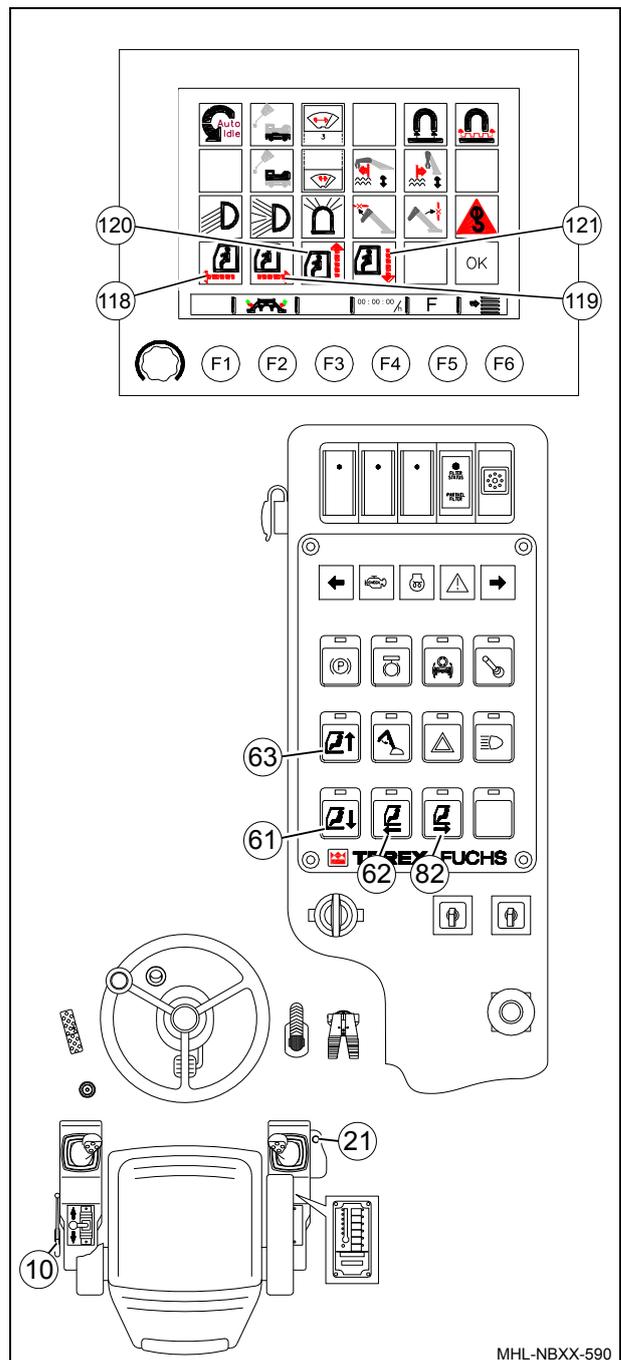


Fig. 107 Emergency lowering of cab

4.11.7 Cab protection ventilation (optional)

The loading machine must be fitted with a cab ventilation system for use in places where the ambient air is contaminated.

The outside air is cleaned by the filter system (fig. 108). An additional ambient air filter device (109/1) cleans the cab air such that it contains no dust particles which enter the cab on shoes, for example. The heating and air conditioning system controls the temperature of the cab air.

The cab is modified such that it achieves the required tightness (for example, one-piece side windows, special sealing elements, outside air flap removed).

If the cab ventilation system is switched on and the internal pressure is above 100 Pa, the green signal lamp (110/2) lights up to signal proper operation to those in the surrounding area.



Fig. 108 Filter system



Fig. 109 Circulating air filter

⚠ WARNING



Danger to life due to suffocation

- Only use the filter specified by the manufacturer for the site of operation.
- When changing the site of operation, check the suitability of the filter system with the manufacturer.
- Retrofitting work may only be performed in consultation with the manufacturer, as various conversions are required on the cab.
- Depending on the site of operation, adapted personal safety gear (such as an escape filter device) must be provided.
- Inform those in the surrounding area of the purpose of the green signal lamp and measures to be taken in an emergency.

In an emergency: Administer first aid, seek treatment from a doctor

4.11.7.1 Operating principle of the filter system

When air enters the filter system, the pre-screener (110/1) removes large dust particles directly. In circuits, other coarse dust accumulates around the subsequent casing cyclone filter (110/3) and can be discharged using the squeeze valve (110/4). The blower in the housing (110/5) draws the air through the casing cyclone filter and pushes it through the exhaust particle filter (also in the housing). Depending on the site of operation, the exhaust particle filter may also contain charcoal. The cleaned air flows through the rear wall of the cab (110/6) in the heating and air conditioning system.



Fig. 110 Filter system

|  WARNING | |
|--|--|
|  | <p>Danger of poisoning</p> <ul style="list-style-type: none"> • Wear personal safety gear when performing maintenance work. • The filter may only be changed by specialists trained by the filter manufacturer. • Do not clean the casing cyclone filter and exhaust particle filter. Dispose of them as contaminated material. <p>In an emergency: Seek treatment from a doctor</p> |



Fig. 111 Monitoring and control unit

Thanks to the blower and quality of the cab's seal integrity, a positive pressure of approx. 150 to 250 Pa builds up, which prevents harmful substances from entering the cab. To achieve the required positive pressure, the windows and cab door must be closed completely.

The control on the monitoring and control unit (111/1) monitors the positive pressure and filter status.

If the cab pressure sinks below the limit value of 100 Pa, the acoustic warning buzzer sounds, the color of the LED (110/1) changes to red and the green signal lamp (110/2) goes out.

 Manufacturer's operating instructions

4.11.7.2 Switching on the filter system

⚠ WARNING



Danger to life due to suffocation

- Check whether personal safety gear is in the cab.
- Leave the danger zone if your sense of smell or taste is impaired and irritation occurs.
- Leave the danger zone at once if the cab pressure is sinking, the warning buzzer is activated or the filter system is generating fault messages.

In an emergency: Administer first aid, seek treatment from a doctor

- ▶ Close all windows and the cab door.
- ▶ Switch on the ignition.

The filter system runs automatically in filter mode.

- ▶ Check:
 - whether the green signal lamp (110/2) lights up.
 - whether a positive pressure between 150 and 250 Pa appears on the display (112/2). The LED (112/3) must light up green.
 - whether the LEDs (112/4) light up green for the filter used. If they are red, the filter should be replaced by the system manufacturer.

The button toggle (112/1) can be used to switch filter mode off and back on again if required.

Under extreme conditions or as the filter (110/1) becomes more contaminated, the positive pressure in the cab can be increased for a short time by turning up the blower (112/88). Leave the danger zone at once and adapt the filter system to the conditions.

ATTENTION

Leaks, such as an improperly closed window can also be the reason for low or no positive pressure in the cab.

i Manufacturer's operating instructions

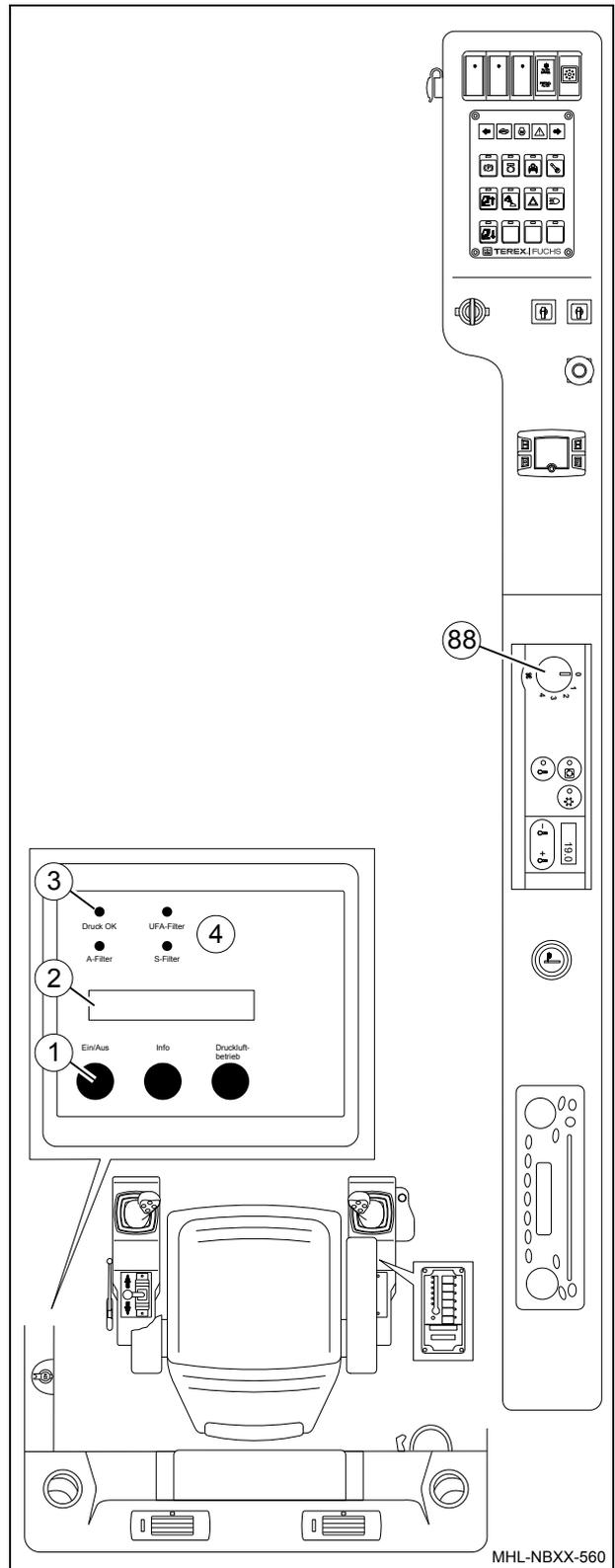


Fig. 112 Monitoring and control unit

4.12 Travel operation

⚠ DANGER



Danger of injury due to restricted visibility

- Before and during travel, check that there are no persons or obstructions in the direction of travel.
- Look to the rear before and during reversing.
- Warn persons in the vicinity of the danger zone by sounding the horn.
- It is essential to comply with all safety instructions in chapter 2 before and during travel.

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION

The loading machine is not licensed for use on the road, and therefore must not be driven on public highways (in Germany).

4.12.1 Carrying loads with loading machines

Basic requirements:

- The ground taken by the route must be level and solid and have sufficient carrying capacity.
- The uppercarriage must be positioned longitudinal to the undercarriage (forward or backward); maximum permissible deviation 5°.
- Turning the uppercarriage with outriggers up and with loads is prohibited.
- The uppercarriage must be secured against rotation (swing brake locked).
- The 4-point outrigger must be retracted completely prior to traversing (risk of accident).
- Recommendation: only travel via steering axle.
- Observe the position of the undercarriage to the uppercarriage in relation to the steering and directional control (accelerator pedal).
- Lock the oscillating axle cylinder during traversing with boom via the oscillating axle.
- The values indicated in the tables of carrying capacity for "not supported, longitudinal" are downtime values. During traversing of the machine, the carrying capacity values must not exceed 60% of the "not supported, longitudinal" values stated in the table.
- Secure the loads against swinging out.
- When traveling with loads, the maximum permissible speed is 5 km/h (walking speed).
- When traveling with loads, consider how this might change the response of the machine (reduced stability due to dynamic loads, avoid sudden changes in speed and direction).

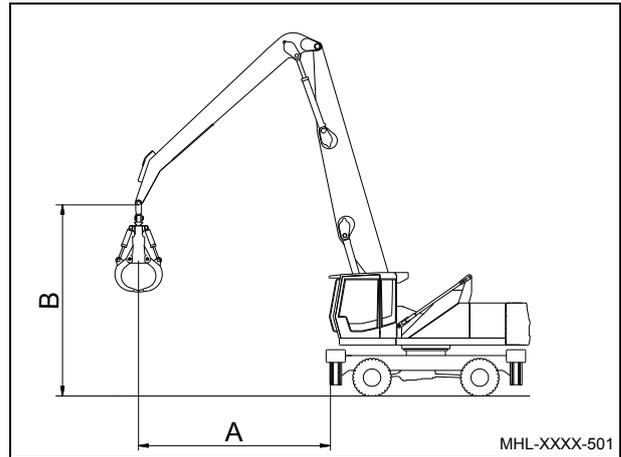


Fig. 113 Traversing position
 A: 5.1 m
 B: 4.5 m

ATTENTION

The "traversing" position represented in Fig. 113 provides the operator with optimum visibility during the traversing of the machine.

4.13 Setting the machine in motion

⚠ WARNING

Danger of injury due to collisions or machine toppling over

- Starting in the wrong direction can lead to serious accidents. Before setting off, check the location of the steering axle and steer the machine accordingly.
- If possible, always turn the uppercarriage so that the steering axle is at the front.

In an emergency: Administer first aid, seek treatment from a doctor

- ▶ Start the diesel engine.
 - ❏ Chapter 4.6.2 Starting the diesel engine
- ▶ Retract the 4-point outrigger.
- ▶ Turn off the parking brake pushbutton (114/65) and release the service brake (114/16) when the pedal is locked.

ATTENTION

The machine cannot be set in motion if the parking brake is applied. The indicator (114/41) lights up.

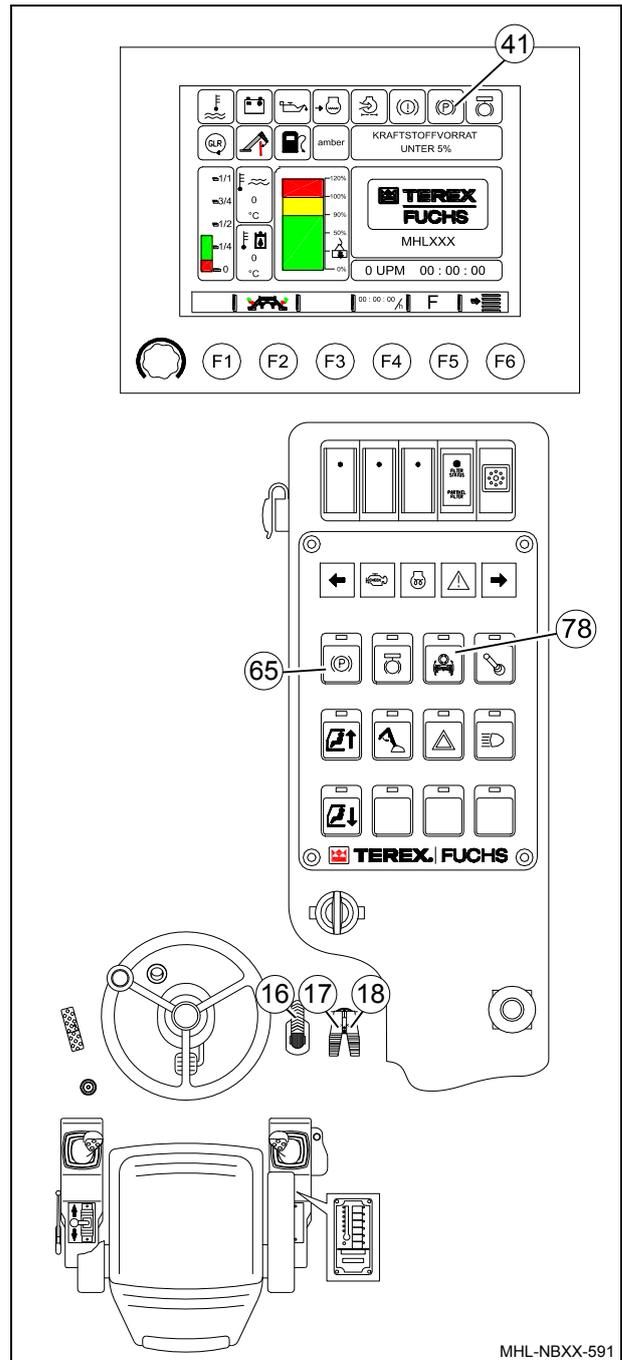


Fig. 114 Driving

- ▶ **Travel direction forward** (related to the steering axle)

Forward travel is initiated by pressing the pedal (114/17).

- ▶ **Travel direction reverse** (related to the steering axle)

Reversing is initiated by pressing the pedal (114/18).

|  CAUTION | |
|--|---|
|  | <p>Danger of injury due to uncontrollable driving statuses</p> <ul style="list-style-type: none"> • Only change from forward to reverse traveling and vice versa when the machine is at a standstill. Do not reverse. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

| ATTENTION |
|---|
| <p><i>The speed of travel is controlled using the travel pedals (114/17) and (114/18). Operate the service brake pedal (114/16) for braking and stopping.</i></p> |

If the machine gets stuck on difficult terrain, do not attempt to free it by rocking.

-  See Chapter 6 Recovery, Loading and Transport for details of how to proceed.

Machines carrying loads with laterally shifted uppercarriage must travel only on level ground and with the oscillating axle locked. The oscillating axle is locked using the pushbutton (114/78).

-  Chapter 5.1.8 Oscillating axle lock release

4.13.1 Rear view camera (optional)

The rear view camera (115/1) allows the driver to see the area at the rear which is not visible in the rear view mirror.

Chapter 7.10.1 Rear view camera

⚠ WARNING

Danger of injury due to restricted visibility

- The rear view camera is set to the area behind the counterweight in the factory. The setting must not be changed.
- The rear view camera is intended as an aid only. Note all other safety information. In the case of missing images or poor quality of the display, the backup must be stopped immediately.

In an emergency: Administer first aid, seek treatment from a doctor

Chapter : 2.2.3 Safe operation despite obscured view

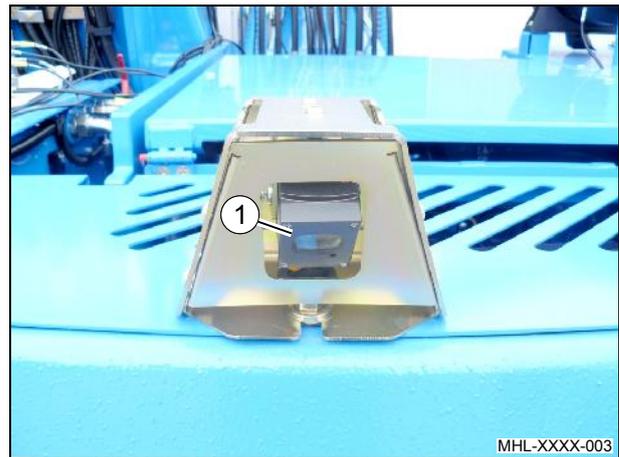


Figure 115 Rear view camera



Figure 116 Full screen display

4.13.1.1 Camera image display

The camera image appears in the multifunction display when the main control display is selected. It is displayed in mirrored form so is like looking in a rear mirror. Possible displays are:

- Full screen display (116) for driving the machine.
- Minimized display (117) for loading operations.
- No camera image (118). Details relating to the machine, options or fault messages are displayed.

Automatic display change

In normal mode, the display changes automatically depending on the position of the accelerator pedals:

- Accelerator pedal depressed: Full screen display
- Accelerator pedal not depressed: Minimized display
- Minimized display. Automatic display changes are only reactivated when the accelerator pedals are depressed.



Figure 117 Minimized display

Manual display change

Each time the F1 function key is pressed, the display changes. Possible displays are:

- Full screen display. Automatic display changes are only reactivated when the accelerator pedals are depressed.
- No camera image. The camera image is briefly hidden in the minimized display. Details about the machine and options appear. The automatic display change function remains active.

Menu change

If the driver switches from the main control display to another menu, the camera image is deactivated. Once the driver has switched back to the main control display, the minimized display reappears soon thereafter.

4.13.1.2 Machine operating statuses

Switching machine on

The camera image only appears once the machine control and multifunction display have powered up (around 20 seconds).

Multifunction display in stand-by mode

If only the ignition is switched off, no camera image appears. If the ignition is switched on, the camera image appears once the machine control has powered up (around 5 seconds).

Monitors

If an important monitor is active during full screen display, the display changes to the minimized display.

- The full screen display remains disabled until the monitor is no longer active.
- Automatic display change is not active.
- Manual display change possible.

Fault messages

Fault messages take priority. The camera image is automatically deactivated.

- Automatic display change is not active.
- Manual display change possible.

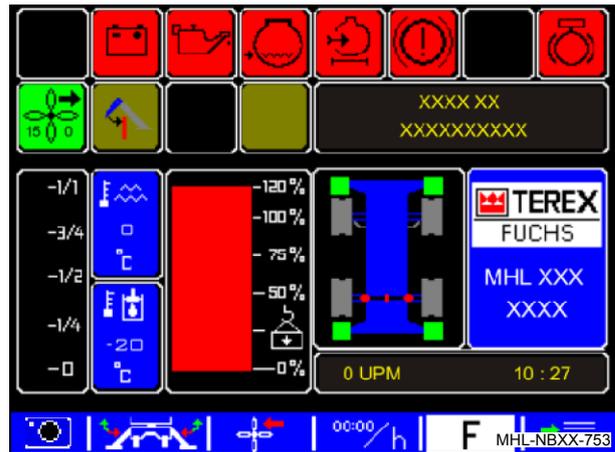


Figure 118 No camera image

4.13.2 Stopping

The speed of travel is reduced by releasing the travel pedals (114/17) and (114/18). The hydrostatic travel drive acts as a non-wearing service brake.

 Chapter 4.13.3 Brakes

4.13.3 Brakes

- ▶ Service brake (can be locked in place)

Apply the service brake (114/16) as required. When the service brake is locked in place, check that the **brake pressure diminishes after the diesel engine has been stopped** for some time.

- ▶ Parking brake

Switch on the parking brake pushbutton (114/65) when parking the machine.

|  WARNING | |
|--|---|
|  | <p>Danger of injury due to unsecured loading machine</p> <ul style="list-style-type: none">• With the exception of emergency braking, do not engage the parking brake unless the machine is stopped. |

4.13.4 Steering

The machine has a hydraulic front axle.

|  WARNING | |
|--|--|
|  | <p>Danger of injury due to uncontrollable driving statuses</p> <ul style="list-style-type: none">• In the event of steering malfunctions, stop work immediately, identify the cause (see Troubleshooting) and contact a service engineer if necessary. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

4.13.5 Driving downhill and uphill

When driving up or down steep gradients, the loading equipment can be used to prevent the machine tipping over. When driving down a steep gradient, the loading equipment must be retracted as far as possible. When driving up a steep incline it must be extended.

When driving downhill or uphill it is normally sufficient to lift the loading equipment far enough to maintain good clearance to the ground.

|  WARNING | |
|--|---|
|  | <p>Danger of injury due to machine toppling over and uncontrollable driving statuses</p> <ul style="list-style-type: none"> • Do not traverse a slope. Do not park the machine on an incline. • The auto-idling system must be turned off when driving on inclines. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

4.13.6 Driving and working headlamps

To turn on the headlamps, the side lights pushbutton (119/81) functions as a central light switch, i.e., the driving and working headlamps can only be switched on if the side lights are on.

Driving headlamps

In the function menu, the switching function "Driving headlamps" (119/112) is displayed in the form of a pictogram.

The driving headlamps are switched on and off with a single short click on the symbol (119/112) with the multifunction button (119/21).

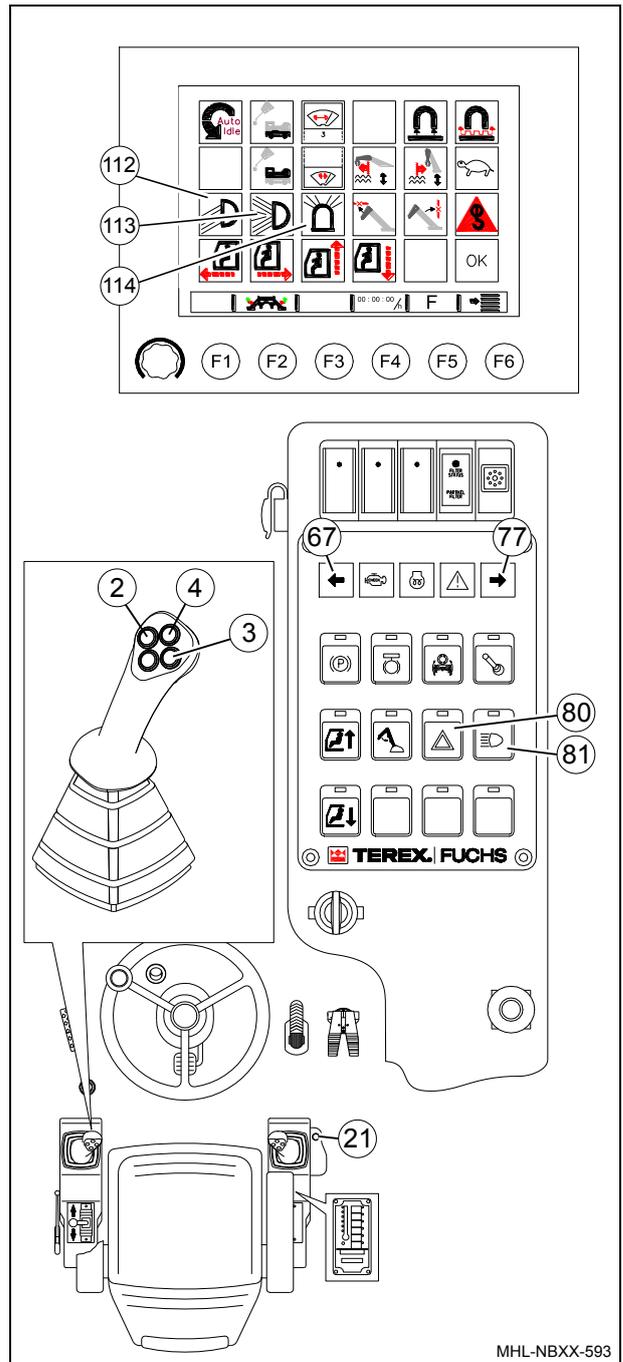


Fig. 119 Lighting

MHL-NBXX-593

Working headlamps (optional)

ATTENTION



The roof headlamps must not be slewed too far such that they cannot be damaged by rainwater

In the function menu, the switching function "Working headlamps" (119/113) is displayed in the form of a pictogram.

A single short click with the multi-function button (119/21) on the symbol (119/113) takes you to the sub-menu "Working headlamps" (Fig. 120). The headlamps on the dipperstick, on the boom and at the front and rear of the cab roof can be switched on and off in this menu.

When the ignition or the side lights pushbutton (119/81) is switched off, the selected settings remain saved. The next time the side lights are switched on, all headlamps that were turned on previously will be turned on again one after the other, which a short gap between each.

ATTENTION

All driving and working headlamps that have been selected are only switched on if the side lights (119/81) are turned on.

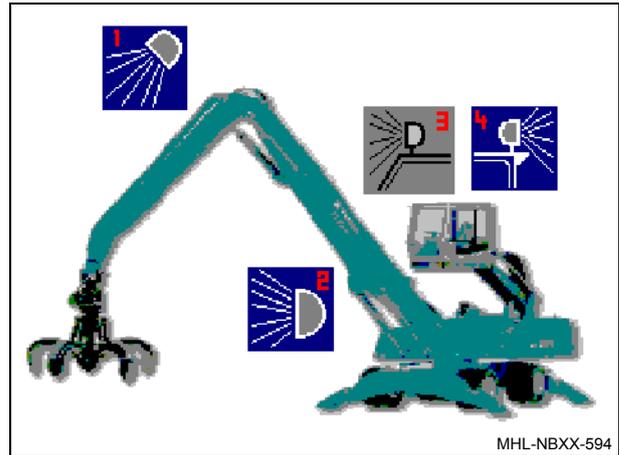


Fig. 120 Working floodlights menu

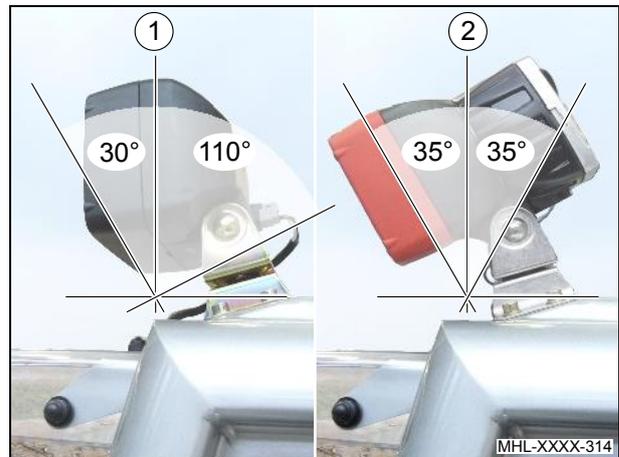


Fig. 121 Roof headlamps - slewing range

- 1 H3 headlamp
- 2 Xenon headlamp

4.13.7 Direction indicators

Indicate right

- ▶ Press the pushbutton (119/3) on the left-hand four-way control lever. The indicator (119/77) on the control panel flashes green.

Indicate left

- ▶ Press the pushbutton (119/2) on the left-hand four-way control lever. The indicator (119/67) on the control panel flashes green.

Switching off

- ▶ Press the pushbutton (119/2) or (119/3) on the left-hand four-way control lever again. The indicator lamps (119/67) and (119/77) go out.

4.13.8 Hazard warning lights

The hazard warning lights system is switched on and off with the pushbutton (119/80) on the control panel. The indicator lamps (119/67) and (119/77) flash.

4.13.9 Horn

- ▶ Press the pushbutton (119/4) on the left-hand four-way control lever.

4.13.10 Flashing beacon (optional)

In the function menu, the switching function "Flashing beacon" (119/114) is displayed in the form of a pictogram.

The flashing beacon (119/114) is switched on with a single short click on the symbol (119/114) with the multifunction button (119/21).

The flashing beacon is switched off again with another single short click on the symbol (119/114) with the multifunction button (119/21).

4.14 Parking the machine

WARNING



Danger of injury due to uncontrolled machine movements

- Park the machine only on a **level and solid** surface.
- When parking the machine, the uppercarriage must be longitudinal to the undercarriage, and the cab must be in the home position. The dipperstick must be positioned vertically and the open grab must be placed on the ground. The stabilizer should be retracted in the standard version with stabilizer plates, if using enlarged stabilizer plates (optional), place these on the floor (see fig. 122).
- Plates should be pushed under the grab tips to stop them digging into the ground.

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION

When switching off the machine, the work attachment must be lowered carefully, as the ground could be damaged by the weight of the loading equipment.

- ▶ Lower the loading equipment to the ground.
- ▶ Switch the parking brake pushbutton (123/65) on and open the service brake (123/16).
- ▶ Switch the swing brake pushbutton (123/66) on or, alternatively, press the pushbutton on the left-hand four-way control lever (123/5).

ATTENTION



The **swing brake** is not a dynamic brake. Activate the "Swing brake" pushbutton only with the swing assembly at standstill!

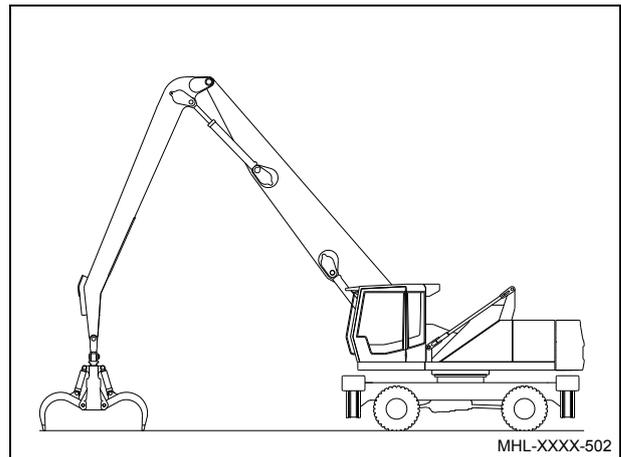


Fig. 122 Proper parking of the machine

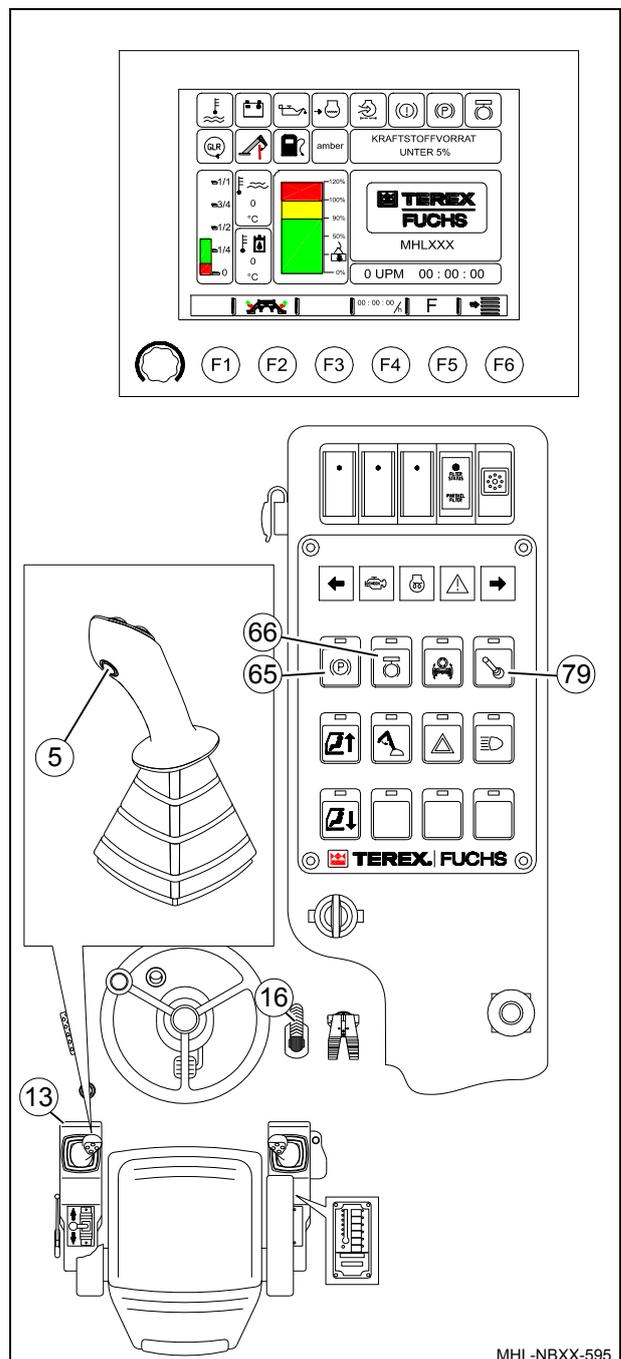


Fig. 123 Parking the machine

- ▶ In the "Speed and FINE MODE" menu, set the engine speed to idle (0%) and run the diesel engine at idle for a short time to allow it to cool down.
 - ▣ Chapter 4.4 Menu levels in the multi-function display
- ▶ Switch off the diesel engine and turn the ignition key to "0".
- ▶ Wait at least 30 seconds, then turn the ignition key to "I" and wait about 5 seconds for the machine control unit to start up. Press and hold down the pushbutton (123/79) and briefly actuate all hydraulic levers in order to relieve the hydraulic system of pressure.
- ▶ Turn the ignition key to "0" and withdraw it.
- ▶ Fold up the left armrest (123/13).
- ▶ Lock the cab, as well as all windows and skylights, to prevent unauthorized access.
- ▶ The machine must be cleaned at regular intervals.

| | | |
|----------|--|------------|
| 5 | Work operation | 5.1 |
| 5.1 | Controls | 5.1 |
| 5.1.1 | ISO control system | 5.2 |
| 5.1.2 | Fuchs control system | 5.3 |
| 5.1.3 | O&K control system | 5.4 |
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| 5.1.5 | Increasing the operating pressure | 5.6 |
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| 5.1.7 | Disabling all travel and work functions | 5.7 |
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| 5.1.9 | Key switches (optional) | 5.9 |
| 5.1.9.1 | Black key switch | 5.9 |
| 5.1.9.2 | Blue key switch | 5.9 |
| 5.1.10 | Close range cut-off (dipperstick) | 5.10 |
| 5.1.11 | Range limit deactivation (dipperstick) (optional) | 5.12 |
| 5.1.12 | Height adjustment (boom) (optional) | 5.13 |
| 5.1.13 | Boom float function (optional) | 5.14 |
| 5.1.14 | Overload warning device for hoisting (optional) | 5.16 |
| 5.2 | Swinging and loading operations | 5.18 |
| 5.3 | Hoisting (optional) | 5.21 |
| 5.3.1 | General | 5.21 |
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| 5.4 | Magnet system (optional) | 5.22 |
| 5.4.1 | Operation of magnet system | 5.22 |
| 5.4.1.1 | Magnet system control device (MMI – Man Machine Interface) | 5.24 |
| 5.4.1.2 | Malfunctions in the magnet system | 5.26 |

5 Work operation

⚠ WARNING



Danger of injury due to restricted visibility

- Before and during the work operation, check that there are no people or obstacles in the danger zone.
- Warn persons in the vicinity of the danger zone by sounding the horn.
- Observe all safety notes.

In an emergency: Administer first aid, seek treatment from a doctor

i Chapter 2 in particular 2.2.3 Safe operation despite obscured view



Fig. 124 Location of control sign

5.1 Controls

Check which type of control unit the machine is equipped with. There is a sign (124/1) in the cab indicating the most important controls. The drawing number (125/1) indicates the control type shown.

| Number | Control |
|---------------|----------|
| 5 358 609 722 | ISO |
| 5 358 609 778 | Fuchs |
| 5 358 609 779 | O&K |
| 5 358 609 780 | Liebherr |

If the customer so wishes, the loading machine may be equipped with a special control.

i Additional operating instructions

⚠ WARNING



Risk of injury due to incorrect operation

- At a low engine speed, check whether the machine movements correspond to the sign.
- Start at low engine speed when familiarizing yourself with the controls and slowly increase this.

In an emergency: Administer first aid, seek treatment from a doctor

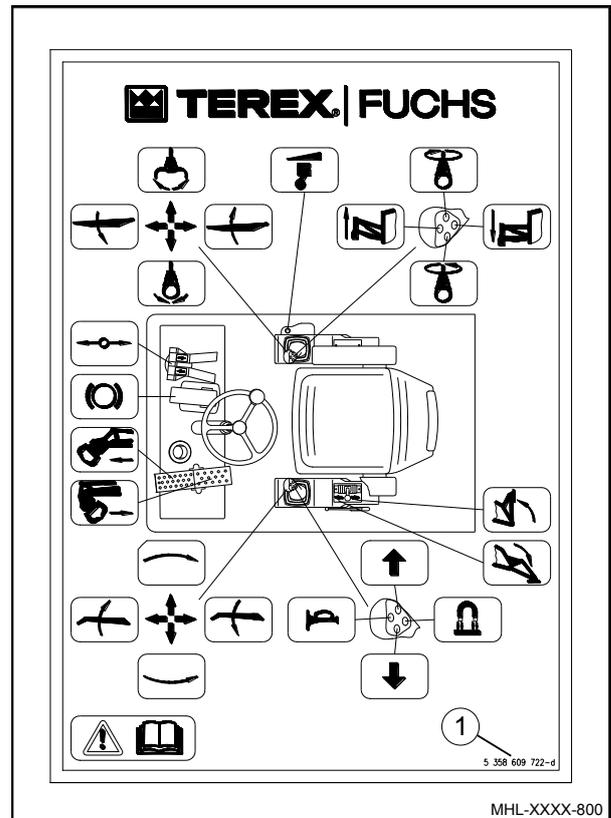


Fig. 125 Control sign (example)

5.1.1 ISO control system

Current machine control unit (if yes, please tick)

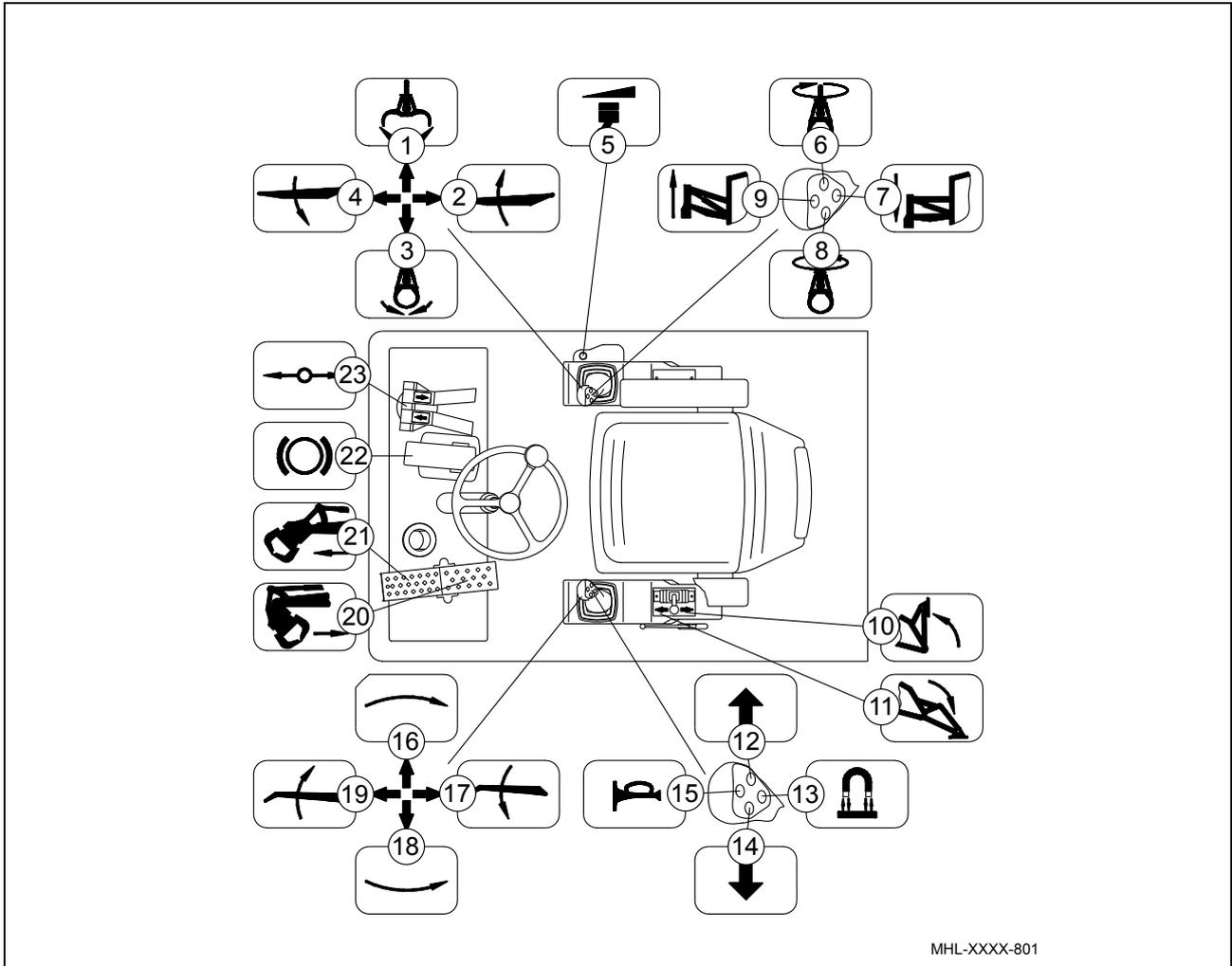


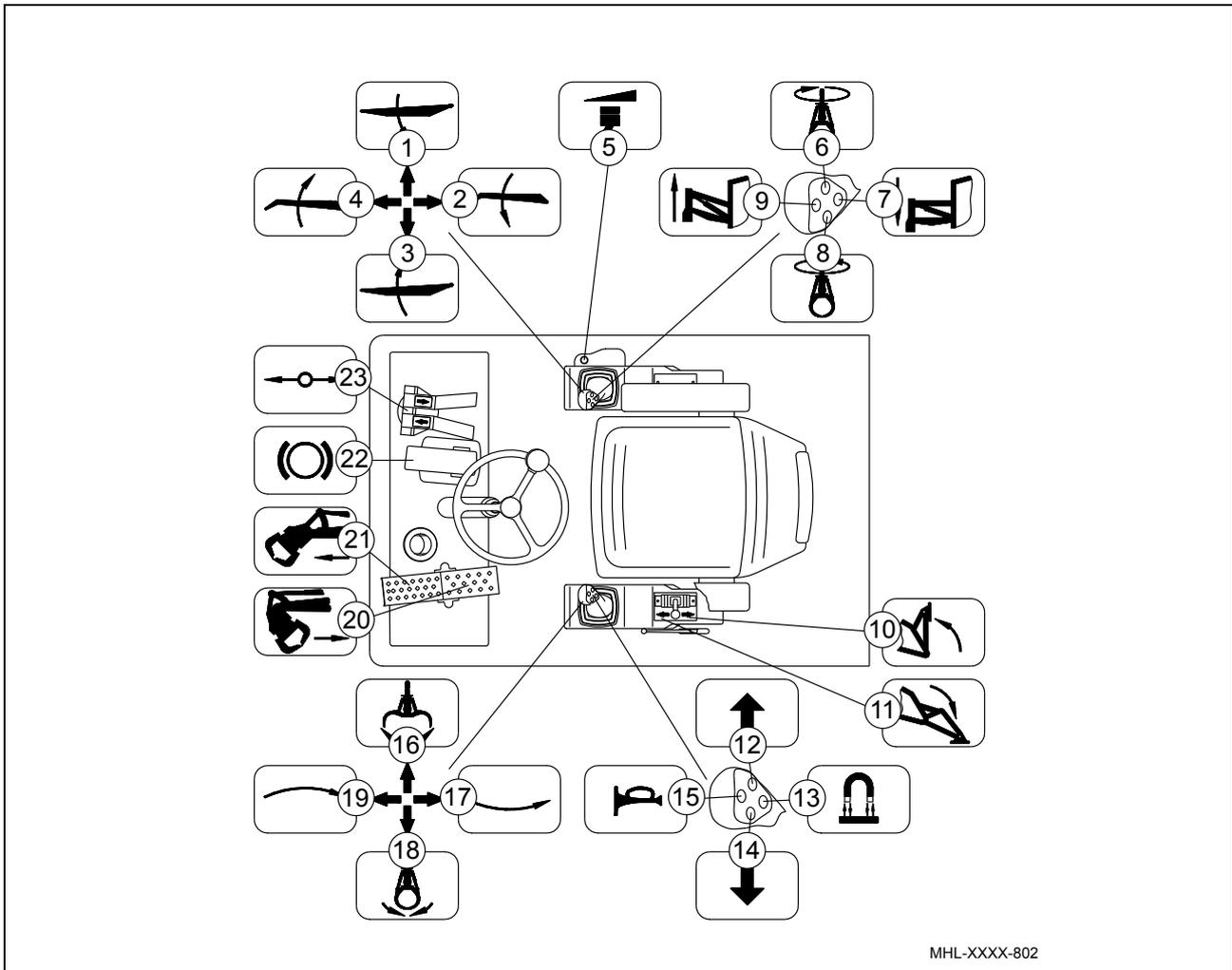
Fig. 126 Assignment with ISO control system

- | | |
|-------------------------------------|--|
| 1 Open grab | 13 Switch magnet system on/off ¹⁾ |
| 2 Raise boom | 14 Left indicator |
| 3 Close grab | 15 Horn |
| 4 Lower boom | 16 Swing uppercarriage clockwise |
| 5 Engine speed | 17 Retract dipperstick |
| 6 Clockwise grab rotation | 18 Swing uppercarriage anticlockwise |
| 7 Extend dozer blade ¹⁾ | 19 Extend dipperstick |
| 8 Rotate grab counterclockwise | 20 Extend tilting cylinder ¹⁾ |
| 9 Retract dozer blade ¹⁾ | 21 Retract tilting cylinder ¹⁾ |
| 10 Retract outrigger | 22 Service brake |
| 11 Extend outrigger | 23 Travel direction FWD/REV |
| 12 Right indicator | |

¹⁾ Optional

5.1.2 Fuchs control system

Current machine control unit (if yes, please tick)



MHL-XXXX-802

Fig. 127 Assignment with Fuchs control system

- | | |
|-------------------------------------|--|
| 1 Lower boom | 13 Switch magnet system on/off ¹⁾ |
| 2 Retract dipperstick | 14 Left indicator |
| 3 Raise boom | 15 Horn |
| 4 Extend dipperstick | 16 Open grab |
| 5 Engine speed | 17 Swing uppercarriage anticlockwise |
| 6 Clockwise grab rotation | 18 Close grab |
| 7 Extend dozer blade ¹⁾ | 19 Swing uppercarriage clockwise |
| 8 Rotate grab counterclockwise | 20 Extend tilting cylinder ¹⁾ |
| 9 Retract dozer blade ¹⁾ | 21 Retract tilting cylinder ¹⁾ |
| 10 Retract outrigger | 22 Service brake |
| 11 Extend outrigger | 23 Travel direction FWD/REV |
| 12 Right indicator | |

¹⁾ Optional

5.1.3 O&K control system

Current machine control unit (if yes, please tick)

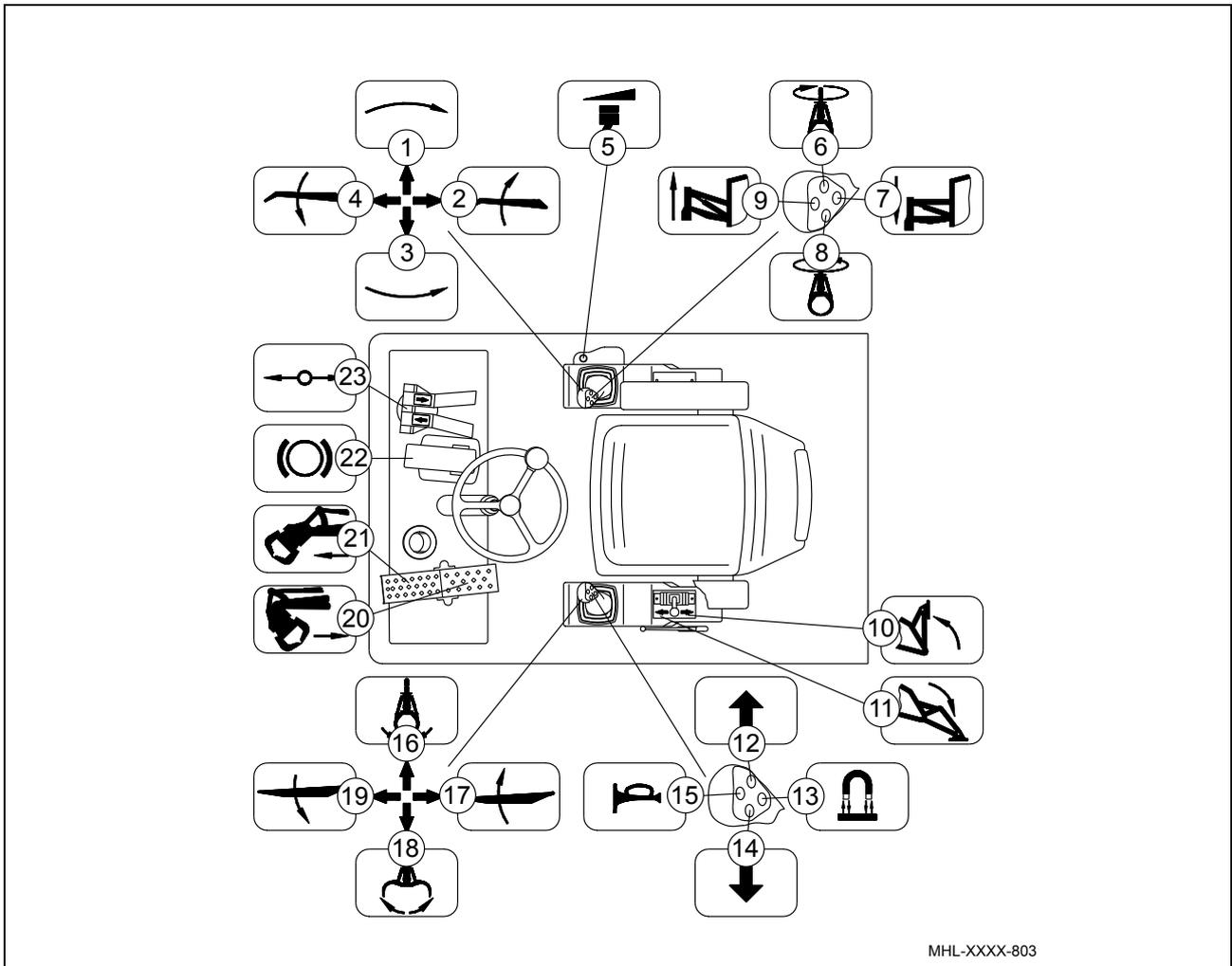


Fig. 128 Assignment with O&K control system

- | | |
|-------------------------------------|--|
| 1 Swing uppercarriage clockwise | 13 Switch magnet system on / off ¹⁾ |
| 2 Extend dipperstick | 14 Left indicator |
| 3 Swing uppercarriage anticlockwise | 15 Horn |
| 4 Retract dipperstick | 16 Close grab |
| 5 Engine speed | 17 Raise boom |
| 6 Clockwise grab rotation | 18 Open grab |
| 7 Extend dozer blade ¹⁾ | 19 Lower boom |
| 8 Anticlockwise grab rotation | 20 Extend tilting cylinder ¹⁾ |
| 9 Retract dozer blade ¹⁾ | 21 Retract tilting cylinder ¹⁾ |
| 10 Retract outrigger | 22 Service brake |
| 11 Extend outrigger | 23 Travel direction FWD/REV |
| 12 Right indicator | |

¹⁾ Optional

5.1.4 Liebherr control system

Current machine control unit (if yes, please tick)

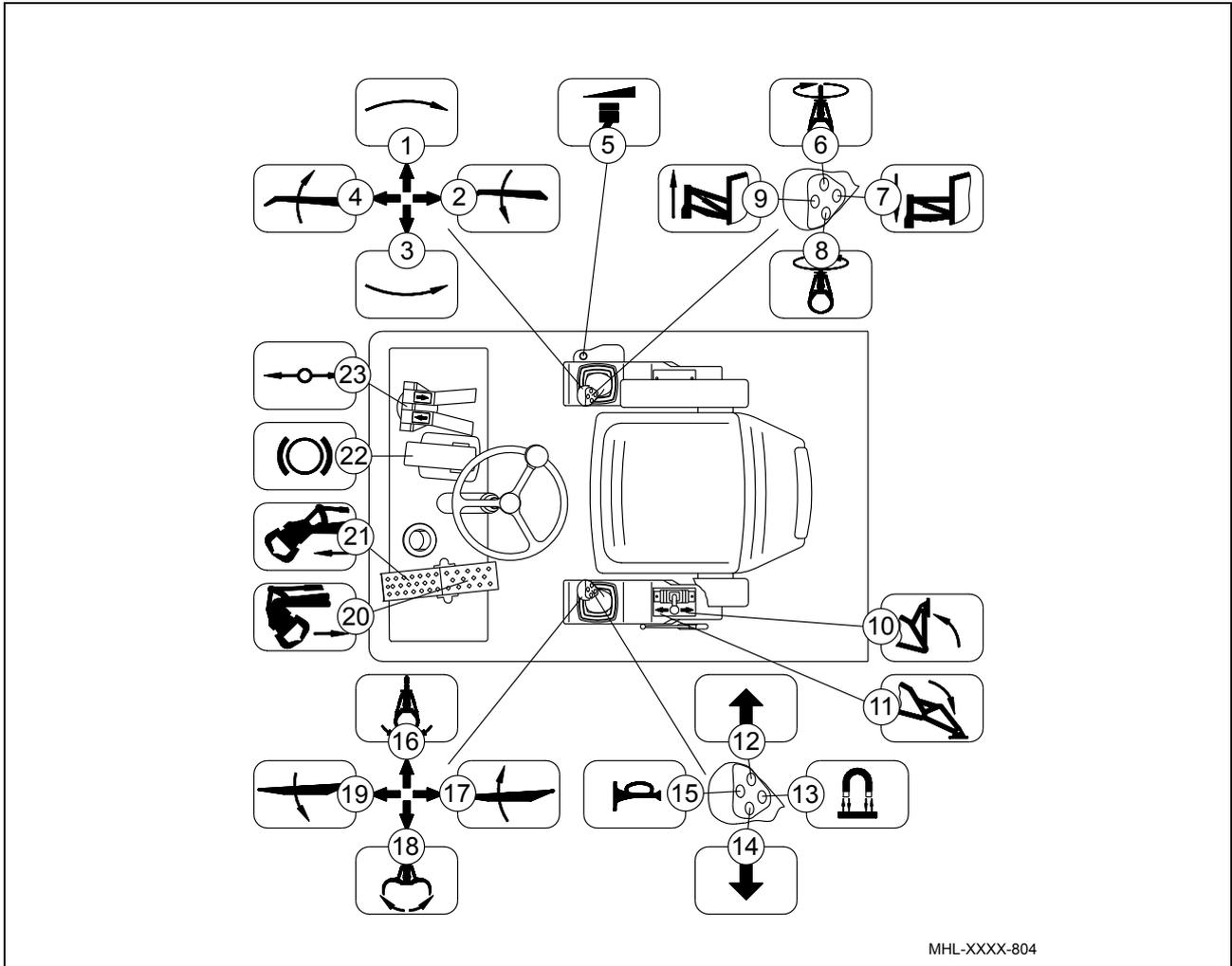


Fig. 129 Assignment with Liebherr control system

- | | |
|-------------------------------------|--|
| 1 Swing uppercarriage clockwise | 13 Switch magnet system on/off ¹⁾ |
| 2 Retract dipperstick | 14 Left indicator |
| 3 Swing uppercarriage anticlockwise | 15 Horn |
| 4 Extend dipperstick | 16 Close grab |
| 5 Engine speed | 17 Raise boom |
| 6 Clockwise grab rotation | 18 Open grab |
| 7 Extend dozer blade ¹⁾ | 19 Lower boom |
| 8 Rotate grab counterclockwise | 20 Extend tilting cylinder ¹⁾ |
| 9 Retract dozer blade ¹⁾ | 21 Retract tilting cylinder ¹⁾ |
| 10 Retract outrigger | 22 Service brake |
| 11 Extend outrigger | 23 Travel direction FWD/REV |
| 12 Right indicator | |

¹⁾ Optional

5.1.5 Increasing the operating pressure

With the "Increase operating pressure" function, the hydraulic pressure can be increased from 320 to 360 bar. This may be necessary for heavy-duty work. To increase the pressure, press the pushbutton (130/5) on the right-hand four-way control lever. The function only takes effect while the pushbutton is held down.

The pressure increase affects the boom and dipperstick only.

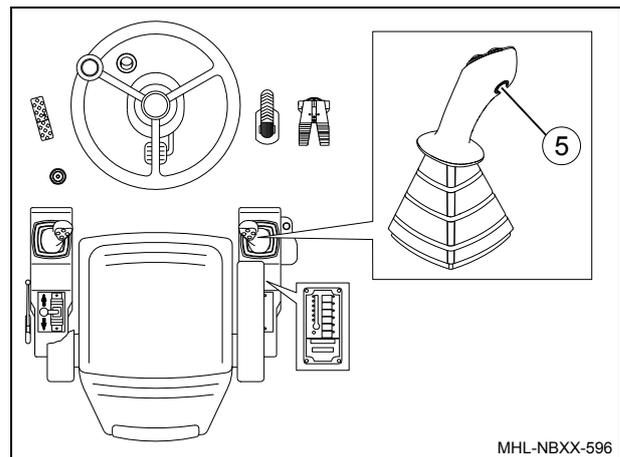


Fig. 130 Increasing the operating pressure

5.1.6 Outrigger

The 4-point outrigger is operated with the lever (131/11).

- ▶ Operating lever forward (131/11.1) ⇒ extend 4-point outrigger.
- ▶ Operating lever backward (131/11.2) ⇒ retract 4-point outrigger.

5.1.7 Disabling all travel and work functions

- All work functions are disabled when the pushbutton (132/79) is switched off. The indicator lamp in the pushbutton does **not** light up; the indicator (132/46) lights up.
- If the level of the hydraulic oil is below the minimum level, indicator (132/38) lights up. A continuous warning buzzer sounds at the same time and the travel and work functions are disabled. The indicator (67/46) lights up. Stop work immediately and top up the hydraulic oil or coolant once the diesel engine **has cooled down**. Once the hydraulic fluid level returns to the permissible range, disabled functions will be made available again. The indicator (132/46) goes out.
- If the service ladder is not closed and the left armrest is folded up, all travel and work functions are disabled. The indicator (132/46) lights up.

ATTENTION

If the travel and work functions are disabled due to high coolant/charge air temperatures or low hydraulic oil level, you can bypass the cut-off for a short time in emergency mode by pressing and holding down the pushbutton (132/79).

i Chapter 4.7 Monitoring the machine during operation

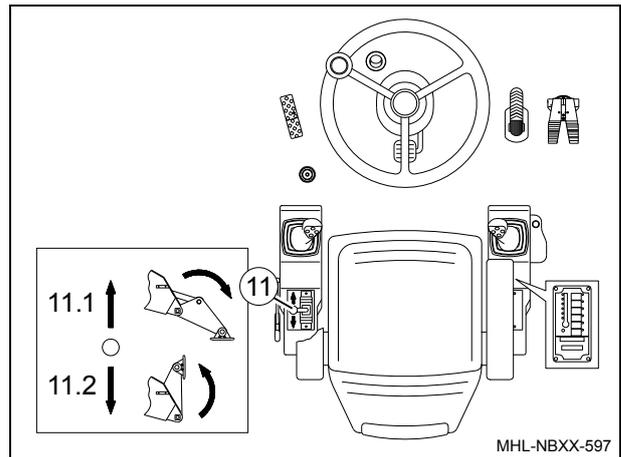


Fig. 131 Outrigger

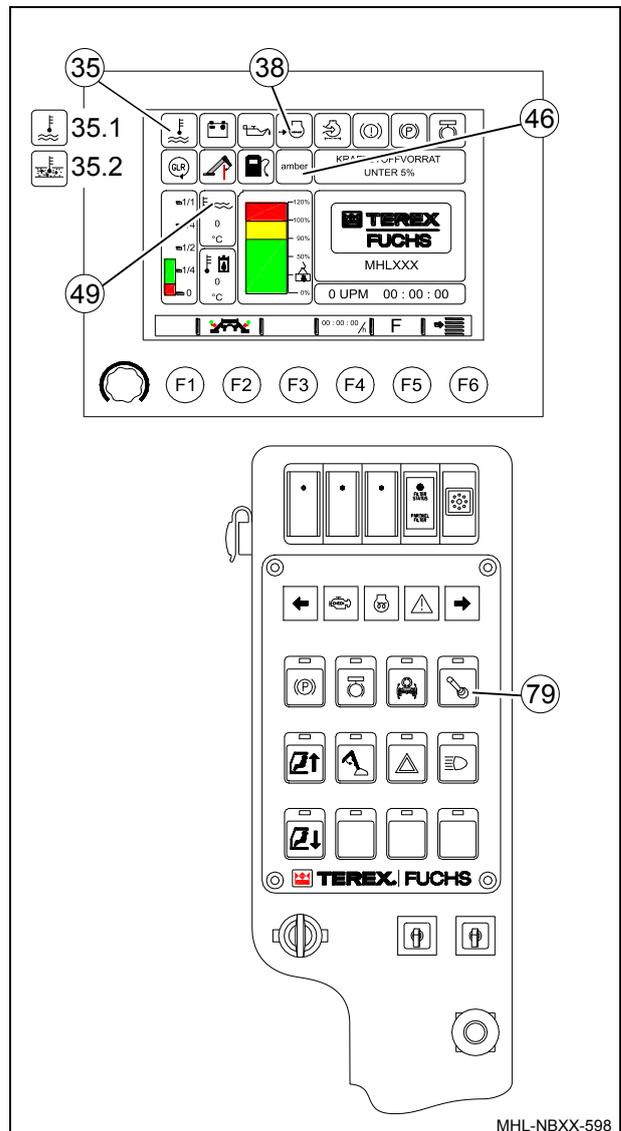


Fig. 132 Disabling travel and work functions

5.1.8 Oscillating axle lock release

The oscillating axle can be unlocked with the pushbutton (133/78). If the oscillating axle is unlocked, the indicator lamp in the pushbutton (133/78) and the indicator (133/45) light up and the text output (133/47) "OSCILLATING AXLE UNLOCKED" appears on the multifunction display. The oscillating axle is locked automatically when the parking brake (133/65) is applied or if the diesel engine is stopped **even if the pushbutton (133/78) is turned on!**

- ▶ For slewing and loading operations: lock the oscillating axle. This increases the stability of the machine. The indicator lamp in the pushbutton (133/78) plus the indicator (133/45) are **not** lit.
- ▶ For travel operation (without load): unlock the oscillating axle. The indicator lamp in the pushbutton (133/78) plus the indicator (133/45) light up.

⚠ WARNING

Danger of injury due to machine toppling over

- An unlocked oscillating axle results in reduced stability and may cause the machine to tip over if a load has been placed on it.

In an emergency: Administer first aid, seek treatment from a doctor

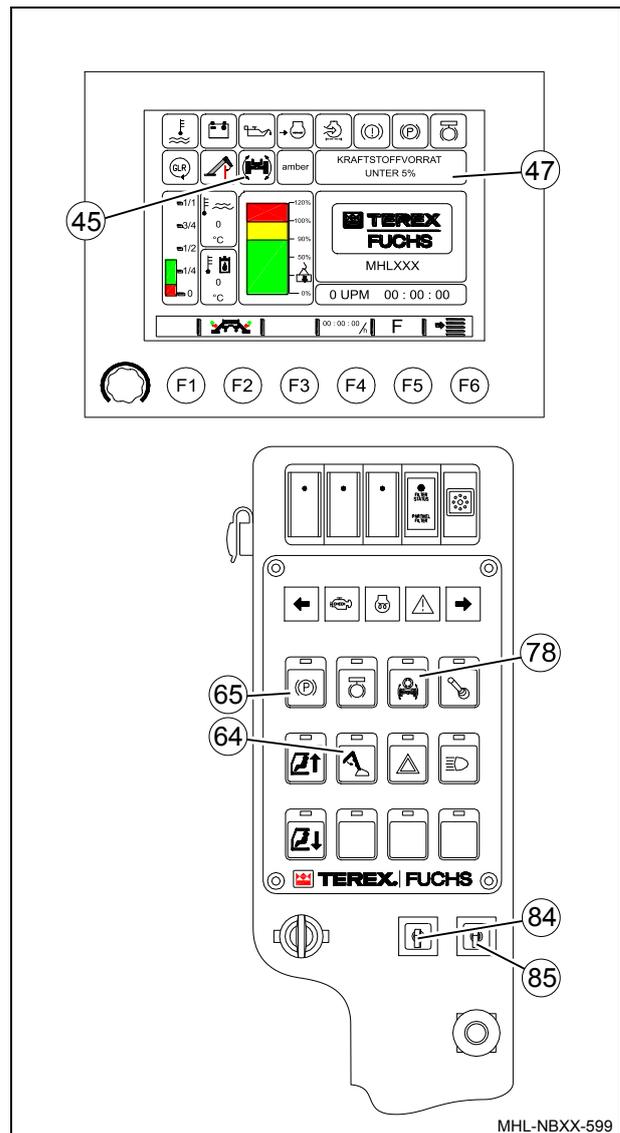


Fig. 133 Oscillating axle unlocking

5.1.9 Key switches (optional)

The machine can be equipped with two key switches (133/84) and (133/85) as optional extras.

5.1.9.1 Black key switch

Black key switch (133/84) ⇒ deactivate overload warning device/overload cut-off

The overload cut-off with warning function sends an audible and visible alert whenever the machine’s load approaches the permissible maximum load due to a load having been taken up. When the permissible load is exceeded, the load-increasing work functions (raise/lower boom and extend dipperstick) are disabled. The overload warning and cut-off functions can be completely deactivated using the key switch (133/84)!

5.1.9.2 Blue key switch

Blue key switch (133/85) ⇒ reduce hydraulic oil pressure or enable work movements with the diesel engine stopped

As an option (for the Italian market, for example), the machine may be equipped with a device that prevents work movements being carried out when the diesel engine is stopped. When using this option, in order to lower the load or reduce any oil pressure that may be present in the hydraulic system when the diesel engine is stopped, the key switch (133/85) must be set to position I by an authorized person. The operator can then lower the load by lowering the boom or retracting the dipperstick, or can reduce the oil pressure in the hydraulic system by triggering another work movement. In the case of machines which are equipped with a dead man’s button in the left-hand four-way control lever, the dead man’s button must also be pressed.

| | |
|--|---|
|  WARNING | |
|  | Danger of injury due to machine toppling over |
| | The cut-off function does not offer complete protection against the generation of critical load torques that exceed the stability of the machine. Depending on the foundation on which the machine is supported, the dynamic forces during the movement of large loads at high speeds, and the resulting swinging out of the grab and load, the machine may be overloaded beyond its stability, even with overload cut-off active! In an emergency: Administer first aid, seek treatment from a doctor |

5.1.10 Close range cut-off (dipperstick)

When the dipperstick is moved (retracted) in the direction of the cab, the grab or the load that has been taken up may collide with the cab due to driver error.

To reduce the risk of collision, the range of motion of the dipperstick in the direction of the cab is restricted by an electrical close range cut-off function.

When the close range limit is reached, an inductive proximity switch on the dipperstick joint triggers disabling of the dipperstick.

The close range cut-off function is not a safety device! It is only intended as an aid for the operator!

For all parts of the loading equipment, including load, a minimum safety distance of 1.5 m from the cab must be observed.

WARNING



Danger of injury due to collisions

Collisions may arise due to:

- (load hook, grab, etc.) or because of differences in dimensions in work attachments when they are open as opposed to closed.
- due to overhead load.
- because of a delay in the shut-off.

Depending on the oil temperature and equipment configuration, the cut-off path can be extended by up to 0.5 m, and depending on the retracting speed and grab content by up to 1.0 m.

- A minimum safety distance of 1.5 m from the cab must be observed.
- Risk of damage! Avoid rapid motions of the dipperstick if you are moving it close to the cut-off points.

In an emergency: Administer first aid, seek treatment from a doctor

Deactivating the close range cut-off function

During normal operation, i.e., while the close range cut-off function is active, the indicator (134/44.1) "Close range cut-off function active" appears on an orange-colored background as soon as the movement of the dipperstick toward the cab has been switched off.

If the dipperstick needs to be extended toward the cab beyond the cut-off point, the close range cut-off function can be deactivated with the pushbutton (134/64). The indicator lamp (134/64) is lit for as long as the close-range cut-off function is deactivated. In addition, the indicator (134/44.2) will appear on a red background when the dipperstick is moved in close range or will flash on a red background when the dipperstick is moved in the safe working area.

⚠ WARNING

Danger of injury due to collisions

When the close-range cut-off function is deactivated, there is a danger that the work attachment could enter the direct vicinity of the cab. Exercise extreme caution when working in the direct vicinity of the cab. There is an increased risk of accidents:

- due to a work attachment (load hook, grab, etc.) swinging or because of differences in the dimensions of work attachments when they are open as opposed to closed.
- due to overhead load.

- **A minimum safety distance of 1.5 m from the cab must be observed.**

In an emergency: Administer first aid, seek treatment from a doctor

The close-range cut-off function is always activated automatically when the ignition is switched on.

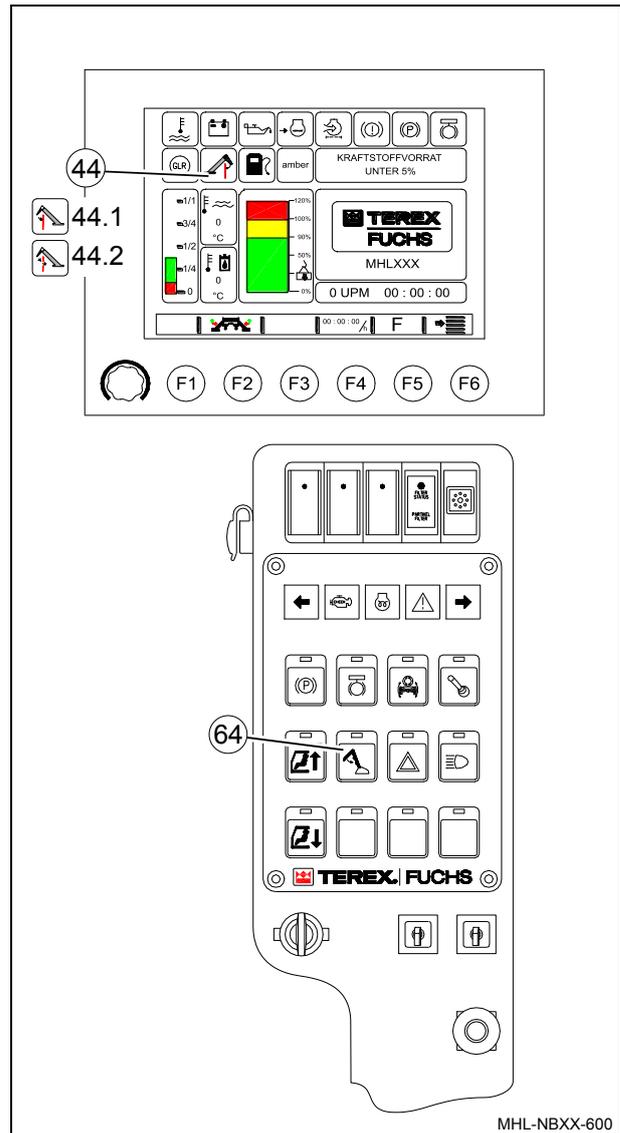


Fig. 134 Deactivating the close range cut-off function

5.1.11 Range limit deactivation (dipperstick) (optional)

As an option, the machine can be equipped with a function to limit the "Extend dipperstick" movement. Cut-off is triggered by an inductive proximity switch on the dipperstick joint.

In the multifunction display, the indicator (135/44.1) appears on an orange-colored background whenever dipperstick movement is switched off.

Deactivating the range limit

The range limit can be deactivated in the function menu using the switch (136/115). When the cut-off function is deactivated, the switch is displayed inside a red border.

On the main control display, the indicator (135/44.2) will appear flashing on a red background when the dipperstick is in the limited, permissible area. The indicator will appear constant on a red background when the dipperstick is outside the limits in the impermissible area.

Range limitation is always activated automatically when the ignition is switched on.

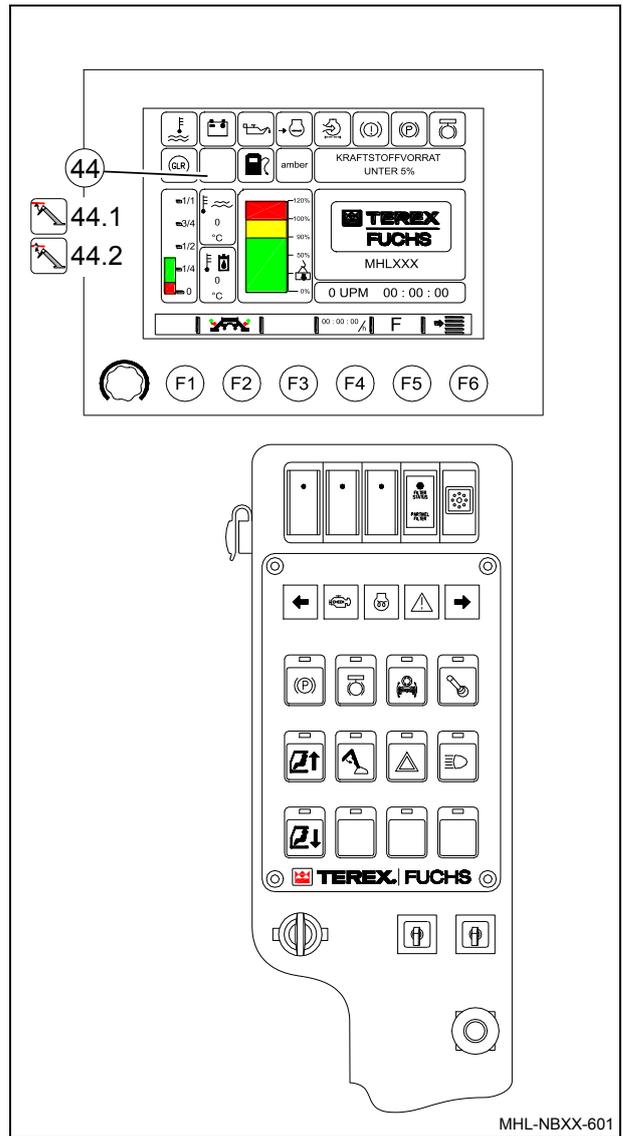


Fig. 135 Deactivating the range limit

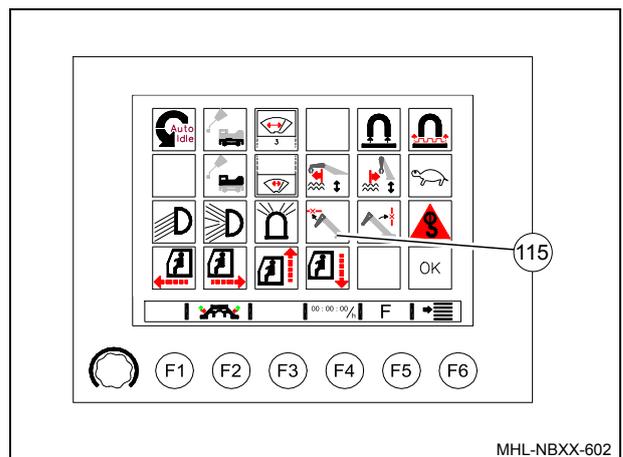


Fig. 136 Function menu

5.1.12 Height adjustment (boom) (optional)

As an option, the machine can be equipped with a function to limit the "Raise boom" movement. Cut-off is triggered by an inductive proximity switch on the boom joint.

In the multifunction display, the indicator (137/36.1) appears on an orange-colored background when the boom movement is switched off.

Deactivating height limitation

Height limitation can be deactivated in the function menu using the switch (138/116). When the cut-off function is deactivated, the switch is displayed inside a red border.

In the main control display, the indicator (137/36.2) will appear flashing on a red background when the boom is in the limited, permissible area. The indicator will appear constant on a red background when the boom is outside the limits in the impermissible area.

Boom height limitation is always activated automatically when the ignition is switched on.

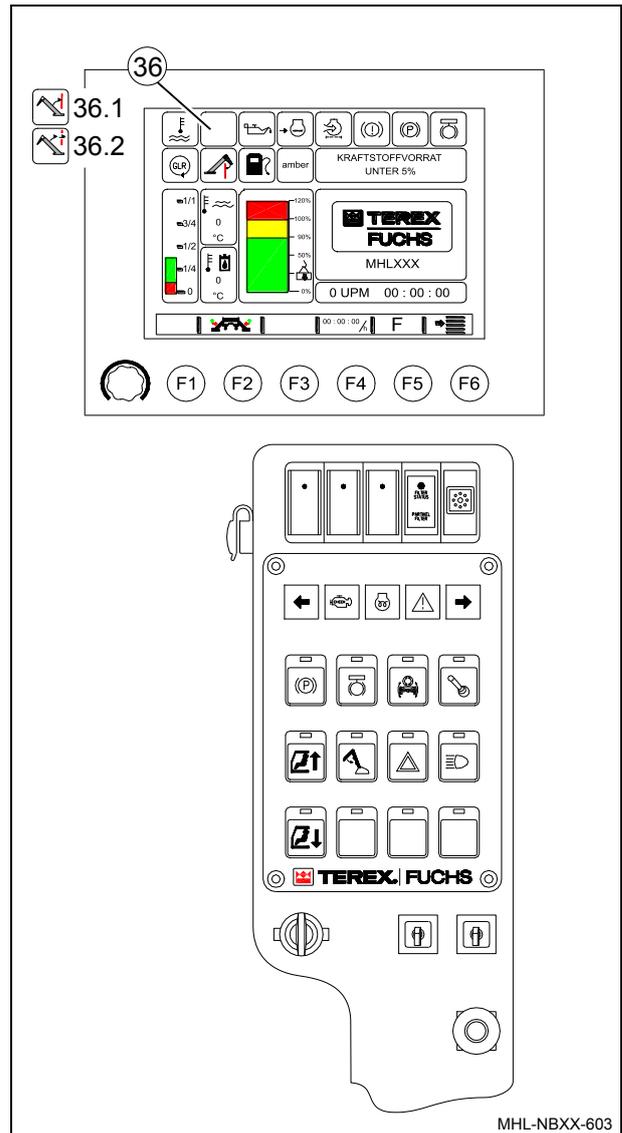


Fig. 137 Deactivating height limitation

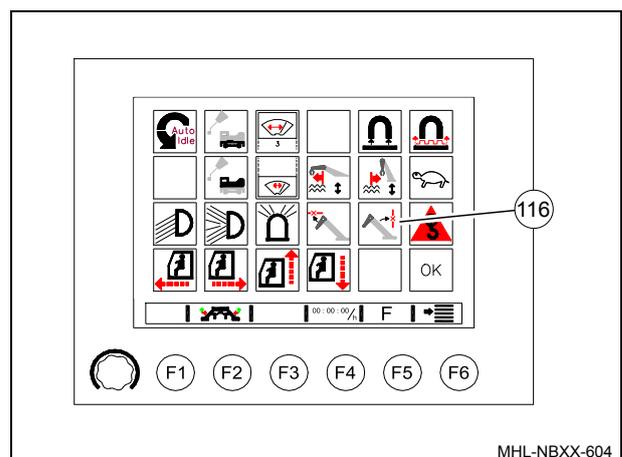


Fig. 138 Function menu

5.1.13 Boom float function (optional)

The "Boom float function" option requires the use of hose rupture safety valves on the lift cylinders.

The float function assists the machine operator when goods are being unloaded from ships.

When the load is being taken up, unintentional contact can occur between the grab tips and the ship's floor due to the closing movement of the grab. This can damage the ship's floor. Additionally, the grab tines are limited in their movement. The closing process is delayed, the work cycles take more time and the transfer capacity drops.

The solution to this problem is provided by a float function, which separates the grab from the floor during closing by automatically lifting the boom.

The function principle is based on the measurement of the ground-based oil pressure in the lift cylinders. When the grab closes, the tips of the tines support themselves on the ship's floor. In doing so, the lift cylinders are relieved at the base and the pressure decreases.

When a defined lower pressure threshold is reached, the "Raise boom" function will be executed automatically. (The "Lower boom" movement with control lever is disabled.)

As soon as the oil pressure in the lift cylinders reaches a preset upper threshold, the automatic lifting motion will be disabled again and the "Lower boom" work function will be enabled.

This will automatically keep the grab "floating" above the surface (for example, above the ship's floor).

To optimize the float function when working in **close range** (boom steep, dipperstick retracted) or when working in **remote range** (boom flat, dipperstick extended), two different value pairs are available for the lower pressure threshold ("ON pressure") and the upper threshold ("OFF pressure"). These threshold values can be set in the service menu.

Operation of the float function

The float function can be activated in the function menu via one of the two switches **"Float function - remote area ON/OFF"** (140/109) or **"Float function - close range ON/OFF"** (140/110).

In the main control display, the various symbols indicating that the float function for remote range or for close range is turned on will appear on a green background (139/36).

However, the function is not "properly" active at this point. The function is only made ready for operation when the operator holds down the foot button (139/14) attached to the cab floor with their left heel. The status "Float function ready" is identified by the symbol (139/36) flashing on a green background.

As soon as the lower pressure threshold is undershot, the **"Active phase"** begins, i.e., the boom is lifted automatically until the upper pressure threshold is reached. The symbol (139/36) is displayed on a yellow background (not flashing) during the active phase.

ATTENTION

The float function is activated only when the foot button (139/14) is pressed and the corresponding symbol (139/36) is shown flashing on a green background.

There is also a user-friendly option for switching between remote and close range by pressing the button (139/1) on the right-hand four-way control lever.

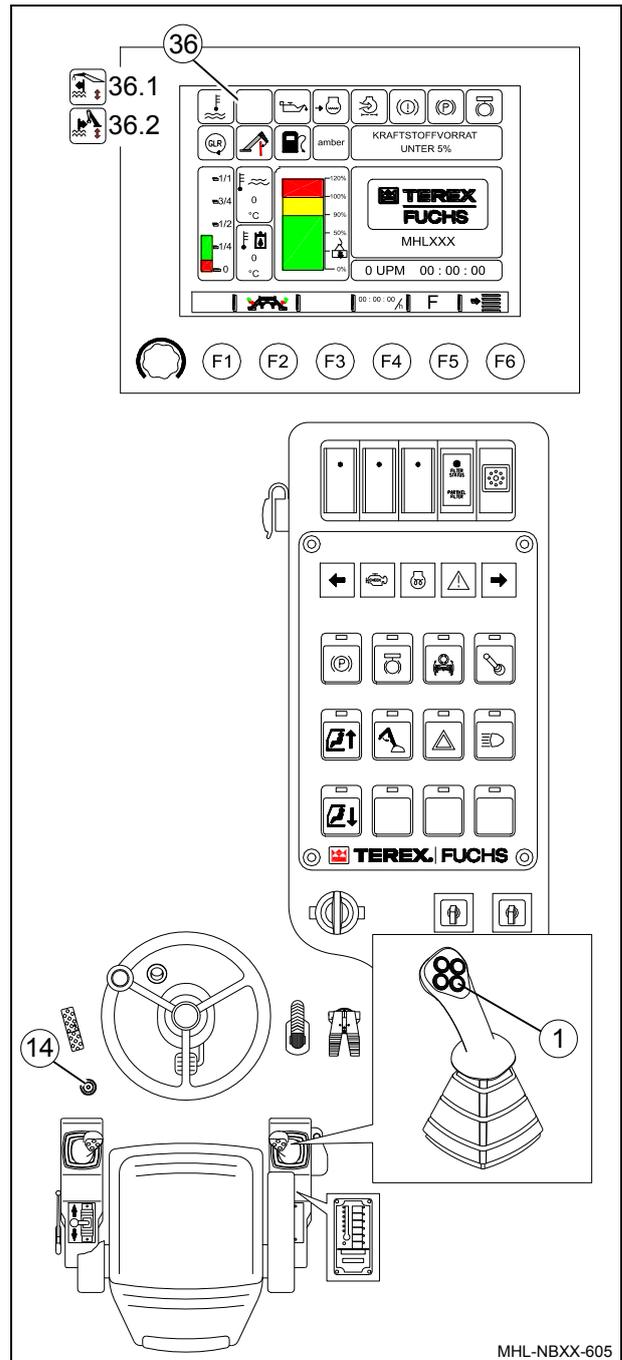


Fig. 139 Boom float function

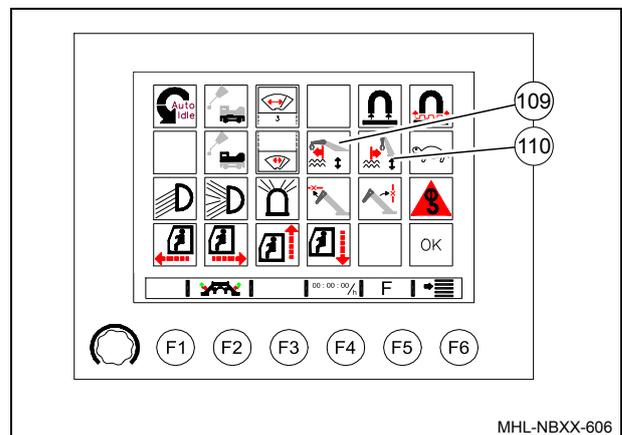


Fig. 140 Function menu

5.1.14 Overload warning device for hoisting (optional)

⚠ WARNING

Danger of injury due to machine toppling over

The overload warning device is only an aid. The following applies for its use:

- Loading machine is on firm ground and is evenly supported.
- Move loads at low speed!
- Reduce load immediately in the event of warning!
- Changing the calibration is prohibited!

In an emergency: Administer first aid, seek treatment from a doctor

Warning without cut-off

In the main control display, a bar (141/51) of varying height and color visualizes the load applied to the loading equipment. Depending on the situation, the warning buzzer may also sound and text may be output.

| Symbol | Value* | Actions |
|--------|----------------|--|
| | Up to 90% | Color (1): green. No text output. |
| | 90% and above | Color (1): yellow: After a short time the warning buzzer sounds, text output: "!!! OVERLOAD !!!" |
| | 100% and above | Color (1): red. Warning buzzer sounds immediately, text output: "!!! OVERLOAD !!!" |

* 100% corresponds to approximately 75% of the static tipping load

Activation/deactivation

- ▶ Move blackkey switch (141/84) to the desired position.

Overload warning device activated.

The key can be removed. The symbol (141/51) appears.

Overload warning device deactivated.

The key can no longer be removed. The symbol (141/51) does not appear, no acoustic/optical warning!

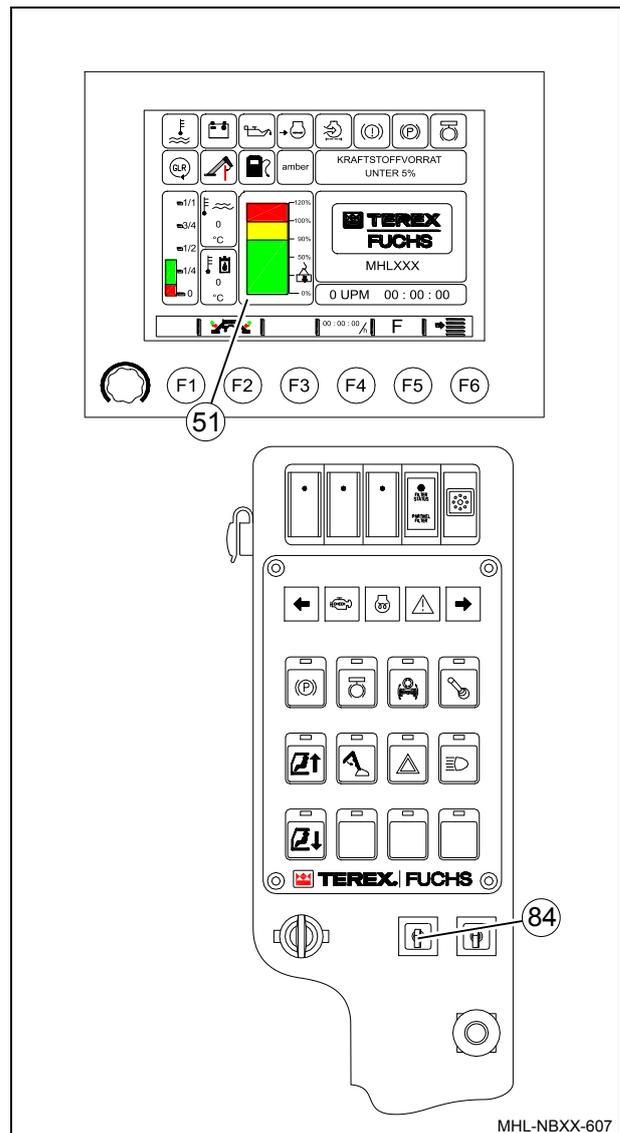


Figure 141 Overload warning device

The function of the overload warning device is checked as follows:

- ▶ connect any load as listed in the table of carrying capacity, but with the smallest possible reach;
 - ▶ lift the load approx. 30 cm off the ground;
 - ▶ increase the reach, always keeping the load close to the ground, until the warning signal sounds on reaching the limit condition;
 - ▶ check to make certain the achieved reach tallies with the value listed in the table of carrying capacity for the corresponding load in this test run. If it does not, abort the check and have the machine restored to correct and proper operation by a specialist workshop.
- i** For overload cut-off special equipment, see supplementary operating instructions.

5.2 Swinging and loading operations

⚠ DANGER

Danger of injury due to overturning loading machine

- The values in the carrying capacity tables must be strictly observed and must not be exceeded.

In an emergency: Administer first aid, seek treatment from a doctor.

Compliance with the following points is essential:

Machine with outriggers up.

- The ground taken by the route must be level and solid and have sufficient carrying capacity.
- The uppercarriage must be positioned longitudinal to the undercarriage (forward or backward); maximum permissible deviation 5°.
- Turning the uppercarriage with outriggers up and with loads is prohibited.
- The uppercarriage must be secured against rotation (swing brake (142/66) locked).
- Recommendation: only travel via the steering axle
- Observe the position of the undercarriage to the uppercarriage in relation to the steering and directional control (accelerator pedal).
- Lock the oscillating axle cylinder during traversing with boom via the oscillating axle.
- The values indicated in the tables of carrying capacity for "not supported, longitudinal" are downtime values. During traversing of the machine, the carrying capacity values must not exceed 60% of the "not supported, longitudinal" values stated in the table.
- Secure the loads against swinging out.
- When traveling with loads, the maximum permissible speed is 5 km/h (walking speed).
- The "traversing" position represented in Fig. 143 provides the operator with optimum visibility during the traversing of the machine.

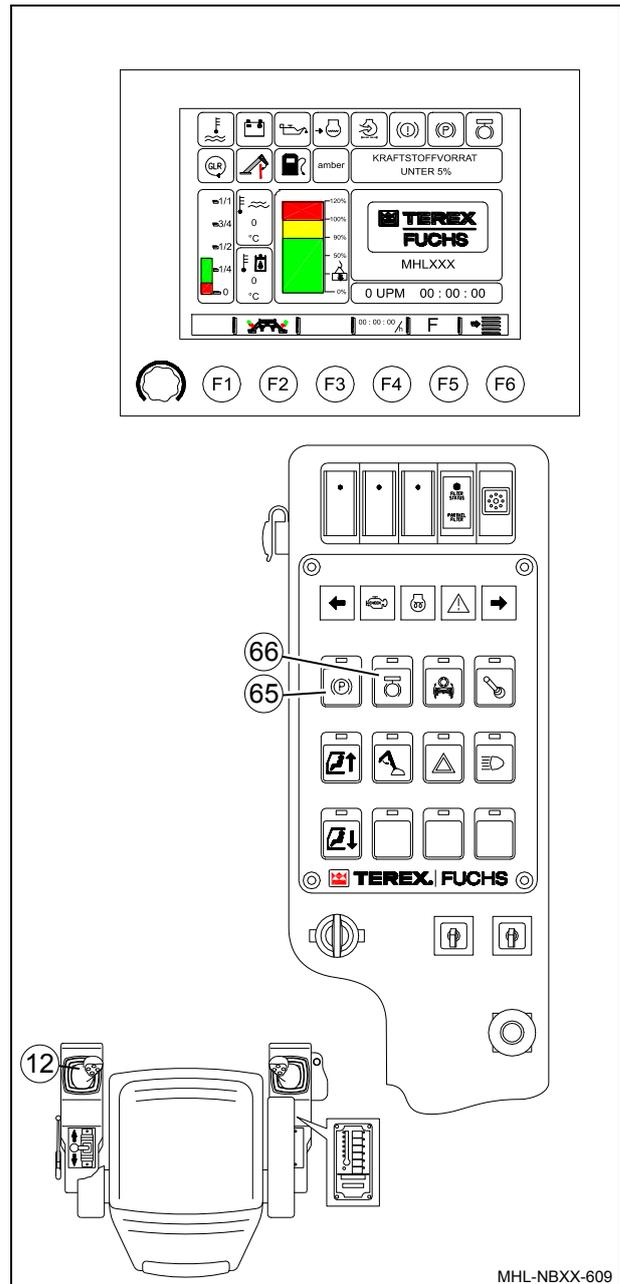


Fig. 142 Swinging and loading operations

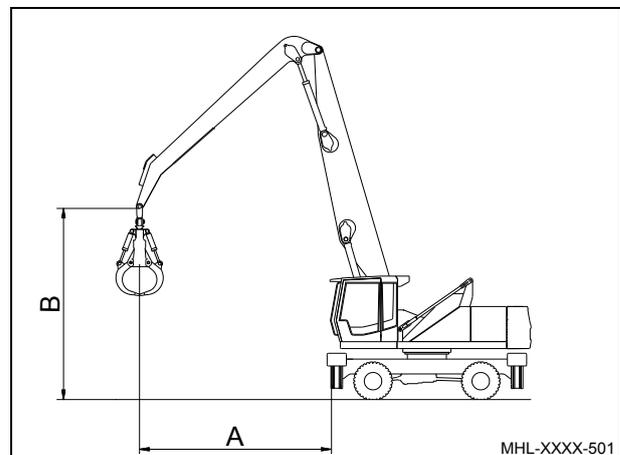


Fig. 143 Traversing position

A: 5.1 m

B: 4.5 m

- When traveling with loads, consider how this might change the response of the machine: (reduced stability due to dynamic loads, avoid sudden changes in speed and direction).
- When the machine is at a standstill, the parking brake (142/65) must be applied. When the parking brake is applied, the oscillating axle is automatically locked.

Machine with outriggers down

- During working operation, the 4-point outrigger must be set down firmly on "even" ground so that the wheels no longer touch the ground. This must also be monitored continuously during operation, and the support cylinders must be readjusted if necessary.
-  The 4-point outrigger must be retracted completely prior to traversing (risk of accident).
- This must also be monitored continuously during operation, and the support cylinders must be readjusted if necessary.

General notes

- Released while the uppercarriage is slewing, the left-hand four-way control lever (142/12) automatically goes to neutral position, and the uppercarriage is "smoothly" braked. The uppercarriage may also be braked by countering, i.e. steering in the opposite direction of slewing.
- The uppercarriage can be kept in a certain position by pressing the pushbutton (142/66), for example for transport on a flat bed trailer or when driving. **The swing brake (142/66) must not be used to brake the uppercarriage.**
- Do not level the ground in front of the loading machine with the loading equipment by slewing the uppercarriage to and fro.
- Do not push, knock or beat with the grab.
- Consider the hoses when lowering the grab into a shaft.
- Do not pull loads with the swing assembly.
- Do not swing the uppercarriage so fast that the load is pulled strongly outwards due to centrifugal force and swings during braking.
- Do not brake the slewing motion of the machine by dropping the loading equipment.
- When slewing, ensure that there is sufficient all-round carrying capacity.
- **No one except the operator may remain on the machine or in the danger zone during operation.**
- Never force the operating levers.

5.3 Hoisting (optional)

5.3.1 General

Hoisting involves the lifting, transporting, and lowering of loads with the aid of a fixing device (rope, chain, etc.), where personnel are needed to assist with attaching and releasing the load.

Loading machines MHL380 D are only to be used for hoisting if the safety equipment prescribed by national law is present and in full working order.

 Chapter 2.2.10 Hoisting (optional)

5.3.2 Safety rules

| |
|--|
| <p>▲ DANGER</p> <p>Risk of fatal injuries from oscillating or falling loads as well as moving and tilting loading machines</p> |
|--|

- **Do not stand under suspended loads.**
- National provisions and accident prevention regulations are to be observed.
- The overload warning device is to be activated. Its display on the multifunction display provides guidance on how the load to be moved will affect the stability of the loading machine.
- The values of the carrying capacity table are to be complied with. The carrying capacity table is contained in these operating instructions.
- A load hook should be used as hoisting equipment. Its permitted carrying capacity must be observed.
- The loading machine is to stand on firm ground and is to be evenly supported. ▲ Be aware of risk of injury from moving outrigger!
- The travel drive is to be blocked by the parking brake and therefore secured against accidental operation.
- Machine operators and personnel attaching the loads must be instructed in the activity of hoisting and authorized to do this.

- Personnel attaching the loads must be clearly visible (with high visibility vests), must be wearing personal protective equipment and may only be in areas directly visible to the machine operator. The area of movement of the personnel attaching the loads must be free from obstructions and must allow secure footing.
- Prior to beginning work, the personnel attaching the loads are to be informed of the range of movements and the risks of dangers from the loading machine. Clear signals are to be agreed upon by the machine operators and the personnel attaching the loads. These signals are to be given to the machine operator by only one of the attaching personnel, appointed in advance by the operator. Before the person attaching the load gives a signal, all staff must leave the danger zone and remain directly visible to the machine operator.
- Personnel attaching loads may only approach the loading equipment from the cab side once they have the approval of the machine operator, because this side offers the best visibility to the machine operator.

The machine operator should only grant his approval if the loading equipment is stationary and in a favorable position for the person attaching the load. The four-way control levers may not be activated if the personnel attaching the loads are in the danger zone.
- Loads are to be attached in such a way that they cannot slip or fall out. ▲ Do not use damaged or inadequately dimensioned load-bearing media (ropes, chains, etc.)! ▲ Always wear a helmet and protective goggles, gloves, and boots when working with the load-bearing media.
- The machine operator must guide the load slowly and as close to the ground as possible, while preventing it from swinging back and forth. If necessary, the load must be secured against swinging out.

5.4 Magnet system (optional)

A magnet system can be used to operate special equipment, for example magnets for handling scrap metal.

5.4.1 Operation of magnet system

ATTENTION

The magnet system should only be switched on after the magnetic plate has been attached.

- ▶ In the "Speed and FINE MODE" menu, set the speed of the diesel engine to full throttle by turning the multifunction button (144/21) clockwise. Insufficient speed results in the generator not being ready for operation. LED 6 (see Fig. 145) in the control device for the magnet system (144/22) lights up.

Normal operation of the magnet system (used for loading):

- ▶ The magnet system is activated in the function menu using the switch (144/104).
- ▶ Move the magnetic plate to the material to be picked up.
- ▶ Activate the magnet using the pushbutton (144/1) on the left-hand four-way control lever. LED 2 (see Fig. 145) in the magnet system (144/22) control device is lit up.

In order to achieve optimum take-up of material with the magnetic plate, do not magnetize the plate by pressing the pushbutton (144/1) on the left-hand four-way control lever until immediately before positioning the magnet on the material to be picked up. Lift the magnetic plate up out of the material after max. 5 seconds

- ▶ Withdraw the magnetic plate with the material attached.
- ▶ To drop the material, deactivate the magnet with the pushbutton (144/1). LED 3 (see Fig. 145) in the magnet system control device (144/22) lights up briefly.

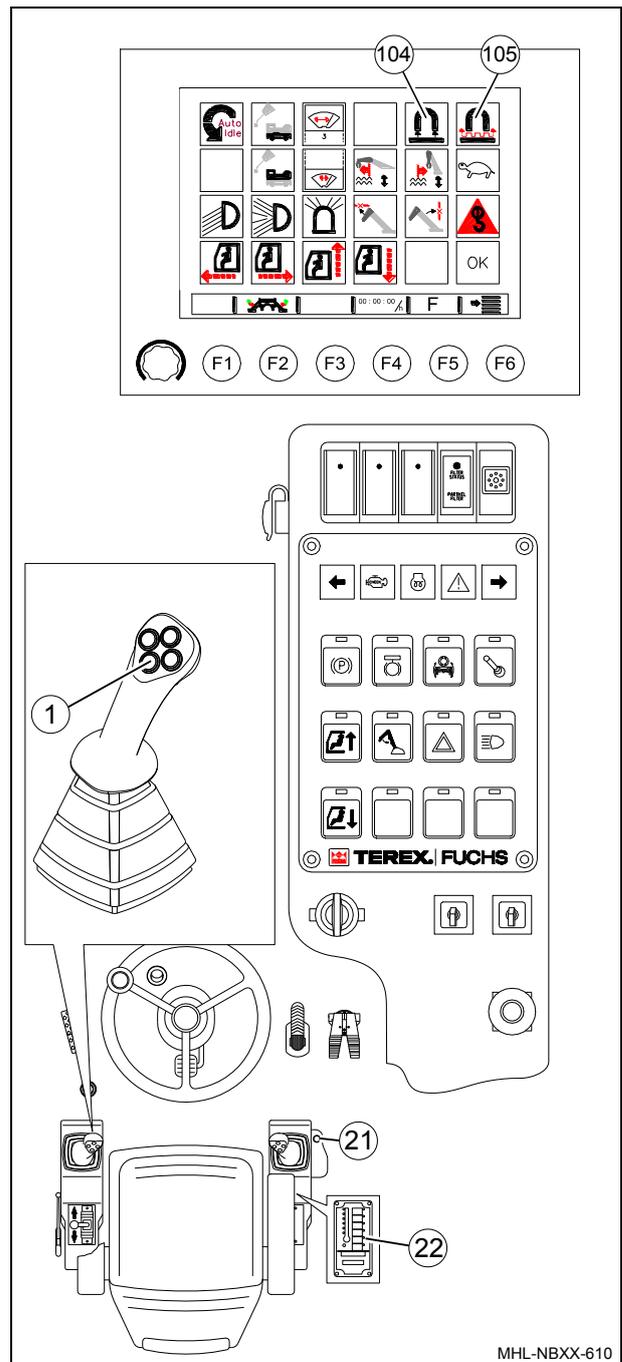


Fig. 144 Magnet system

Magnet system jog mode (used for sorting):

- ▶ In addition to the switched-on magnet system in the function menu, activate the "Jog mode" by using switch (144/105).
- ▶ Press and hold down the pushbutton (144/1) on the left-hand four-way control lever → material is taken up.
- ▶ Release the pushbutton (144/1) on the left-hand four-way control lever → material drops slowly.

| ⚠ CAUTION | |
|---|--|
|  | <p>Danger of injury due to falling material</p> <ul style="list-style-type: none"> • Jog mode can only be used for sorting material and must not be used for loading. • Jog mode must only be used at low working heights! <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

To avoid generator overload, the maximum permissible output of the magnetic plate must not be exceeded in accordance with the following table and depending on the generator system that is installed.

| Output of the generator system installed | Max. permissible output of magnetic plate |
|---|--|
| 30 kW | 20 kW * |

* Magnetic plates with a lower power consumption can be used at any time.

5.4.1.1 Magnet system control device (MMI – Man Machine Interface)

LED 1: Supply voltage present for magnet system control device – green status indicator

The system is switched on and ready for operation, the generator is running.

LED 2: Magnetic plate switched on for "Lift" – yellow status indicator

This LED remains lit as long as the magnetic plate is switched on. When the magnet plate is switched off, i.e. when the load is dropped, this LED goes out.

| ATTENTION |
|--|
| <p><i>If, after switching on the magnetic plate, this LED only lights up for approx. 1 second and then goes out automatically, the magnetic plate's connecting cable is not plugged in or has been broken.</i></p> |

LED 3: Quick demagnetization of the magnetic plate "Drop" – yellow status indicator

This LED is lit during automatic quick demagnetization. The LED goes out as soon as quick demagnetization is completely finished.

This LED also goes out if quick demagnetization is interrupted. In this case there might be some residual magnetization on the magnetic plate for a certain time as natural demagnetization is a considerably slower process.

LED 4: Interruption / Interface error – red error indicator

LED lit: Interruption

This LED lights up if the magnetic plate's connecting cable is not plugged in or has been broken. After power-up, a check is made to see whether current is being supplied to the magnetic plate. If there is no current, the magnetic plate is switched off again after approximately 1 second and this LED lights up.

It will go out if the error is corrected before the system is switched on again.

LED flashing: Interface error:

This LED flashes if there is an error on the communication interface between the magnet system's control device and the control system.

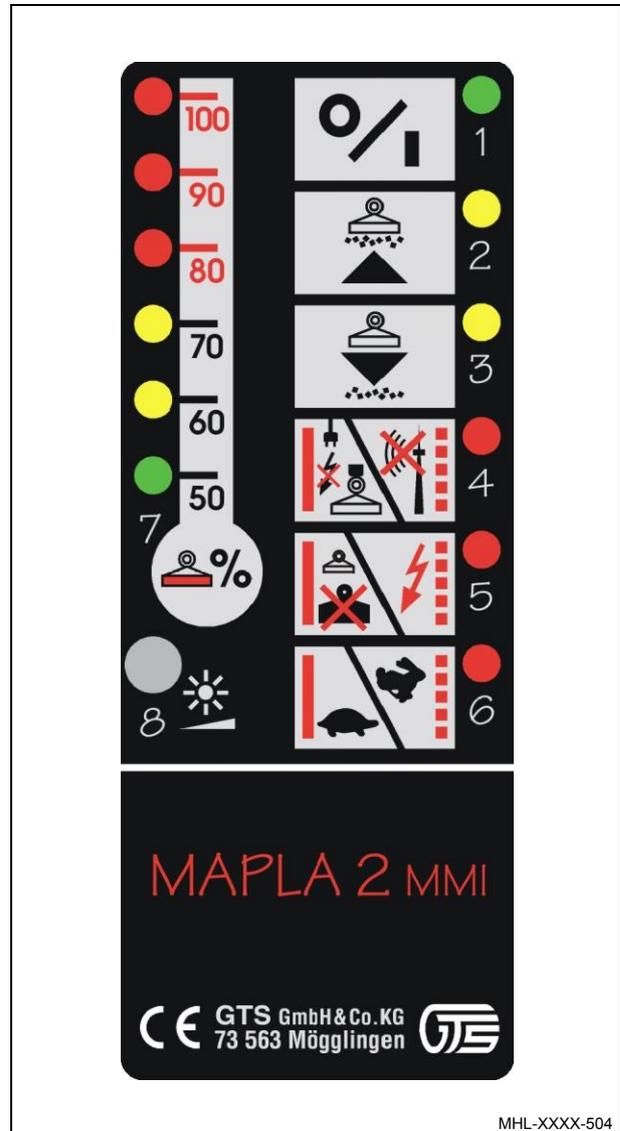


Fig. 145 Magnet system control device

LED 5: Overload / Short circuit – red error indicator

LED lit: Overload

This LED lights up if the magnetic plate connected is too large for the MAPLA system. As a result, the system is overloaded.

It remains lit even after the system is switched on again and will not go out until the magnet plate is switched off again and the system no longer detects an overload.

LED flashing: Short circuit

The LED flashes if the magnetic plate's connecting cable has a short circuit. In this case the output to the magnetic plate is switched off immediately. The LED does not go out until the system is RESET. It cannot be switched back on until a RESET has been performed.

LED 6: Insufficient speed / Excessive speed – red error indicator

LED lit: Insufficient speed

This LED lights up to indicate that the speed of the generator is insufficient and there is a possibility that full power will no longer be output. If this LED is lit there will be no "quick demagnetization" with pulse excitation when the magnetic plate is switched on. The LED goes out automatically as soon as the speed returns to within the tolerance limits.

LED flashing: Excess speed

This LED flashes to indicate that the speed of the generator is too high. If the LED flashes, the system cannot be switched on again after dropping the load. The LED goes out automatically as soon as the speed returns to within the tolerance limits.

LEDs 7: Relative operating time of the magnetic plate (50% green, 60% and 70% yellow, 80% – 100% red) – multicolored status indicator

The relative operating time of the magnetic plate is the ratio between ON time and OFF time. For instance, an ON time of 1 minute and a subsequent OFF time of 1 minute correspond to a relative ON time of 50%.

This display shows the relative ON time of the magnetic plate as a percentage. Values below 50% are not shown. At a value of 100%, the magnetic plate will **not** be prevented from being turned on again.

| ATTENTION | |
|---|---|
|  | <p><i>At 100% ON time, there is a reduction in output and under some circumstances the magnetic plate might heat up beyond permissible limits.</i></p> <p><i>To protect the magnetic plate, 80% of the relative ON time should not be exceeded.</i></p> |

5.4.1.2 Malfunctions in the magnet system

If malfunctions occur in the magnet system, write down the operating status on the display diodes of the magnet system control device and contact Customer Service with this information.

|  CAUTION | |
|--|--|
|  | <p>Danger of injury due to falling material</p> <ul style="list-style-type: none">• The load must be set down immediately and work with the magnet system must be aborted. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

 See Chapter 8 "Malfunction" for details of how to proceed.

6 Recovery, loading, and transport..... 6.1

- 6.1 Towing the machine 6.1
- 6.2 Recovery of the machine..... 6.4
- 6.3 Safety requirements for loading with a crane 6.4
- 6.4 Flat bed trailer loading..... 6.6

6 Recovery, loading, and transport

6.1 Towing the machine

The loading machine may only be towed in exceptional circumstances, for example to move the machine away from a dangerous location for repairs. Damage and accidents that occur when towing the machine do not fall under the warranty obligation of the manufacturer.

Rods that are used for towing must have sufficient tensile strength and be fastened to the towing lug (146/1) provided for this purpose at the front or back of the undercarriage.

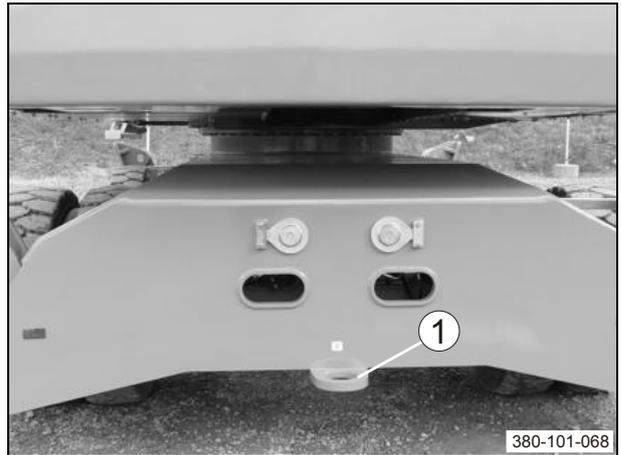


Fig. 146 Towing lug

| ATTENTION |
|---|
| <i>The towing lugs have a maximum bearing pressure of 250 kN.</i> |

| CAUTION | |
|--|---|
|  | <p>Danger of injury due to uncontrollable machine</p> <p>The following values must not be exceeded when towing:</p> <ul style="list-style-type: none"> • Towing speed: max. 5 km/h • Towing distance: max. 10 km • With the diesel engine turned off and the parking brake released, all machine brakes are out of operation and the steering is not ready for operation. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

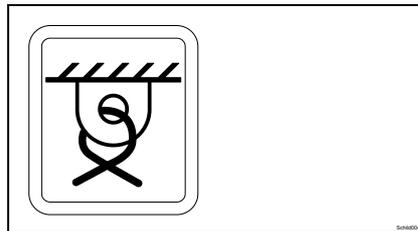


Fig 147 Symbol

| WARNING | |
|---|--|
|  | <p>Danger of injury due to machine rolling away</p> <ul style="list-style-type: none"> • Before work on the parking brake or underneath the machine in general commences the machine must be secured with chocks so that it cannot roll away. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

Before the loading machine can be towed, the parking brake must be released and the two propshafts must be decoupled and tied up on the axle sides.

Disengaging the parking brake:

- ▶ Remove the screw cap (148/1).
- ▶ Loosen the lock nut (148/3).
- ▶ Unscrew the set screw (148/2) to release the brake disk.
- ▶ Screw on the screw cap (148/1) by a few thread turns to prevent contamination.

Decoupling the propshafts:

⚠ WARNING



Risk of injury from falling propshafts

- Prior to loosening the screws, the propshafts must be safeguarded against falling

In an emergency: Administer first aid, seek treatment from a doctor

- ▶ Loosen screws (149/1) and (150/1) at the flange. Secure the brake disk.

On completion of the towing procedure, the parking brake must be engaged and the propshafts installed.

Reengaging the parking brake:

- ▶ Start the diesel engine and release the parking brake.
- ▶ Remove the screw cap (148/1).
- ▶ Unscrew the lock nut (148/3) on the set screw (148/2).
- ▶ Turn the set screw (148/2) clockwise until the two brake lining carriers (151/4) make contact with the brake disk (151/5).
- ▶ Unscrew the set screw (148/2) by ½ turn and tighten the lock nut (148/3).
- ▶ Screw on the screw cap (148/1) hand-tight.

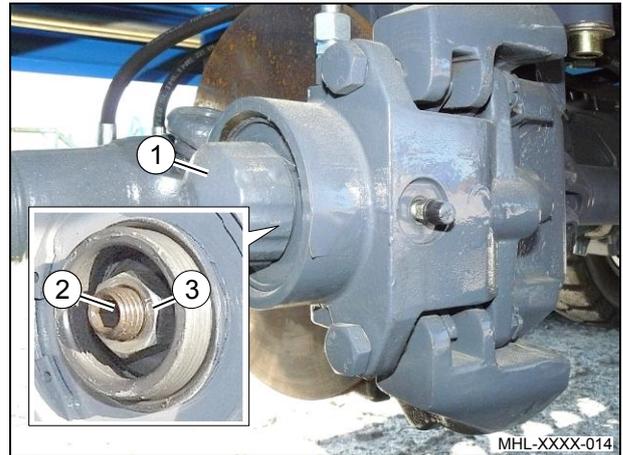


Fig. 148 Disengaging the parking brake

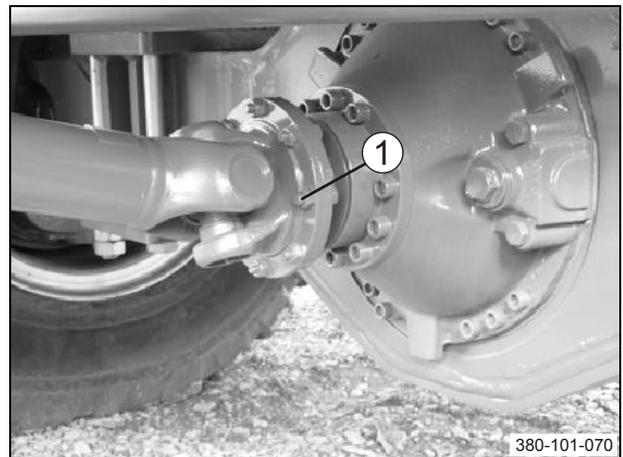


Fig. 149 Dismantling the front of the propshaft

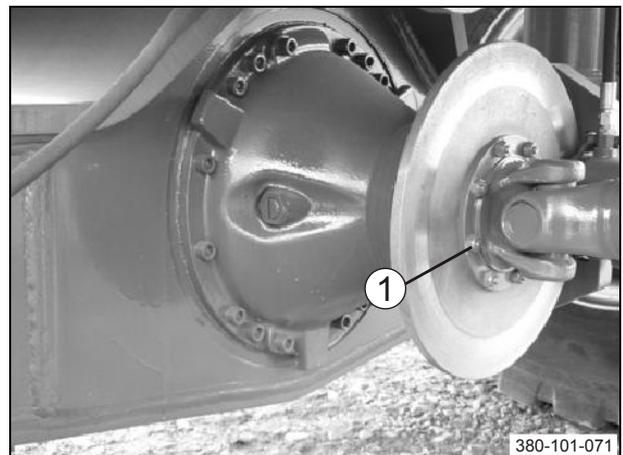


Fig. 150 Dismantling the rear of the propshaft

Installing the propshafts:

- ▶ Secure propshafts to the flange with the screws (149/1) and (150/1) and tighten the nuts. Torque: 120 Nm.

⚠ WARNING



Serious injury due to uncontrolled travel movements

In the event of damage to the diesel engine, the machine brakes and steering will not be operational during recovery.

- The machine may only be moved a few meters to move it out of a potentially dangerous area.
- Cordon off dangerous area. Ensure that unauthorized persons cannot remain in the dangerous area.

In an emergency: Secure the machine. Administer first aid, seek treatment from a doctor

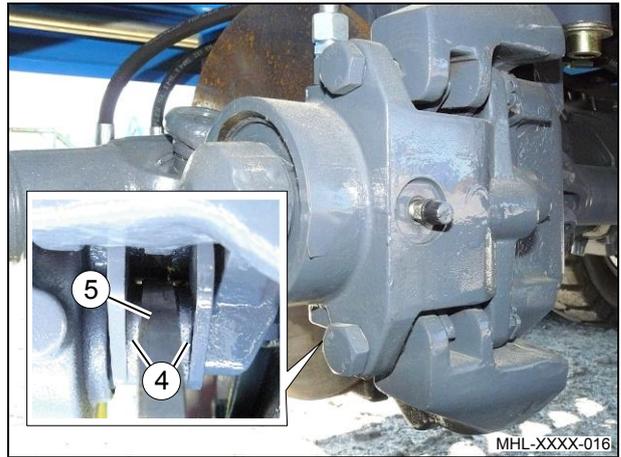


Fig. 151 Brake pads

6.2 Recovery of the machine

If the machine is stuck fast on difficult terrain, do not attempt to free it by rocking.

The machine can be pulled free with the aid of the loading equipment. In certain conditions, the work attachment must be removed.

If the machine cannot be freed using the loading equipment, it must be towed clear in the manner described.

Chapter 6.1 Towing the machine

If the machine needs to be recovered, for example because of a technical defect, it can only be lifted and loaded with a suitable crane in the manner described.

Chapter 6.3 Safety requirements for loading with a crane

6.3 Safety requirements for loading with a crane

| WARNING | |
|----------------|---|
| | Danger of injury due to machine toppling over |
| | <ul style="list-style-type: none"> • Pivot-mounted work attachments such as a grab or magnet must be removed before the machine is lifted. Potential swinging movements of the work attachment would otherwise make safe lifting impossible. |
| | In an emergency: Administer first aid, seek treatment from a doctor |

- ▶ Dismantle the supporting feet from the outriggers.
- ▶ Attach the hoisting device (152/1) with the pins (152/2) and the fastening elements (152/3). Set the outriggers (152/4) horizontally.
- ▶ The pins and fastening elements match the attachment of the outrigger feet.
- ▶ If required, the hoisting device may be obtained from TEREX | Fuchs.

- ▶ Rigging with a D-link (152/5) size 25 Form C DIN 82101 is recommended, as appropriate for the weight of the machine.
- ▶ Lower the loading equipment and tilt the dipperstick in as far as the stop. In this position, the load is distributed fairly evenly in relation to the lifting points.
- ▶ Move all operating levers to the neutral position and close the parking brake.
- ▶ Lock the swing brake and stop the diesel engine according to the operating instructions. Fold up the left armrest before leaving the operator's seat.
- ▶ Close all doors, covers, and hoods on the loading machine.
- ▶ Only experienced persons must be assigned the task of attaching loads and acting as guides for crane drivers. Guides must remain within the operator's range of vision or stay in voice contact.
- ▶ The minimum lifting capacity per rope must be 250 kN. For reasons of weight distribution, the four slinging ropes (152/6) must be at least 13 m in length. Alternatively, a sufficiently dimensioned lifting harness should be used.
- ▶ Lift the loading machine carefully with the crane.
- ▶ The ropes must be routed so that no damage is caused to the cab or lining.

| WARNING | |
|----------------|---|
| | Source and consequence |
| | <ul style="list-style-type: none"> • Do not stand underneath the loading machine once it has been lifted off the ground. |
| | In an emergency: Administer first aid, seek treatment from a doctor |

- ▶ When putting the machine back into operation, proceed solely in accordance with the operating instructions.

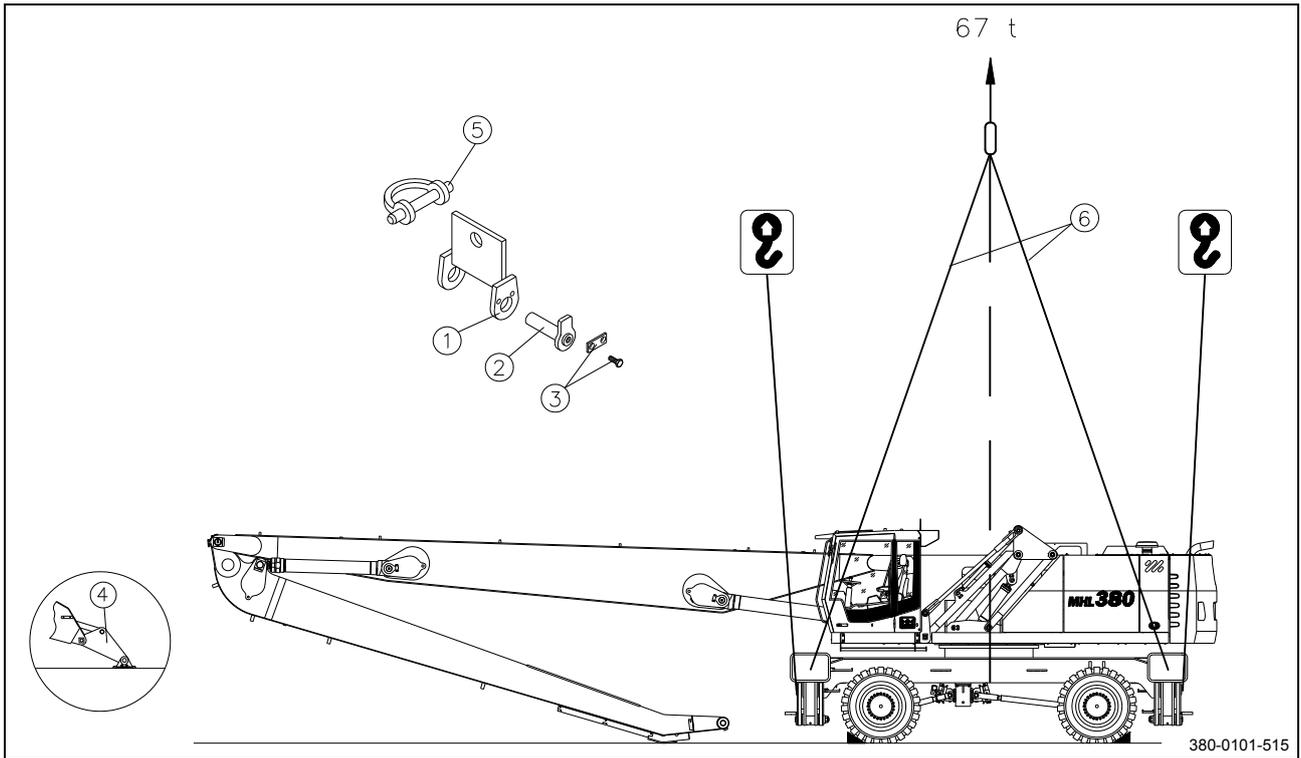


Fig. 152 Lifting the machine

6.4 Flat bed trailer loading

For transport on a flat bed trailer, the machine must be lashed in place so that it cannot move.

The machine is equipped with two lashing points on the undercarriage for this purpose (see Fig. 154).

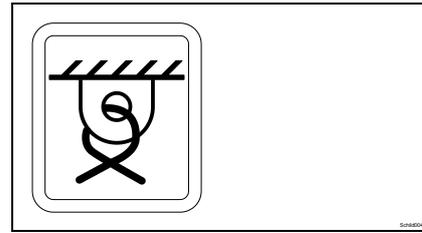
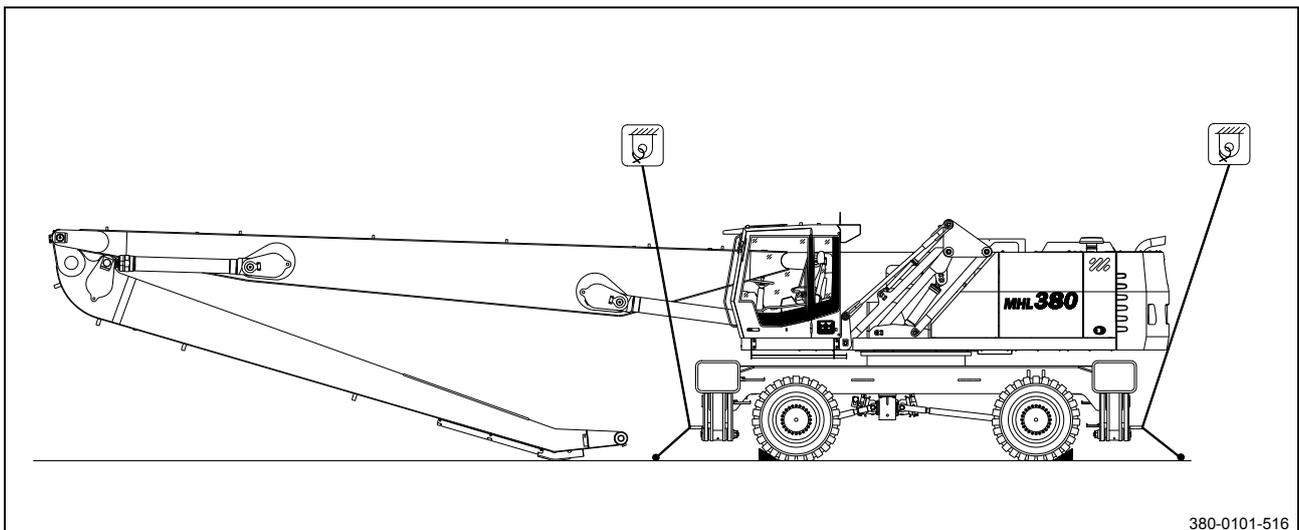


Fig. 153 Symbol

| ⚠ WARNING | |
|---|--|
|  | <p>Danger of injury due to machine toppling over</p> <ul style="list-style-type: none"> • The machine must not be lifted by these lashing points. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

- ▶ Use only suitable transport and lifting equipment with sufficient carrying capacity.
- ▶ Park the machine on flat ground and use chocks to secure the wheels.
- ▶ The gradient of the ramp for driving onto the flat bed trailer must not exceed 30°. Wooden planks must be placed on ramps to prevent slipping.
- ▶ Clean the undercarriage. The undercarriage must be swept clean. Before driving onto the ramp, any snow, ice and sludge must be cleaned off the wheels.
- ▶ Remove the chocks from the wheels.
- ▶ Line the machine up exactly with the loading ramp.
- ▶ **It is prohibited to turn the uppercarriage whilst the machine is on the transport vehicle.**
- ▶ Have a banksman give the machine operator the necessary signs.
- ▶ Swing in the loading equipment and drive onto the ramp. Always keep the loading equipment just above the loading surface. Drive onto the ramp very carefully and then onto the transport vehicle.

- ▶ Once the machine has been loaded onto the flat bed trailer, the uppercarriage must be secured against the undercarriage to prevent the uppercarriage from turning (swing brake engaged).
- ▶ Secure the machine and other piece parts against slipping with chains and chocks, in compliance with national requirements for loading and transport.
- ▶ Before leaving the machine, relieve all pressure lines of pressure (as described in the operating instructions), remove the ignition key and fold up the left armrest.
- ▶ Close all cab and paneling doors.
- ▶ Ensure no one is on the machine during transport.
- ▶ Before setting off, find out about the route to be taken, especially with regard to limits for width, height and weight.
- ▶ Pay close attention when driving under electrical lines and bridges or driving through tunnels.
- ▶ When unloading, proceed as cautiously as when loading.



380-0101-516

Fig. 154 Flat-bed trailer loading

| | | |
|----------|--|------------|
| 7 | Care and maintenance | 7.1 |
| 7.1 | General information | 7.1 |
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7 Care and maintenance

7.1 General information

The working order and service life of the machine are largely influenced by care and maintenance.

For this reason, it is in the interest of every machine owner to carry out the recommended maintenance work and comply with these maintenance instructions. This chapter of the operating instructions contains detailed information about periodic maintenance, inspection and lubrication tasks.

The type-specific maintenance and inspection plan contains a list of all jobs that must be carried out on the machine at regular intervals. All operating instructions contain maintenance and inspection plans.

During the warranty period, mandatory inspections must be carried out by trained specialist dealer personnel.

i Chapter 7.8.3 Maintenance and inspection plan

Inspection intervals

| Inspection intervals in operating hours | |
|---|----------------------------|
| 1. inspection | after 500 operating hours |
| 2. Inspection | after 1000 operating hours |
| 3. Inspection | after 1500 operating hours |
| Subsequently | every 500 operating hours |

ATTENTION

The obligation to have mandatory inspections carried out during the warranty period is binding. Such inspections incur charges.

The performance of the inspections as specified shall be confirmed on the inspection cards forming part of the warranty and handover documentation.

Noncompliance will restrict the scope of the warranty.

ATTENTION



The battery isolator switch of the machine is located in the service section of the engine compartment panel. The machine must not be switched off using the battery isolator switch whilst it is running, as this will damage the electrical system. Before working on the electrical system, the power supply must be disconnected via the battery isolator switch.

To avoid damage to the control device, the three plug connections on the engine controller as well as the positive cable of the battery must be disconnected before performing welding jobs on the machine! The positive cable of the battery must be connected to the adjacent grounding bolts. The battery isolator switch should be switched off.

⚠ WARNING



Serious injury due to sagging cab

- The cab may only be repaired while in the elevated position if the lift frame is adequately supported.

In an emergency: Administer first aid, seek treatment from a doctor

i Chapter 4.11.1 Before putting the machine into operation

⚠ CAUTION



Danger of injury due to uncontrolled machine movements, residual energies, unpredictable events

- During all maintenance and repair work, the necessary safety precautions must be observed.

In an emergency: Administer first aid, seek treatment from a doctor

i Safety and accident prevention chapter

⚠ WARNING

Danger of suffocation due to nitrogen

- Pressure accumulators are under hydraulic and gas pressure and must not be opened. They contain hydraulic fluid and nitrogen (risk of asphyxiation).
- Only trained specialist personnel are permitted to replace pressure accumulators and/or put them into operation. Do not touch a pressure accumulator unless it has cooled down.
- No changes may be made to the pressure accumulators (welding, drilling, forcing open, etc.).

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION


When changing fuels, lubricants and coolants (e.g. engine oil, lubricating oil, hydraulic fluid, fuel, etc.) care must be taken to ensure that these fluids do not seep into the ground. Suitable containers must be used to collect them. However, if they do seep into the ground, the leak must be stopped immediately and the fluid bound with suitable binding agents. If necessary, the soil affected must be removed. Binding agents and removed soil must be disposed of properly. The environmental standards currently valid must be observed.

7.2 Regular oil analyses

Rather than questioning the specified oil change intervals, oil analyses are designed to identify potential for reducing maintenance costs and detect imminent damage, as well as increase environmental awareness.

Advantages of an oil analysis

Extension of oil change intervals in the case of normal or light-duty operating conditions

- Minimum wear of high-quality components because of optimum utilization of fuels, lubricants and coolants
- Periodic lab analyses allow early recognition of imminent damage
- Early service/repair work protects equipment from serious and unforeseeable damage
- Consequential damage is avoided

At what intervals should the oil be analyzed?

Regular oil analyses track changes in the condition of the oil condition and that of the machine.

Upon reaching the scheduled oil change time, oils should be analyzed at the following intervals in order to check their quality and thus extend oil change intervals:

- Hydraulic oil: 500 operating hours

Based on the initial results, the lab will recommend a date for the next oil sample to be taken.

Ask your TEREX | Fuchs dealer for an information leaflet specifying the scope and procedures involved.

7.3 Discharging residual pressure in the hydraulic circuit

⚠ WARNING



Danger of injury due to residual energy

- When performing maintenance and repair work on the hydraulic system, the residual pressure in the hydraulic circuit must be discharged.
- Before performing this task, the loading equipment must be safely lowered to the ground.

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION

The ignition must be switched on (ignition key in position I). The left armrest (155/13) must be folded down and the maintenance ladder closed. Travel and work functions must be enabled (control light on button toggle (155/79) must light up). The "Travel and work functions disabled" indicator (155/46) must not light up.

The following must be performed at least five times to also relieve the control pressure:

- 1) Lower the four-way control levers (155/12) and (155/20), lower the loading equipment, slew the uppercarriage, open/close the grab.
- 2) Service brake pedal (155/16) (press 20 times).
- 3) Pushbutton (155/65) for parking brake
- 4) Pushbutton (155/66) for swing brake
- 5) Accelerator pedals (155/17) and (155/18)
- 6) Emergency lowering function (155/10) or (106/1) for cab lift
- 7) Lever (155/11) to extend/retract 4-point outrigger
- 8) Pushbutton (155/2) and (155/3) for grab rotation right/left
- 9) Pushbutton (155/78) for oscillating axle lock release

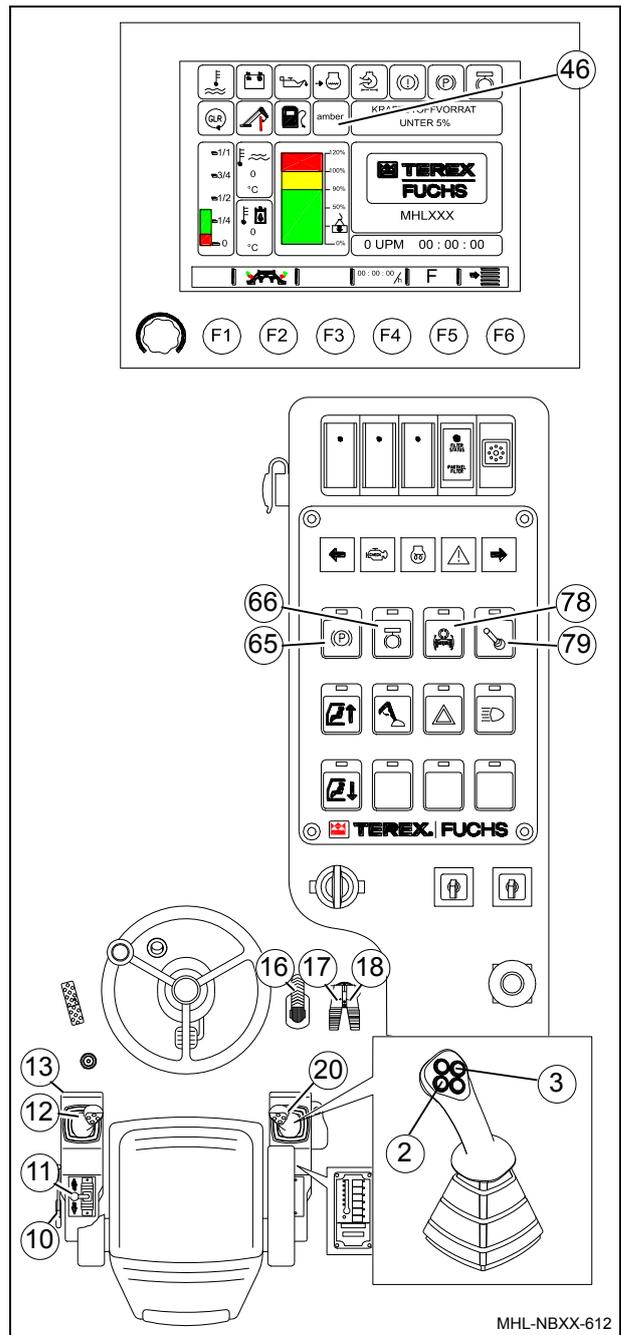


Fig. 155 Discharging residual pressure

7.4 Maintenance and wearing parts

ATTENTION

A list of maintenance and wearing parts appears in the spare parts catalog included in the scope of supply.

Contact your dealer in good time, so that all parts are available for the inspection.

Fuels, lubricants and coolants

The machine's service life and working order are largely dependent upon the use of the specified fuels, lubricants and coolants, as well as compliance with service intervals.

If fuels, lubricants and coolants which do not conform to our recommendations are used, consequential damage may occur for which we will not assume liability, even within the warranty period.

-  Filling quantities and specifications:
Chapter 3.15 Fuels, lubricants and coolants

7.5 Safe working positions

7.5.1 Maintenance position

- ▶ Drive the machine to a suitable location with even and solid ground. Take the weather into account.
- ▶ Slew uppercarriage into direction of travel.
- ▶ If possible, move dipperstick into a steep position.
- ▶ If necessary, lay out plates to lay the grab tips on so that the ground does not get damaged.
- ▶ Put the grab down on the ground in an open position.
- ▶ Retract the stabilizer in the standard version with stabilizer plates, if using enlarged stabilizer plates (optional), place these on the floor.
- ▶ Switch off and secure machine.
 - ▶  Chapter 4.14 Parking the machine
- ▶ Place a sign in the cab informing that maintenance work is being performed.
- ▶ Ensure that no-one can enter the danger zone.

7.5.2 Uppercarriage

Routes and platforms are available in the uppercarriage to reach the following maintenance points:

- Filler neck for diesel tank
- Fuel filter, fuel pre-filter
- Engine oil level
- Engine oil filter
- Belts alternator
- Hydraulic oil level
- Central lubrication system for uppercarriage
- Batteries

Use the maintenance ladder (156/1) to gain access.

- ▶ Attach the maintenance ladder to the handle recess (156/2) and fold it out.
- ▶ Snap maintenance door (157/3) into place in the locking device using the door latch (157/4).
- ▶ Pull out the ladder 157(2).
- ▶ Only use the ladder (157/2) and handles (157/5-4) provided to climb in and out of the machine. Grab on with both hands and face the machine.

After finishing maintenance work on the machine:

- ▶ Slide ladder (157/2) back into hatch and close hatch. If this is not done, travel and work functions are disabled.
- ▶ Unlock door latch (157/4) by pressing in and close maintenance door (157/3) again.

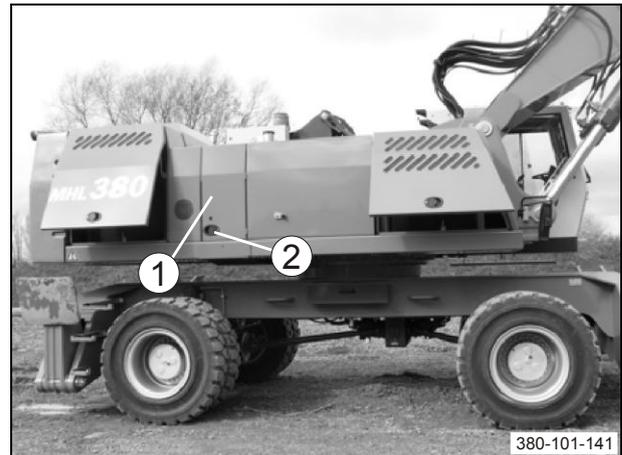


Fig. 156 Position of maintenance ladder

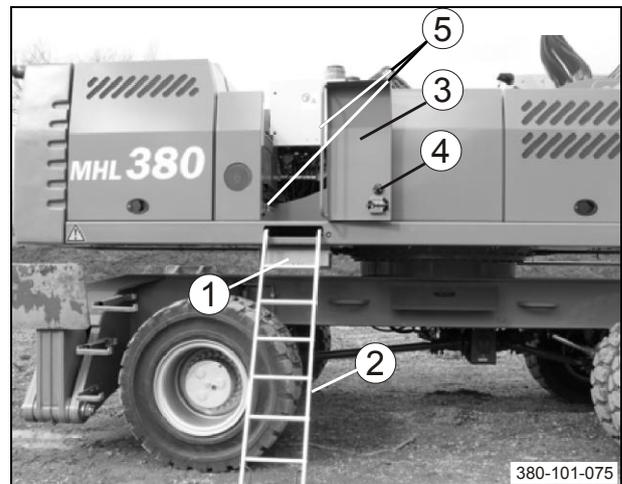


Fig. 157 Maintenance ladder

Work platforms

- ▶ A work platform or pedestal should be used for work on the air filter, ventilation filter, and return filter of the hydraulic system and for filling hydraulic oil, coolant, and wiper water. These must enable safe access and prevent falling.

7.5.3 Undercarriage

Top

No maintenance points are available on the undercarriage.

|  WARNING | |
|--|---|
|  | <p>Danger of injury due to slipping</p> <ul style="list-style-type: none">• Do not climb onto the uppercarriage <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

Bottom

The following maintenance points are on the bottom:

- Axles and transmission
- Steering cylinder

|  WARNING | |
|--|---|
|  | <p>Serious injury due to sagging machine</p> <ul style="list-style-type: none">• Always retract outrigger <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

7.6 Jobs before putting the machine into operation

- ▶ Move the machine into the maintenance position.

 Chapter 7.5.1 Maintenance position

WARNING



Danger of injury due to uncontrolled machine movements

- Before putting the machine into operation, the necessary safety precautions must be observed.

In an emergency: Administer first aid, seek treatment from a doctor

 *Chapter 2.2.4 Putting the machine into operation safely*

7.6.1 Checking the engine oil level


WARNING
**Burns due to hot fluids and surfaces**

- Engine oil is hot when the machine is at operating temperature.
- Avoid touching hot oil or parts carrying oil.

In an emergency: Administer first aid, seek treatment from a doctor

- ▶ The oil level in the diesel engine must be checked daily before starting work with the machine in a horizontal position (with the diesel engine turned off and after a short wait so the oil can collect in the oil pan).
 - ▶ The oil must be between **MIN** and **MAX** on the oil-level dip-stick (158/1).
 - ▶ If necessary, top up with oil until the level reaches the upper mark **MAX**.
- i** Filling quantities, oil quantity and change intervals:
 Chapter 3.15 Fuels, lubricants and coolants
 Chapter 7.8.3 Maintenance and inspection plan

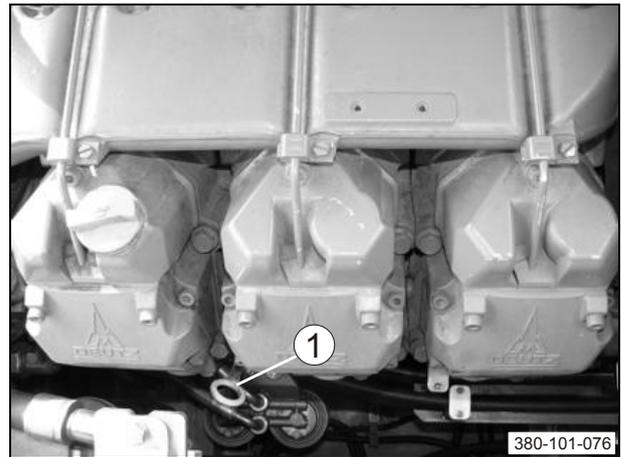


Fig. 158 Checking the engine oil level

7.6.2 Fuel system

7.6.2.1 Fuel level

Check the fuel level on the fuel gauge (159/52). If the fuel in the diesel tank is below the reserve quantity of 5 %, the indicator (159/45) will light up and the message "FUEL RESERVE BELOW 5 %" appears on the multifunction display (159/47). To prevent condensation forming before the next time the machine is put into operation, the tank must be topped up with fuel daily after use. To do this, open the tank cap (160/1).

ATTENTION

Keep the level of fuel in the tank as high as possible to prevent condensation from building up.

Never allow the fuel tank to run empty, otherwise the fuel system will need to be vented.

CAUTION



Irritation to skin or eyes due to diesel fuel spraying out

- Wear protective goggles and protective gloves when filling the tank.

In an emergency: Wash off diesel fuel. Administer first aid, seek treatment from a doctor.

7.6.2.2 Draining water from the fuel pre-filter

If the message (159/37) "Water in fuel" appears, screw open the drain valve (160/2) on the fuel pre-filter and observe the liquid that flows out. Collect the water/fuel mixture that drains out in a suitable container. Close the drain valve (160/2) when only fuel flows out. Dispose of the collected water/fuel mixture properly.

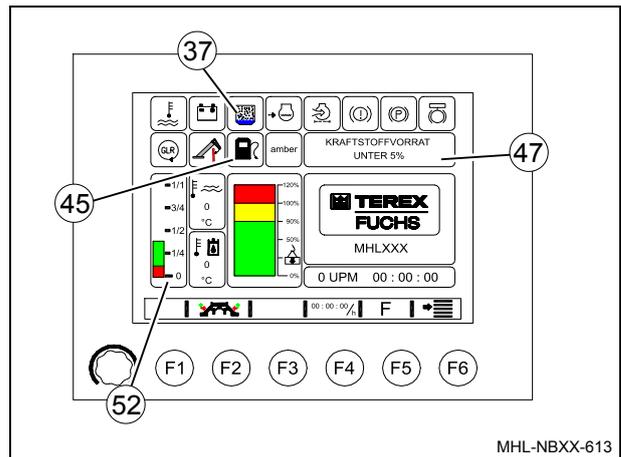


Fig. 159 Fuel level

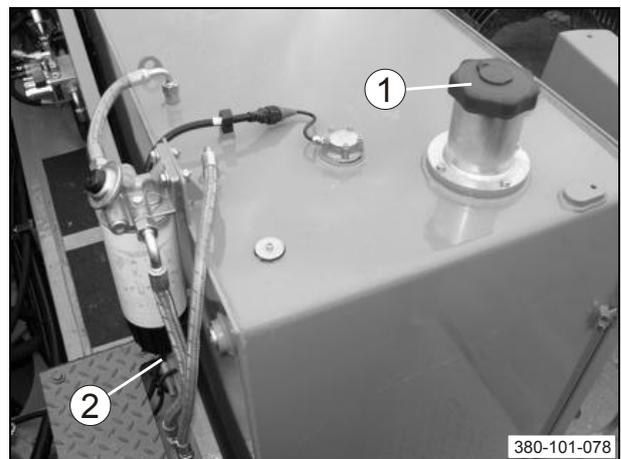


Fig 160 Draining water from the fuel pre-filter

7.6.3 Cooling system

7.6.3.1 Coolant level in the engine cooling circuit

⚠ WARNING

Burns due to hot fluids and surfaces

- At operating temperature, the engine cooling system is hot and pressurized.
- Avoid touching coolant or parts carrying coolant. There is a risk of burns.
- Only check the coolant level once the cap has cooled down enough for you to hold it. Then turn the cover carefully first to discharge the excess pressure.

In an emergency: Administer first aid, seek treatment from a doctor

- ▶ Check the diesel engine, fan and cooler for damage. Clean if necessary.
- ▶ If the coolant level is too low, the indicator (162/38) will light up.
- ▶ Unscrew the protective cover (161/1).
- ▶ Remove the cooling system sealing cover (161/2) and check the coolant level.
- ▶ The coolant must be up to the overflow pipe.
 - ▶ **i** Coolant specification Chapter 3.15.2 Specifications for fuels, lubricants and coolants
- ▶ After filling the cooling system, let the diesel engine run for a while with the heating turned on. Then check the coolant level again.
- ▶ When the machine is delivered, the coolant contains antifreeze protection to -35°C (corresponding to a mixture of about 45% antifreeze).

Antifreeze should be added throughout the year every time the system is topped up.

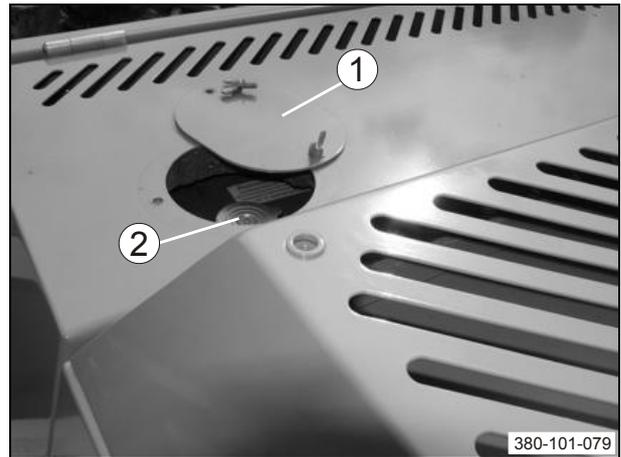


Fig. 161 Cooling system sealing cover

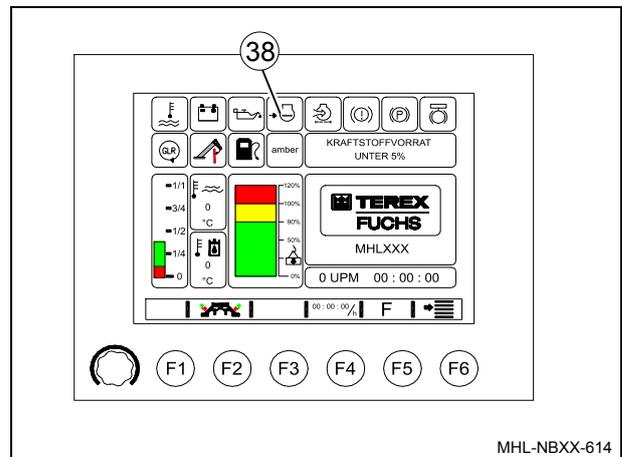


Fig. 162 Coolant level

7.6.3.2 Checking the antifreeze

Check the level of antifreeze protection before the start of the cold season.

ATTENTION

Always use an antifreeze with anti-corrosion protection. The antifreeze level is factory-set to approx. -35 °C. When topping up, only a mixture of water and max. 45 % antifreeze should be used. A concentration of less than 35 % or more than 45 % antifreeze must be avoided, otherwise cooling will be impaired. For the exact composition and concentration, please refer to the engine manufacturer's operating instructions.

i Chapter 3.15 Fuels, lubricants and coolants

7.6.4 Checking the hydraulic oil level

When checking the oil level or when adding oil:

- the machine must be positioned horizontally,
- the outrigger must be retracted / the optional dozer blade must be raised,
- and the loading equipment must be set down on the ground extended and with the grab open.

In this position, the oil level must not be below the bottom mark (red) in the viewing glass (163/1).

If it is, oil must be added through the ventilation filter (163/2) until the level reaches at least the bottom mark (red) or better, the top mark (black).

In the machine position described above, the oil level must always be between these two marks.

If the oil level falls considerably below the bottom mark, the indicator (164/38) lights up. A continuous warning buzzer sounds at the same time and the travel and work functions are disabled. The indicator (164/46) lights up. Once the hydraulic oil level returns to the permissible range, the disabled functions are made available again and the indicators go out.

i Refilling process Chapter 7.9.13.2 Changing hydraulic fluid.

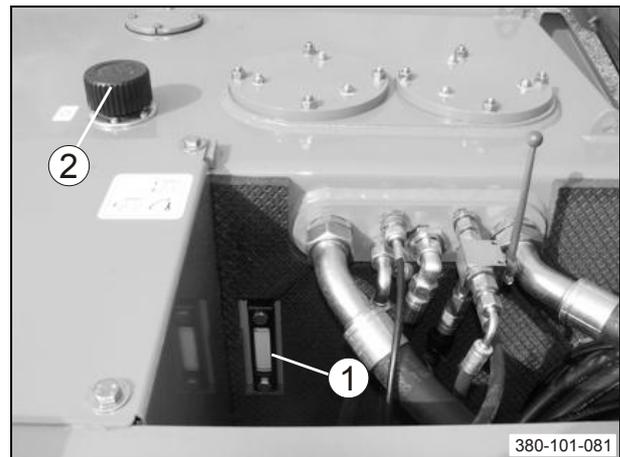


Fig. 163 Sight glass for hydraulic oil

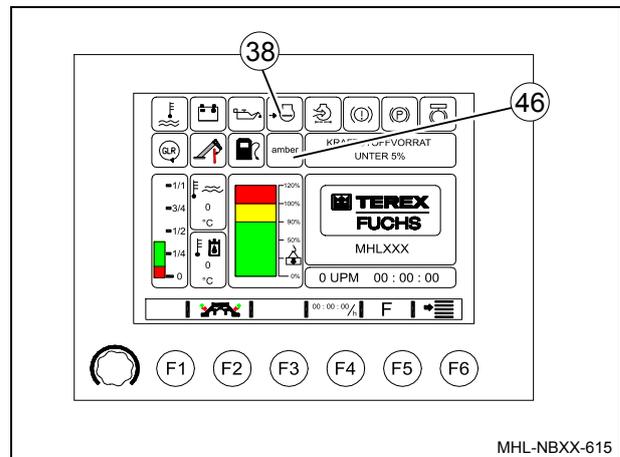


Fig. 164 Hydraulic oil level

7.6.5 Cleaning the cooler

The machine is equipped with separate coolers for combined water/charge air cooling and the hydraulic oil.

| ⚠ WARNING | |
|---|---|
|  | <p>Danger of injury due to rotating parts and hot surfaces</p> <ul style="list-style-type: none"> • Cleaning jobs must only be carried out when the diesel engine is turned off and has cooled down. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

| ATTENTION | |
|---|--|
|  | <p><i>Diesel engine overheating can result in damage to the machine. Carefully clean away any dirt that becomes attached to the coolers.</i></p> |

- ▶ Clean the combined water/charge air cooler (165/2) and the hydraulic oil cooler (165/1) from the outlet side with compressed air. Keep at a safe distance to avoid damaging the cooler flaps!
- ▶ Clean the engine compartment (remove deposits of dirt, oil and diesel fuel).
- ▶ Blow the engine off with compressed air or clean it with a cold cleaner. Wash off the loosened dirt with water. (Do not spray a jet of water directly at sensitive engine parts; for example, generator, starter, cabling, electronic components, connectors.)
- ▶ After every wet cleaning operation, let the diesel engine warm up so that water residue evaporates and corrosion formation is avoided.

If necessary (if the cooler is dirty, for example) use a cold cleaner or a high-pressure cleaner.

- ▶ Place the machine on a washing surface equipped with an oil separator.
- ▶ Clean the machine with a high-pressure cleaner.
- ▶ After cleaning, bring the drive motor to operating temperature to dry out the cooler.

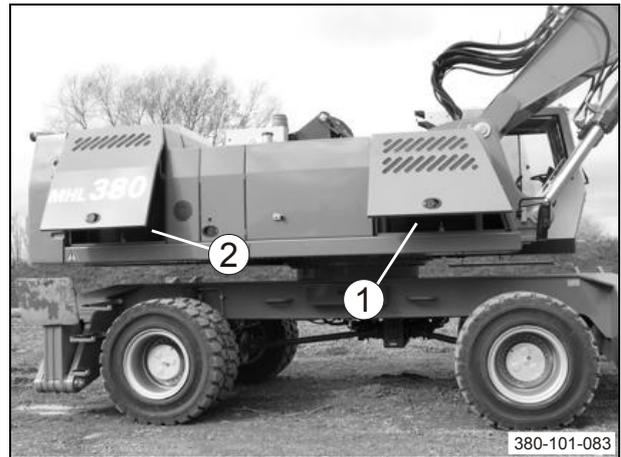


Fig. 165 Cleaning the hydraulic oil cooler and the water/charge air cooler

7.6.6 Tires

WARNING



Danger of injury due to machine movements

- Repair work on the wheels, for example dismantling tires from the rim or fitting them onto the rim, may only be performed by specialists and with suitable assembly tools.
- When working on the tires make sure that the machine is parked safely and has been secured against rolling away (chocks)!

In an emergency: Administer first aid, seek treatment from a doctor

Checking the condition of the wheels

- ▶ Check the tires for tears, cuts, foreign bodies, etc.
- ▶ During the first 50 operating hours, check the torque of the wheel nuts weekly, and subsequently at regular intervals, tightening to the correct torque if necessary.

Tightening torque: 650 Nm

When changing a wheel, always tighten the wheel nuts to the specified torque crosswise in several stages.

7.6.7 Oil level check

| | |
|---|--|
| ⚠ WARNING | |
|  | <p>Burns due to hot fluids and surfaces</p> <ul style="list-style-type: none"> • Oil is hot when the machine is at operating temperature. Avoid touching hot oil or parts carrying oil. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

Check the oil level as follows:

- ▶ Park the machine on level ground.
 - ▶ Turn the wheel until the drain plug (168/2) is at the bottom.
 - ▶ Switch off the engine.
 - ▶ Remove checking plugs, check and top up oil if required.
- i** Filling quantities, oil specification and change intervals:
 Chapter 3.15 Fuels, lubricants and coolants
 Chapter 7.8.3 Maintenance and inspection plan

7.6.7.1 Checking positions

Axes and wheel hubs

- ▶ the rear axle (166/1)
 - ▶ the front axle (167/1)
 - ▶ the wheel hub (168/1)
- i** Oil change procedure:
 Chapter 7.9.14 Changing axle and transmission oil

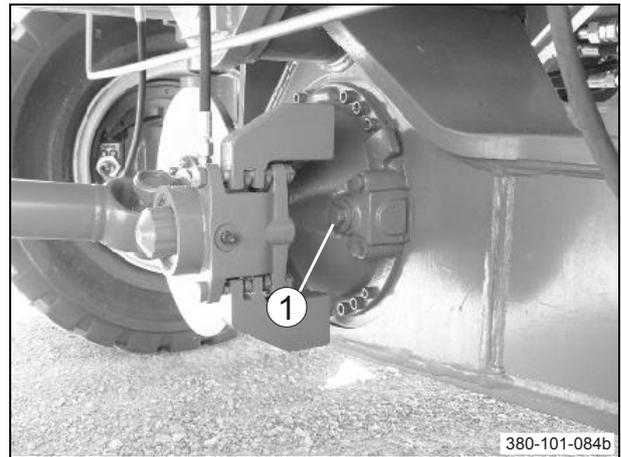


Fig. 166 Rear axle

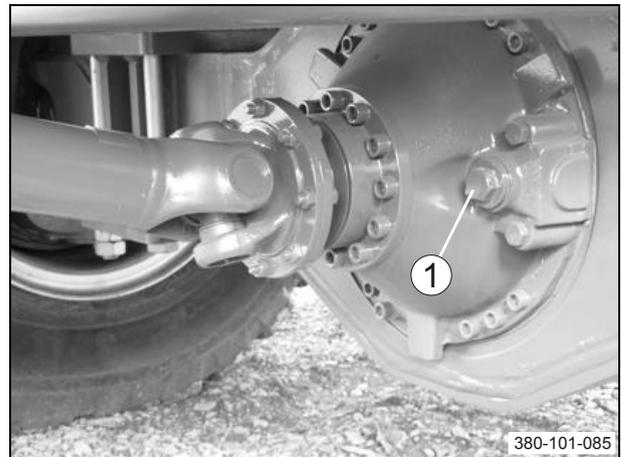


Fig. 167 Front axle

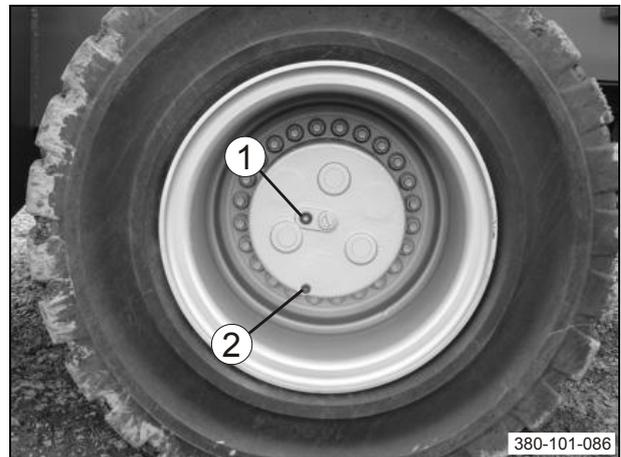


Fig. 168 Wheel hub

Transfer gear

► Transfer gear (169/1)

Check transfer gear oil level in sight glass (169/2).

Swing gear

- Use an oil level dip-stick to check the swing gear oil (170/1) and top up if required. The notches on the oil level dip-stick indicate the minimum and maximum oil levels.

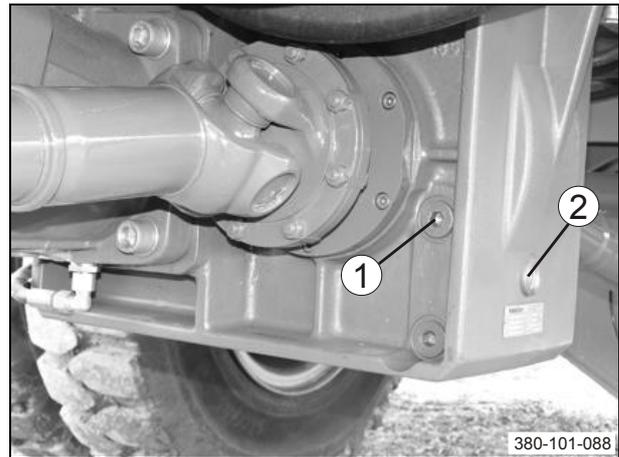


Figure 169 Transmission

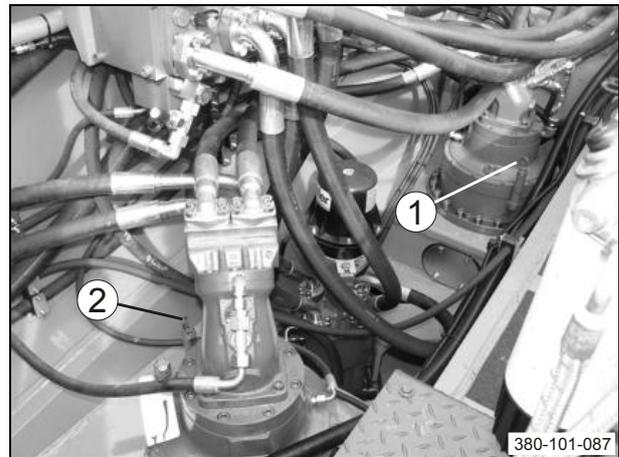


Fig. 170 Swing gear

7.6.8 Electrical equipment

The lighting and warning equipment must be checked prior to use, along with the function of the LEDs and indicator lamps.

| ⚠ WARNING | |
|---|--|
|  | <p>Danger of injury due to electric shock</p> <ul style="list-style-type: none"> • Do not touch live parts. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

| ATTENTION | |
|---|--|
|  | <p><i>Check the polarity of the connections. Cover electrical/electronic components and connections (e.g., control devices, generator, solenoid valves, etc.) before cleaning the engine</i></p> |

7.6.8.1 Batteries

The batteries are located in the service section in front of the diesel engine under the cover plate.

| ATTENTION | |
|---|---|
|  | <p><i>Before installing or removing the batteries, the power supply must be disconnected via the battery isolator switch. Make certain batteries are properly and tightly connected. Dispose of old batteries in compliance with environmental regulations.</i></p> <p><i>The battery manufacturer's instructions must be observed when using the batteries for the first time.</i></p> |

It is important that the batteries are always kept clean to ensure they function properly.

The terminal heads and cable terminals must be cleaned regularly and then greased with a thick coating of pole grease.

The level of liquid in the cells should always be 10 mm above the top of the plates.

If you need to add water, use only distilled water.

Measure the acid density from time to time with an acid tester. When the battery is fully charged, the specific weight is 1.28 kg/l (37% sulfuric acid).

If the acid tester indicates a lower value, the battery is discharged to some extent and must be recharged.

ATTENTION

Maintenance-free batteries need not be checked.

Removing a battery

- ▶ Remove the cover.
- ▶ When disconnecting the battery, always disconnect the negative pole first. Otherwise there is a risk of short circuit!
- ▶ Remove the fastening and take out the battery.

Charging a battery

- ▶ Unscrew the caps.
- ▶ Charge the battery with a standard commercial battery charger. Follow the manufacturer's instructions.
- ▶ Screw on the caps.

Installing a battery

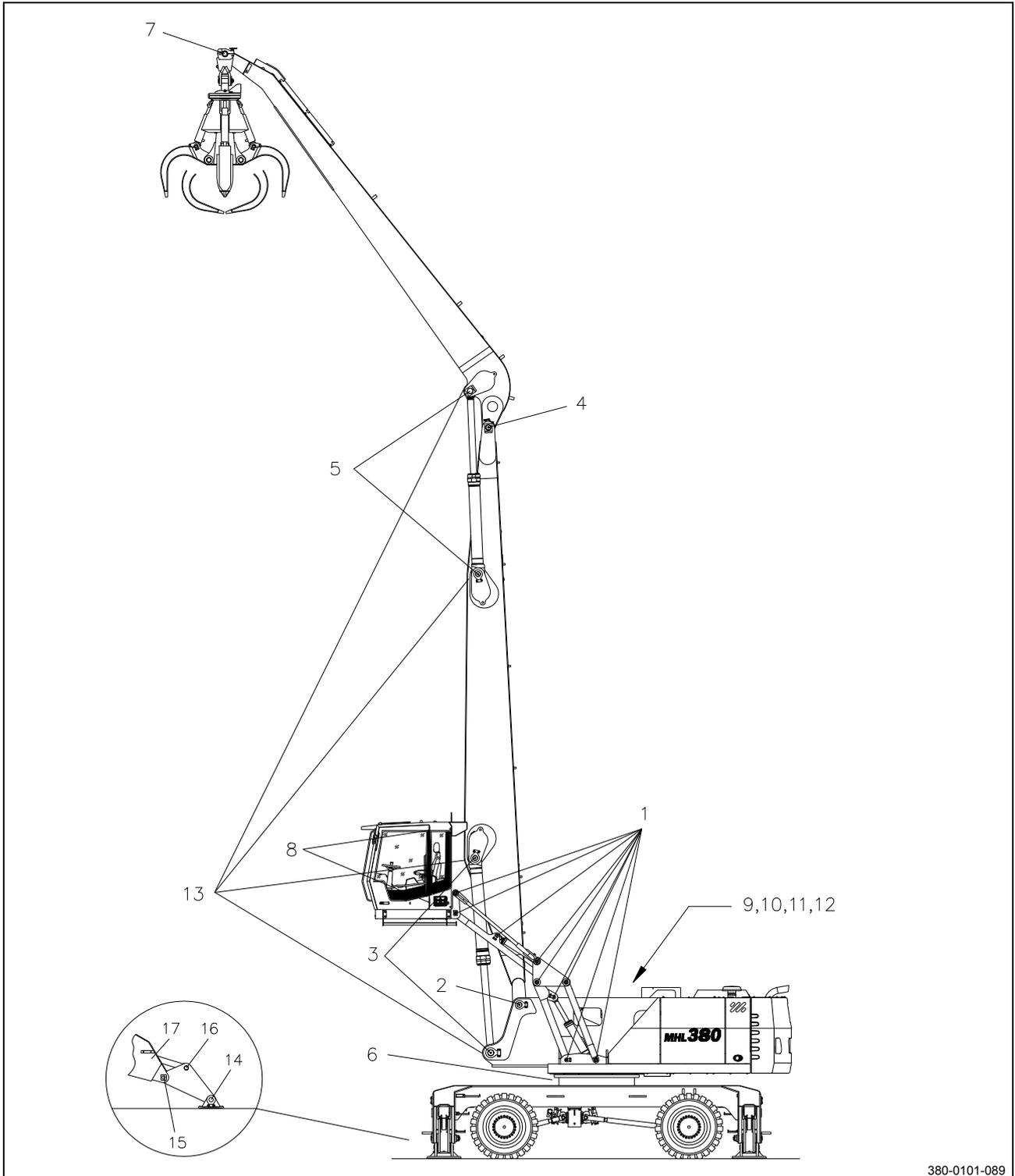
- ▶ Install the new or charged battery and attach the fastening.
- ▶ Clean the connection terminals and battery poles with fine-grain sandpaper.
- ▶ When connecting the battery, connect the positive pole first, then the negative pole. Otherwise there is a risk of short circuit! Ensure good contact to the terminal connections. Tighten the terminal screws hand-tight.
- ▶ Lubricate the assembled terminals with acid-free and acid-resistant grease (pole grease).
- ▶ Replace the cover.

The battery charge should be closely monitored in winter in particular.

7.6.8.2 Lighting and warning equipment

- ▶ Check the lighting equipment for proper functionality.
- ▶ Check the function of the LEDs and indicator lamps in the display.
- ▶ Check the warning equipment for proper functionality.

7.7 Overview of lubricating points



380-0101-089

Fig. 171 Overview of lubricating points

| Item | Lubricating point | Quantity | | | Remarks |
|------|---|----------|-------|--------|--|
| | | | daily | weekly | |
| 1* | Bearing of cab which can be raised and moved forward | 24 | X | | Automatic central lubrication, uppercarriage |
| 2 | Boom bearing | 2 | X | | |
| 3 | Lift cylinder bearing | 4 | X | | |
| 4 | Dipperstick bearing | 2 | X | | |
| 5 | Dipperstick cylinder bearing | 4 | X | | |
| 6 | Slewing joint (slew ring, toothing) | 8 | X | | |
| 7 | Work attachment mounting bearing | 2 | X | | Manual lubrication |
| 8 | Cab door hinge, lock (see Fig. 175) | 3 | | X | |
| 9 | Engine hood hinge | 2 | | X | |
| 10 | Maintenance door hinge | 2 | | X | |
| 11 | Hinge on the cooler flap of the water/charge air cooler | 2 | | X | |
| 12 | Hinge on the cooler flap of the hydraulic oil cooler | 2 | | | |
| 13 | Grease nipple on cylinder bearings | 8 | X | | Perform additional lubrication (manual lubrication) with work equipment lowered to the ground (system not under pressure). |
| 14 | Outrigger foot bearing | 4 | | X | Automatic central lubrication, undercarriage (optional) |
| 15 | Outrigger leg bearing | 4 | | X | |
| 16 | Outrigger cylinder bearing (for outrigger leg) | 4 | | X | |
| 17 | Outrigger cylinder bearing (for undercarriage) | 4 | | X | |
| 18 | Steering housing bearing (see Fig. 172) | 4 | | X | |
| 19 | Steering cylinder bearing (see Fig. 173) | 4 | | X | |
| 20 | Oscillating axle bearing (see Fig. 174) | 1 | | X | |

ATTENTION



* The designated points must undergo a visual and functional inspection every 500 operating hours. Look out for general damage and wear in particular.

i Chapter 7.8.3 Maintenance and inspection plan

Defective lubrication nipples may result in bearing damage. Replace damaged lubrication nipples immediately and check to ensure grease is passing through them. Following maintenance work, manually lubricate a lubricating point until grease escapes.

⚠ WARNING



Danger of injury due to falling

- Before greasing the machine, apply the outriggers and lower the loading equipment (boom in horizontal position).
- The grab must be lubricated separately as described in the operating instructions supplied with the grab.

In an emergency: Administer first aid, seek treatment from a doctor

Steering gear case

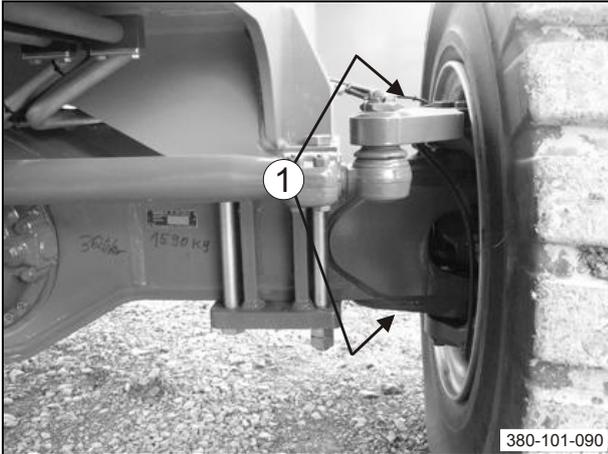


Fig. 172 Steering gear case
1: 2 Lubricating points per steering gear case

Oscillating axle

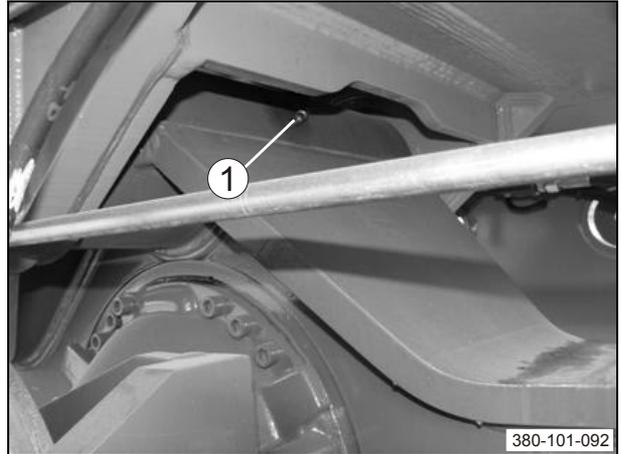


Fig. 174 Oscillating axle
1: 1 lubricating point

Steering cylinder

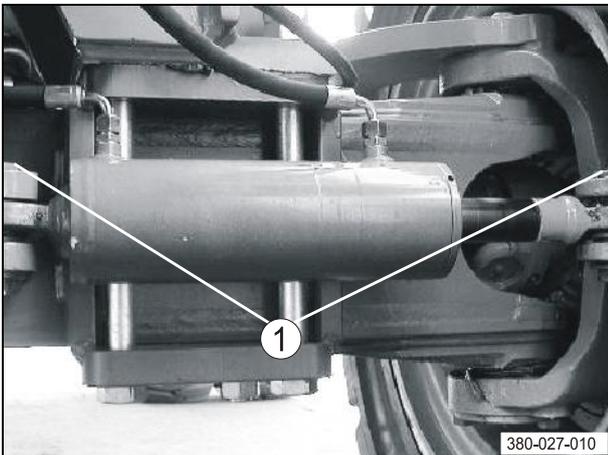


Fig. 173 Steering cylinder
1: 2 lubricating points each per steering cylinder

Cab door

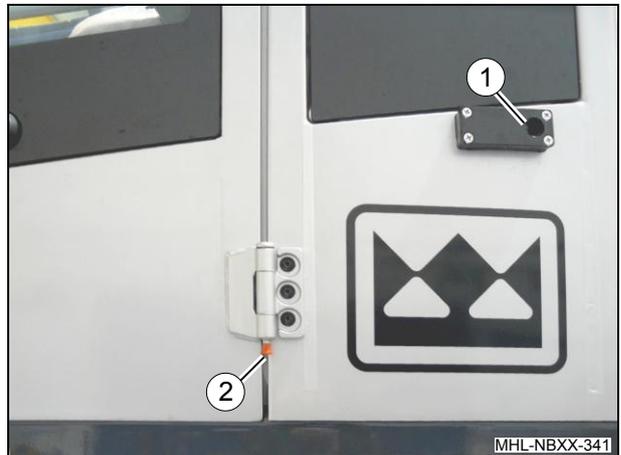


Fig. 175 Cab door
1: Lock
2: Hinges

7.7.1 Automatic central lubrication system for uppercarriage, loading equipment and work attachment mounting

Various lubricating points are connected to the automatic, time-controlled central lubrication system.

 Chapter 7.7 Overview of lubricating points

Operating principle

The lubricating pump (176/1), which consists of a grease reservoir, agitator and pump, supplies the lubricating points with lubrication grease via several distributors (176/2).

The main control (176/5) switches the pump on and off automatically. The pre-set grease lubrication pause time is **28 minutes**. It can only be changed by a service engineer in the service menu (176/6). An additional lubrication cycle can be activated if necessary.

 Chapter 7.7.4.1 Triggering an additional lubrication pulse

The distributor of lubricants (176/2) transports the lubrication grease to other distributors and directly to the lubricating points (176/3) via pistons. A piston detector (176/4) is connected to one of the distributors. It detects the piston movement in the distributor. If no piston movement is detected within a number of lubrication cycles, it is assumed that there is a fault. An error message appears in the main control display on the multifunction monitor (176/6). Automatic lubrication stops.

 Chapter 7.7.4.2 Lubrication when lubricating pump is faulty

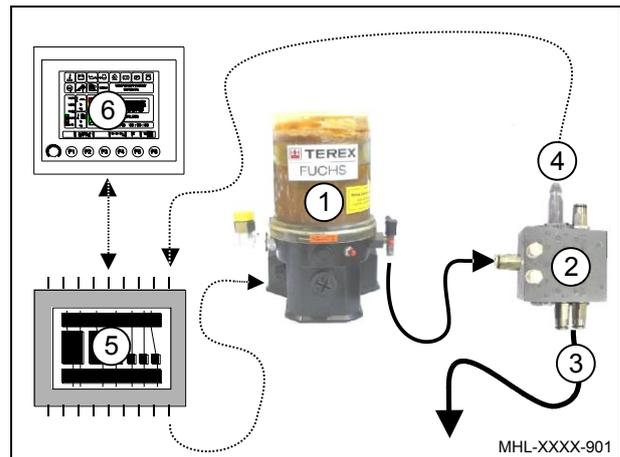


Fig. 176 Operating principle of central lubrication system

- 1 Lubricating pump
- 2 Distributor
- 3 Outgoing lubricating pipe to another distributor or a lubricating point
- 4 Piston detector
- 5 Main control
- 6 Multifunction display

7.7.2 Diagnostics for grease lubrication system (optional)

The diagnostics function displays the operating modes, parameters and current status for central grease lubrication.

Calling up diagnostics function

- ▶ Call up diagnostics menu (Fig. 177) and select the "upper carriage lubrication diagnostics" function.
- ▶ Exit with OK.

7.7.2.1 Image structure and functionality

Electronic pump control can be performed in automatic or manual mode. The corresponding display screens are shown.

Automatic mode

When the diesel engine is running, the display screen for automatic mode appears (Fig. 178).

The pump runs in accordance with the parameters displayed (178/1). The status of the piston detector is monitored during the set number of pump cycles. If a status change takes place during these pump cycles (pause time and pump run time) the piston has moved in the monitored distributor. If no status change takes place, an error message appears (also in the main control display).

The middle area of the display screen (178/2) indicates the current operating status of the pump and piston detector. If the pump is running or the piston detector changes its status, the display and text change.

The progress indicator (178/3) shows the expired and outstanding pump run time and pause time with colored bars and percentages.

F2 exits the pause time. The pump starts.

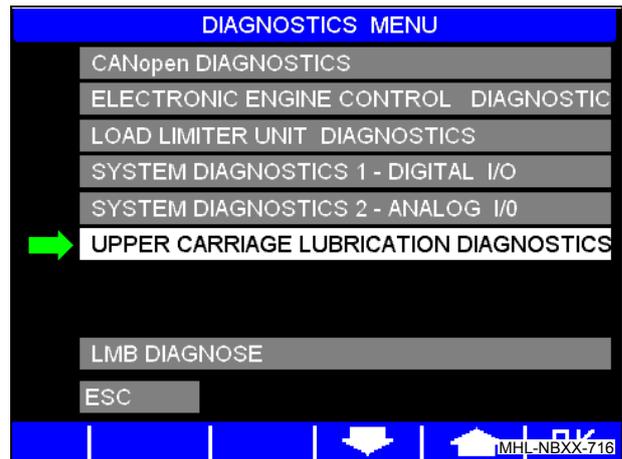


Fig. 177 Diagnostics menu

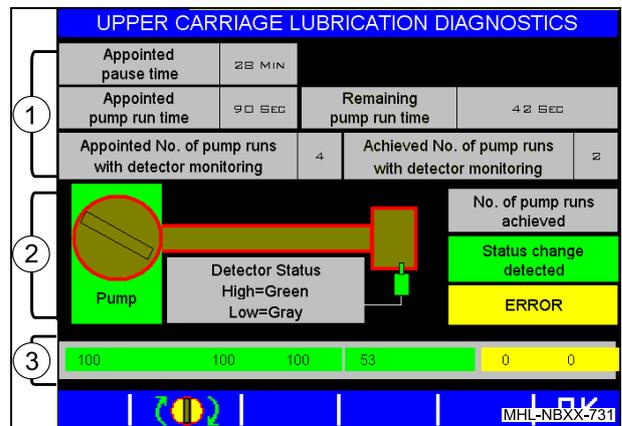


Fig. 178 Automatic mode
 1 Parameters and cycle status
 2: Current operating status
 3 Progress indicator

Manual mode

The display screen for manual mode appears when the diesel engine is switched off (Fig. 179).

F2 switches the lubricating pump on. It then runs without interruption! The pump is switched off by pressing F2 again.

If the diesel engine is started, the screen changes to automatic mode. The pump then runs according to the parameters and cycles displayed.

7.7.2.2 Resetting error and status messages

Displayed error and status messages can only be reset in manual mode using F4 and F5.

If the error message is not reset, automatic lubrication cannot take place.

- i Chapter 7.7.4.2 Lubrication when lubricating pump is faulty

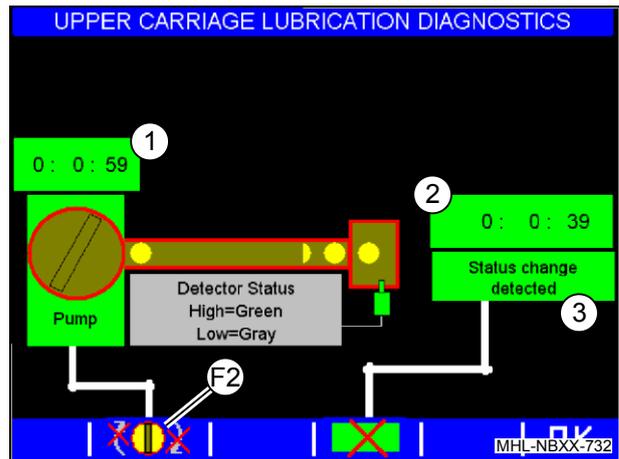


Fig. 179 Manual mode
 1 Completed pump run time
 2 Completed fault-free pump run time
 3 Status display

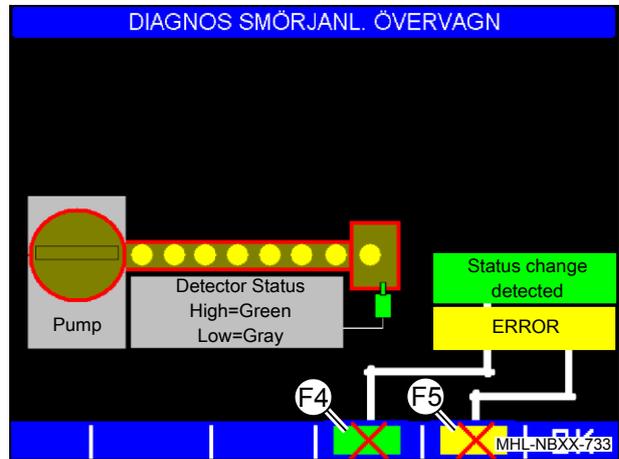


Fig. 180 Pump stationary with error message

7.7.3 Grab spherical plain bearing (optional)

The facility for lubricating the spherical plain bearing is intended for machines that are usually operated with a grab. If the machine is being operated without a grab, the lube fitting should be removed. To prevent the central lubrication system's monitoring facility from outputting a fault warning, the lube fitting must not be sealed.

- ▶ Place the lube fitting inside a strong plastic bag and seal up the bag with an elastic band by wrapping it around the lube fitting.
- ▶ Attach the bag containing the lube fitting securely to the boom.
- ▶ Empty the bag at regular intervals.

7.7.4 Filling the grease container on the uppercarriage

Unscrew the cover (181/1) of the grease container and fill with grease. The container holds approx. 4 kg of multi-purpose grease.

It is also possible to fill the grease container via the filler nipple (181/2) up to the overflow.

- Use the following grease: Chapter 3.15 Fuels, lubricants and coolants

ATTENTION

If the lubrication system runs completely dry, you should add a few drops of oil before refilling it with grease. This will force the air out of the piston components.

Grease must be free from impurities and its viscosity should not change over time. Lubricating additives, such as molybdenum disulfide, must not be mixed in.

Additional lubrication may need to be triggered after filling to achieve complete venting.

- Chapter 7.7.4.1 Triggering an additional lubrication pulse

7.7.4.1 Triggering an additional lubrication pulse

An "additional lubrication pulse" for additional lubrication of the uppercarriage can be triggered in the function menu using the pushbutton function (182/101). The additional lubrication pulse then runs automatically.

An "additional lubrication pulse" for additional lubrication of the undercarriage (optional) can be triggered in the function menu using the pushbutton function (182/107). The additional lubrication cycle then runs automatically.

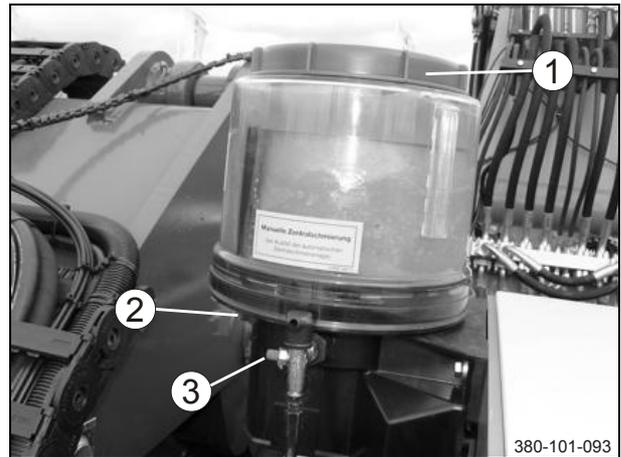


Fig. 181 Grease reservoir on uppercarriage

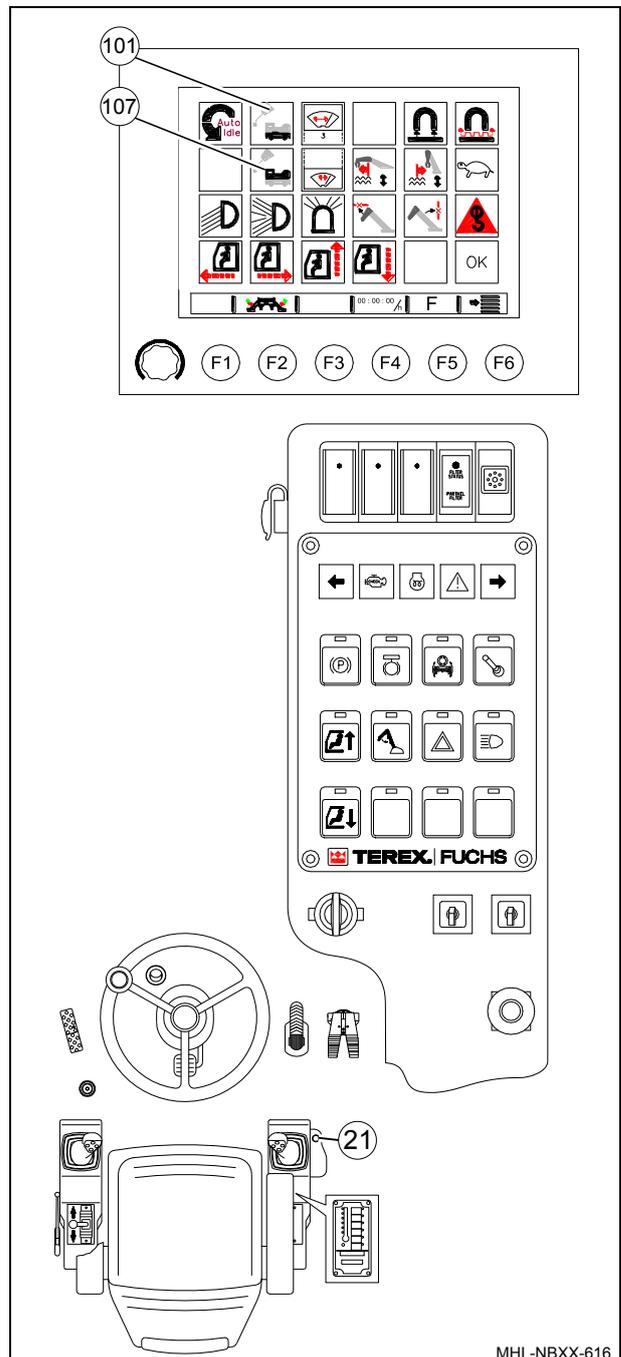


Fig. 182 Triggering an additional lubrication pulse

7.7.4.2 Lubrication when lubricating pump is faulty

ATTENTION



If the lubricating pump is defective, it may cause serious bearing damage. The lubricating pump must therefore be repaired immediately.

If the loading machine starts running again on its own accord for a short period of time, the lubrication system behind the lubricating pump should be supplied with grease manually.

Lubrication interval: **every 4 operating hours**

- ▶ Attach filler pump to grease nipple (183/1).
- ▶ Pump in lubrication grease until fresh lubrication grease escapes from the boom bushings and dipperstick bearing, creating a collar of grease.

If the machine has been operated for several days without the lubricating pump, grease must be pumped in until fresh grease escapes on all bearing points.



Fig. 183 Grease nipple

7.7.5 Hydraulic lubricating pump on undercarriage (optional)

The machine can optionally be equipped with an hydraulic lubricating pump on the undercarriage. All bearing points on the undercarriage are then permanently connected to the lubricating pump.

Filling is as for the uppercarriage.

 Chapter 7.7 Overview of lubricating points

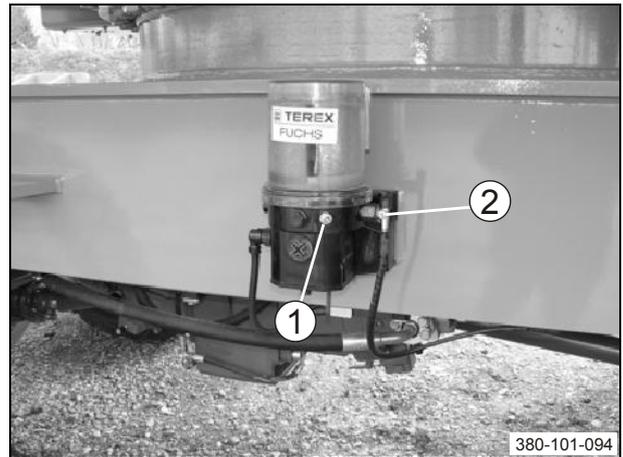


Fig. 184 Grease container on undercarriage (optional)

7.8 Monitoring, maintenance and inspection plans
7.8.1 Initial inspection (delivery inspection)
Work to be performed by trained dealer or service personnel:

| Item | Test method | Chapter |
|------|--|---------|
| 1 | Check whether machine-specific operating instructions are available in the machine. | — |
| 2 | Check the engine oil level | 7.9.1.1 |
| 3 | Checking the coolant level | 7.6.3 |
| 4 | Checking hydraulic oil level | 7.6.4 |
| 5 | Check the fuel level. | 7.6.2 |
| 6 | Check the oil levels in the axles, wheel hubs, swing gear and drive transmission | 7.6.7 |
| 7 | Check the condition of the tires and the wheel nut fastenings. | 7.6.6 |
| 8 | Check the filling level and charge of the batteries. | 7.6.8.1 |
| 9 | Fill the windscreen washwipe system. | 4.10.12 |
| 10 | Lubricate the machine (all lubricating points). | 7.7 |
| 11 | Perform a test run, a functional test of the hydraulic system and a test job. | — |
| 12 | Perform a visual inspection for leaks on all lines, hoses, cylinders, etc. | — |
| 13 | Check the function of electrical indicating and warning elements, as well as lighting. | 7.6.8 |
| 14 | Initial handover card and return to manufacturer. | 7.1 |

7.8.2 Daily and weekly tasks**7.8.2.1 Daily tasks**

Inspection and maintenance work to be performed by operators:

| Item | Test method | Chapter |
|------|---|---------|
| 1 | Check the hydraulic oil level | 7.6.4 |
| 2 | Check the engine oil level | 7.9.1.1 |
| 3 | Check the coolant level | 7.6.3 |
| 4 | Check the fuel prefilter in the fuel line for water and accumulation of sludge and clean if necessary. | 7.6.2.2 |
| 5 | Check the fuel level (fuel gauge in the multifunction display). | 7.6.2 |
| 6 | Check the cleaning fluid level for the windscreen wipers. | 4.10.12 |
| 7 | Check the tightness of lines, hoses, control valves, hydraulic pumps, cylinders, etc.  When tightening hose and line connections, the screw couplings must be locked to prevent rotation. | — |
| 8 | Visual inspection of all steel parts and components for material cracks, deformation, wear, external damage, completeness, etc. | — |
| 9 | Check electrical indicating and warning elements, as well as the lighting system | 7.6.8 |
| 10 | Check control elements for precise ease of operation. | — |
| 11 | Lubricate the machine according to the overview of lubricating points. | 7.7 |
| 12 | Check the central lubrication system and the lubricating points it supplies in terms of leaks, seating of the connections and the lubricant supply. | 7.7 |

7.8.2.2 Weekly tasks
Inspection and maintenance jobs to be performed by operating staff:

| Item | Test method | Chapter |
|------|---|----------|
| 1 | Clean the cooling fins of the water/charge air cooler and hydraulic fluid cooler. ⚠ If there is a heavy accumulation of dust, shorten the cleaning intervals. Otherwise the result could be engine damage. | 7.6.5 |
| 2 | Check the coolant level and perform a visual inspection of the viewing glass as well as a functional test of the air conditioning system. | 4.9.3 |
| 3 | Check the windscreen for proper functionality. | 4.10.3 |
| 4 | Check the door catch for proper functionality. | — |
| 5 | Check the fastening of the wheel nuts. | 7.6.6 |
| 6 | Check the fastening of the slewing joint (hydraulic motor, transmission and slewing ring). | 7.9.15.1 |
| 7 | Check the bearing bushings and pins of the loading equipment. | — |
| 8 | Check the hydraulic axle lock and vent the oscillating axle cylinders. | 7.9.12 |
| 9 | Check the pneumatic springs of the maintenance flaps on the windscreen to ensure they are functioning properly. | — |
| 10 | Check the function, condition and completeness of safety equipment. | — |
| 11 | Lubricate the machine according to the overview of lubricating points. | 7.7 |
| 12 | Check the grease container fill level | 7.7.4 |

7.8.3 Maintenance and inspection plan

Work to be performed by trained dealer or service personnel:

| O = Inspection, maintenance X = Replace | | Operating hours | | |
|--|---|-----------------|-------------|----------------------|
| | | every 500 | every 1,000 | at least once a year |
| Perform work with machine at operating temperature! | | | | |
| 1 | Check whether machine-specific operating instructions are available in the machine | O | | O |
| 2 | Change engine oil. | X | | X |
| 3 | Change the engine oil filter. | X | | X |
| 4 | Check the crankcase breather screw ^{1), 3)} | | O | |
| 5 | Replace flame glow plugs ³⁾ | | O | |
| 6 | Clean discharge drain between cylinder heads. | O | | |
| 7 | Drain water from fuel tank. | O | | O |
| 8 | Flexible fuel pipes (replace completely) ¹⁾ | | O | |
| 9 | Replacing the fuel filter | | X | X |
| 10 | Fuel pre-filter, filter cartridge | O | X | X |
| 11 | Check the air filter pipe. | O | | O |
| 12* | Air filter – replace main cartridge and safety cartridge. | | X | X |
| 13 | Clean the cooling fins of the water/charge air cooler and hydraulic fluid cooler. If there is a heavy accumulation of dust, shorten the cleaning intervals. Otherwise the result could be engine damage. | O | | O |
| 14 | Check antifreeze in coolant (AVIA, BASF, SHELL). | | | O |
| 15 | Change coolant ¹⁾ | O | | |
| 16 | Replace coolant pump ³⁾ | | | |
| 17 | Check belts alternator (retension if necessary, replace if damaged) ¹⁾ | O | | |
| 18 | Check the engine suspension and pump attachments. | O | | O |
| 19 | Check the engine speed adjustment/load limit sensing control | O | | O |
| 20 | Check the exhaust system | O | | O |
| 21 | Check valve lash on engine (adjust if necessary, sooner if there is noise) ²⁾ | | | |
| 22 | Check the acid level and cable connections of the batteries. | | O | |
| 23 | Check the condition of the tires and the fastening of the wheel nuts. | O | | O |
| 24 | Check the fastening of the axles and propshafts. | O | | O |

1) at least every 2 years

2) every 1000 operating hours

3) replace every 6000 operating hours

ATTENTION

* A filter element is not considered dirty and does not have to be replaced until the contamination indicator responds once the hydraulic system has reached operating temperature and the signal comes up continuously.

| O = Inspection, maintenance X = Replace | | Operating hours | | |
|--|---|-----------------|------------|----------------------|
| | | every 500 | every 1000 | at least once a year |
| Perform work with machine at operating temperature! | | | | |
| 25 | Tighten the fastening screws on the counterweight (1000 Nm). | O | | O |
| 26 | Check the bearing of the movable cab (i Chapter 7.7) | O | | O |
| 27 | Check that the door catch is in perfect working order and replace if necessary. | O | | O |
| 28 | Check the bushings and pins of the loading equipment and adjust to "no play" | O | | O |
| 29 | Check electrical indicating and warning elements, as well as the lighting system | O | | O |
| 30 | Check the control elements for ease of operation and adjust if necessary. | O | | O |
| 31 | Check the function of the hydraulic axle lock and vent the oscillating axle cylinders. | O | | O |
| 32 | Check the function of the steering. | O | | O |
| 33 | Check the condition and function of the outriggers. | O | | O |
| 34 | Visual inspection of all steel parts and components for material cracks, deformation, wear, external damage, completeness, etc. | O | | O |
| 35 | Check tightness of all pipes, hoses, control valves, hose-rupture safety valves, hydraulic pumps, cylinders, etc. i When tightening hose and line connections, the screw couplings must be locked to prevent rotation. | O | | O |
| 36 | Check function of brakes and brake disc play and vent brakes. | O | | O |
| 37 | Check the pump drive. | O | | O |
| 38 | Check that the slewing ring fastening screws are seated correctly. | O | | O |
| 39 | Secure fastening of slewing ring attachment, swing gear, swing gear motor | O | | O |
| 40 | Lubricate the machine according to overview of lubricating points | i Chapter 7.7 | | |
| 41 | Check function, condition and completeness of safety equipment. | O | | O |
| 42 | Hydraulic function check with pressure function test | O | | O |
| 43 | Replace the air filter insert for the supplementary heating ⁴⁾ | O | | X |
| 44 | Change the filter material for the air filter (hot water heating) ⁴⁾ | O | | X |
| 45 | Check V-belt tension, generator. | O | | X |
| 46 | Check the condition, V-belt tension and filter for the air conditioning. | O | | O |
| 47 | Replace hydraulic oil tank ventilation filter. | | X | X |
| 48 | Test run and test work | O | | O |
| 49 | Initial inspection cards and return to TEREX Fuchs. | O | | |

4) The intervals should be shortened in dusty ambient conditions.

| O = Inspection, maintenance X = Replace | | Operating hours | | |
|--|-------------------------------------|-----------------|------------|-------------------------|
| Perform work with machine at operating temperature! | | after 500 | every 1000 | at least once a year |
| 50 | Swing gear: oil check or oil change | X | X | X |

| O = Inspection, maintenance X = Replace | | Operating hours | | |
|--|---|-----------------|------------|-------------------------|
| Perform work with machine at operating temperature! | | after 500 | every 2000 | at least once a year |
| 51 | Wheel hubs on front and rear axles: oil check or oil change | X | X | X |
| 52 | Differential rear and front axles: oil check or oil change | X | X | X |
| 53 | Transfer gear: oil check or oil change | X | X | X |

| O = Inspection, maintenance X = Replace | | Operating hours | | |
|--|---|-----------------|------------|-------------------------|
| Perform work with machine at operating temperature! | | every 500 | every 3000 | at least once a year |
| 54 | Change or check hydraulic oil ^{5), 6)} | O | X | X |
| 55 | Hydraulic oil – replace return filter insert. | | X | X |

- 5) Extension of hydraulic oil change intervals
Hydraulic oil changed according to oil sample analyses and lab report. Oil sample intervals as specified by test lab.
- 6) Shortening of the hydraulic oil change intervals
If the loading machine is generally operated with a hydraulic hammer or under difficult conditions (frequent changing of work attachments, surroundings exposed to dust), there is a danger that the hydraulic oil will become dirtier than normal.
To prevent the hydraulic components wearing prematurely as a result, the oil change intervals (and/or the intervals between oil samples) should be reduced.

7.9 Inspection and maintenance work

7.9.1 Engine oil

All inspection and maintenance work not described here should be performed as described in the separate diesel engine operating instructions included in the scope of supply.

7.9.1.1 Checking the engine oil level

| | |
|---|--|
| ⚠ WARNING | |
|  | <p>Burns due to hot fluids and surfaces</p> <ul style="list-style-type: none"> Oil is hot when the machine is at operating temperature. Avoid touching hot oil or parts carrying oil. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

- ▶ The oil level of the diesel engine must be checked when the machine is positioned horizontally (with the engine turned off and after a short wait so the oil can collect in the oil pan).
- ▶ The oil must be between **MIN** and **MAX** on the oil-level dip-stick (186/2).
- ▶ If necessary, top up with oil until the level reaches the upper mark **MAX**.

7.9.1.2 Changing the engine oil

i Filling quantities, oil quality, and change intervals: Chapter 3.15 Fuels, lubricants and coolants; Chapter 7.8.3 Maintenance and inspection plan; Chapter 7.2 Regular oil analyses

| | |
|---|---|
| ⚠ WARNING | |
|  | <p>Burns due to hot fluids and surfaces</p> <ul style="list-style-type: none"> Risk of scalding when hot oil is drained! Wear suitable protective clothing and safety goggles. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

- ▶ Perform the oil change only when the diesel engine is hot.
- ▶ Park the machine on level ground.
- ▶ Rotate the uppercarriage 90° to the undercarriage.

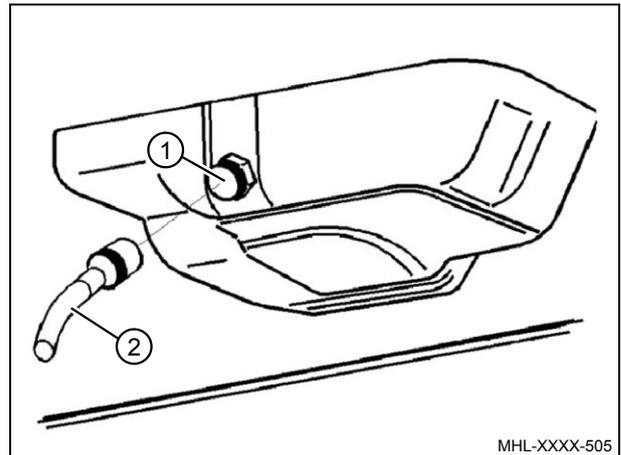


Fig. 185 Drain valve in oil pan

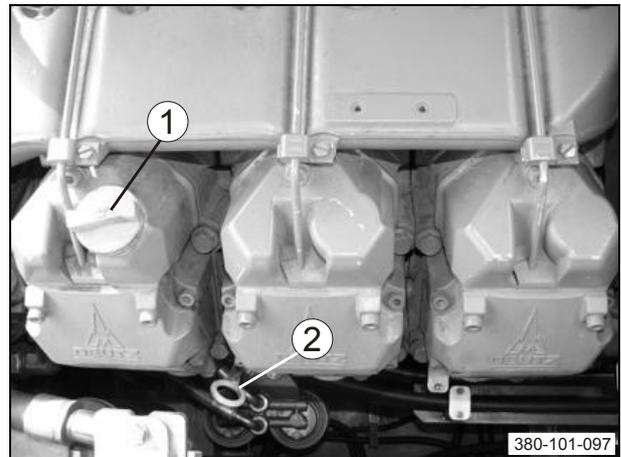


Fig. 186 Sealing cover

- ▶ Switch off the diesel engine.
- ▶ Unscrew the protective cap from the drain valve (185/1).
- ▶ Screw the oil drain hose included in the scope of supply (185/2) onto the drain valve (185/1) on the oil pan and collect the oil in a suitable container.

ATTENTION



Collect old oil with a suitable reservoir. Do not allow it to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

- ▶ Remove the oil drain hose (185/2) and screw the protective cap onto the drain valve (185/1).
- ▶ Change the engine oil filter.
 - ▶  Chapter 7.9.1.3 Changing the engine oil filter
- ▶ Remove the cap (186/1).
- ▶ Add oil until the level reaches the top mark on the oil-level dip-stick (186/2).
- ▶ Close the cap (186/1).
- ▶ Start the diesel engine and run at a low idle for approx. 2 minutes.
- ▶ Switch off the diesel engine.
- ▶ Check the oil level after approx. 15 minutes and top up if necessary.

7.9.1.3 Changing the engine oil filter

The engine oil filter must be replaced every time the engine oil is changed:

- ▶ Remove cover plate (188/1) in maintenance process.
- ▶ Place a suitable container under the engine oil filter.
- ▶ Clean the outside of the engine oil filter cartridge (187/1).
- ▶ Loosen and unscrew the filter cartridge (187/1) using a standard tool. Check that the fastening stud is located securely in the filter head.
- ▶ Dispose of the filter cartridge (187/1) according to regulations.
- ▶ Check the condition of the filter head and clean.
- ▶ Fill the new filter with oil. Wet the sealing ring with oil and tighten firmly by hand until the seal is securely in place.
- ▶ With one more half turn, tighten the filter cartridge.
- ▶ Refit cover plate (188/1) in maintenance process.
- ▶ **Only start the engine if it contains sufficient oil.**
 - ▣ Chapter 7.9.1.1 Checking the engine oil level
- ▶ After a trial run, check the engine oil filter for leaks.

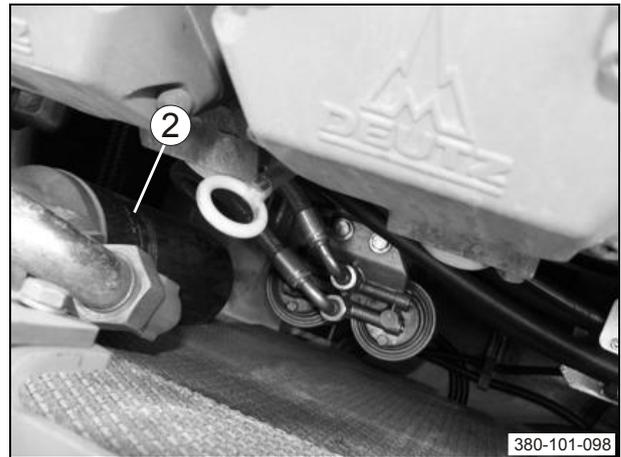


Fig. 187 Engine oil filter

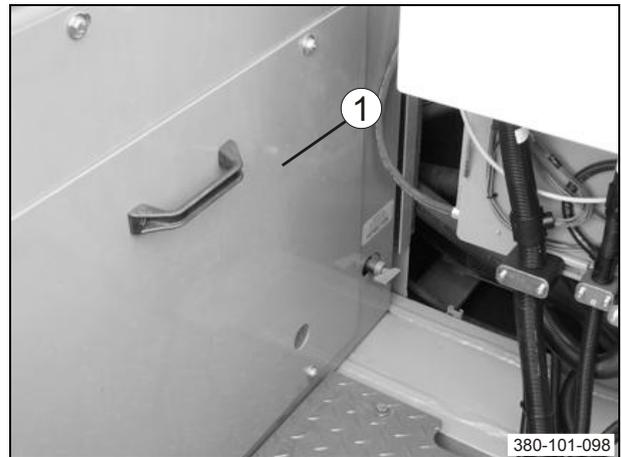


Fig. 188 Cover plate

7.9.2 Fuel system

7.9.2.1 Fuel level

- ▶ Check the fuel level on the fuel gauge (189/52).
- ▶ If the fuel in the diesel tank is below the reserve quantity of 5%, the indicator (189/45) will light up on the multifunction display and the message (189/47) "FUEL RESERVE BELOW 5%" will appear.
- ▶ To prevent condensation forming before the next time the machine is put into operation, the tank must be topped up with fuel daily after use.
- ▶ If the message (189/37) "Water in fuel" appears in the display, the fuel pre-filter must be drained.
 - ❗ Chapter 7.6.2.2 Draining water from the fuel pre-filter

7.9.2.2 Electrical refueling pump (optional)

The electrical refueling pump is used to pump fuel into the fuel tank of the loading machine.

⚠ WARNING

Danger of injury due to overflowing diesel fuel

- Please note that the refueling pump does not cut off automatically when the tank is full. The pump should therefore not be left unattended during the fuelling process.

In an emergency: Clean up escaped diesel fuel

ATTENTION

When refueling with the electrical tank filling pump, open the tank cover so no excess pressure can build up in the fuel tank!

Do not allow the fuel tank to run empty, otherwise the fuel system will need to be vented.

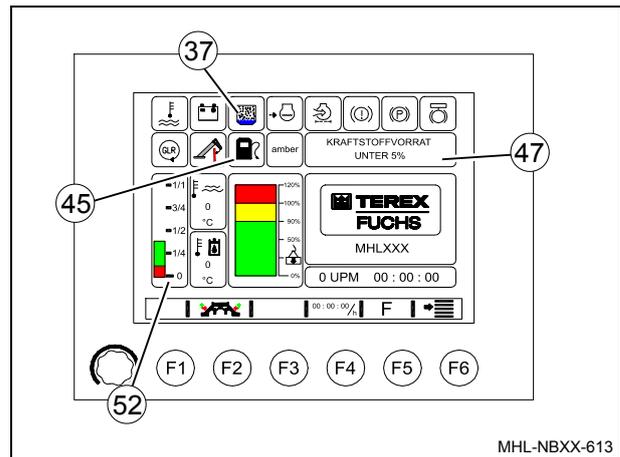


Fig. 189 Fuel gauge

To refuel, proceed as follows:

- ▶ Open the tank cover on the fuel tank (pressure equalization!).
- ▶ Remove the sealing cover (190/1) from the intake adapter (190/2).
- ▶ Mount the intake hose on the intake adapter (190/2).
- ▶ Introduce the free end of the intake hose with the filter side into a fuel barrel.
- ▶ Keep the toggle switch (190/3) next to the tank filling pump in the upper position, "ON", to pump fuel into the tank of the machine. The maximum fill level is achieved when the LED (190/4) lights up red.

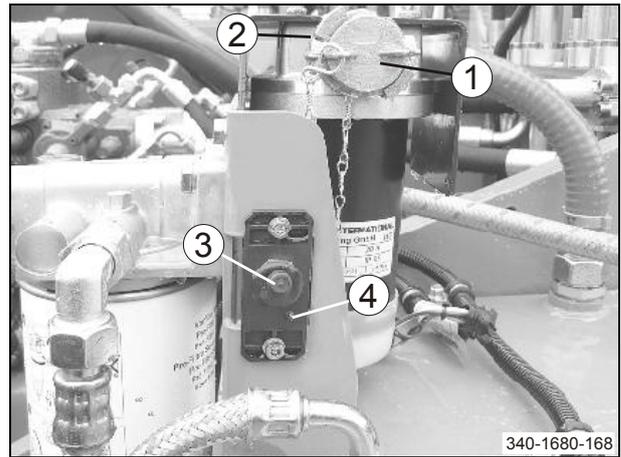


Fig. 190 Tank filling pump

ATTENTION



Make certain the fuel level does not fall below the intake level of the intake hose. The pump should not be allowed to run dry under any circumstances.

- ▶ Release the toggle switch (190/3) to the lower "OFF" position. The refueling pump stops.
- ▶ Uncouple the intake hose and make sure that there is no fuel in the intake hose before stowing it away. Seal the intake adapter (190/2) with the cap (190/1).

ATTENTION



It is essential to use the cap, since the built-in non-return valve is not suitable for providing a long-term seal.

- ▶ Close the tank cover.

7.9.2.3 Replacing the fuel filter

- i Replace as described in Chapter 7.8.3 Maintenance and inspection plan
- ▶ Remove cover plate (192/1) in maintenance process.
- ▶ Place a suitable container under the fuel filters (191/1).
- ▶ Clean the outside of the fuel filter cartridges (191/1).
- ▶ Unscrew the filter cartridges (using a tightening strap wrench if necessary).
- ▶ Collect the fuel and dispose of filter cartridges according to regulations.
- ▶ Clean the filter heads and check their condition.
- ▶ Wet the seals or fuel filter cartridges with oil or diesel fuel.
- ▶ Screw on the new fuel filter cartridges and tighten firmly by hand.
- ▶ With one more half turn, tighten the fuel filter cartridges.
- ▶ Refit cover plate (192/1) in maintenance process.

ATTENTION

There is no need to vent the fuel system.

- ▶ After a trial run, check the fuel filter for leaks.



Fig. 191 Fuel filter



Fig. 192 Cover plate

7.9.2.4 Cleaning the fuel prefilter with integrated filter cartridge

i Carry out maintenance as described in chapter 7.8.3 Maintenance and inspection plan.

| ⚠ WARNING | |
|---|---|
|  | <p>Danger of injury due to escaping diesel fuel</p> <ul style="list-style-type: none"> • All maintenance work on the fuel prefilter must be carried out with the engine switched off. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

- ▶ Switch off the diesel engine.
- ▶ Open the filter cover vent plug (193/1).
- ▶ Open the drain valve (193/2), collect any dirt and water in an appropriate container and dispose of in compliance with environmental regulations.
- ▶ Close the drain valve (193/2).
- ▶ Vent the fuel prefilter using the hand pump (193/6).
- ▶ Use the hand pump until fuel which is free of bubbles flows out through the opened vent plug of the fuel prefilter cover. Collect any fuel that leaks out and dispose of it in compliance with environmental regulations.
- ▶ Close the vent plug (193/1).

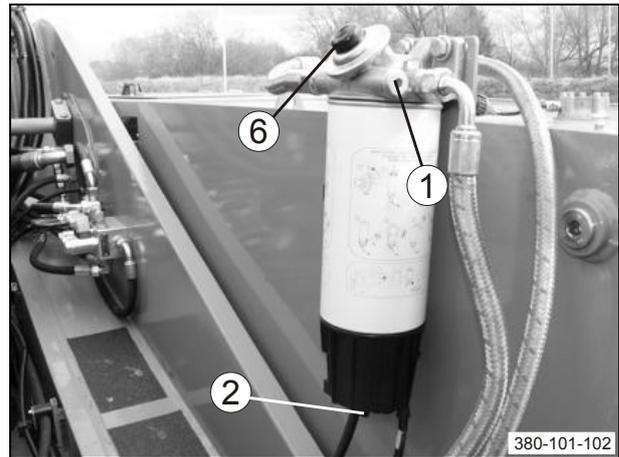


Fig. 193 Fuel pre-filter

7.9.2.5 Replacing the fuel prefilter with integrated filter cartridge

- i** Replace as described in Chapter 7.8.3 Maintenance and inspection plan.

⚠ WARNING



Danger of injury due to escaping diesel fuel

- All maintenance work on the fuel pre-filter must be carried out **with the engine switched off**.

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION

Function of drain valve: press the control knob toward the valve body, then turn.

- ▶ Switch off the diesel engine.
- ▶ Open the filter cover vent plug (193/1).
- ▶ Open the drain valve (193/2), collect any dirt and water in an appropriate container and dispose of in compliance with environmental regulations. **The volume of fluid to be disposed of should not exceed 0.5 – 1.0 liters.**
- ▶ Close the drain valve (193/2).
- ▶ Unscrew and clean the lower part of the housing (194/3). Unscrew the filter cartridge (194/4) from the filter head (194/6). Dispose of the filter cartridge in compliance with environmental regulations.
- ▶ Oil the threads and the sealing surfaces on the lower part of the housing (194/3), the filter head (194/6) and the sealing rings (194/5) with hydraulic oil.
- ▶ Carefully push the new filter cartridge (194/4) onto the holding lug. Make sure it is seated correctly! Screw the filter cartridge (194/4) onto the filter head (194/6).
- ▶ Screw on the lower part of the housing (194/3) by hand as far as the stop and then turn it back one quarter of a turn.
- ▶ Vent the fuel prefilter.
 - i** Chapter 7.9.2.7 Venting the fuel system

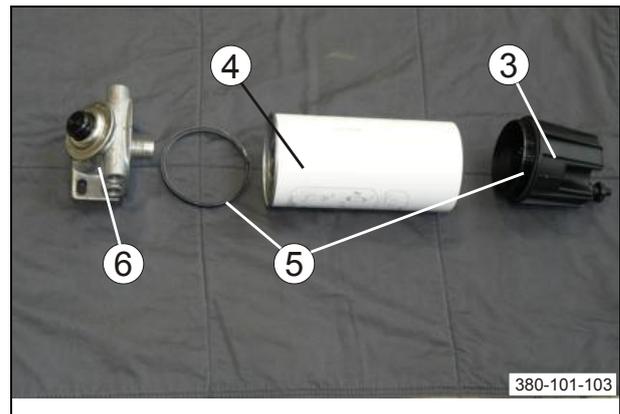


Fig. 194 Fuel pre-filter cartridge

ATTENTION



The starter is not to be operated for longer than 20 seconds.

- ▶ After starting the engine, check the fuel prefilter for leaks.

7.9.2.6 Draining water from the fuel system

- i** Carry out maintenance as described in chapter 7.8.3 Maintenance and inspection plan.

Water must be drained daily from the fuel system through the fuel tank and the fuel prefilter.

ATTENTION



Collect the fuel/water mixture in a suitable reservoir. Do not allow it to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

Fuel tank

- ▶ Remove the fuel drain plug (195/1) from the fuel tank and replace it with the drain valve from the tool box included in the scope of supply.
- ▶ Screw the drain hose onto the drain valve and drain the condensate. Once fuel instead of water starts to flow, close the drain valve.

ATTENTION

Keep the level of fuel in the tank high to prevent condensation from building up.

Fuel prefilter

- ▶ If the message (196/37) "Water in fuel" appears in the display, open the drain valve (193/2) on the fuel pre-filter. Collect the water/fuel mixture that drains out in a suitable container. Close the drain valve (193/2) when only fuel flows out. Dispose of the collected water/fuel mixture properly.

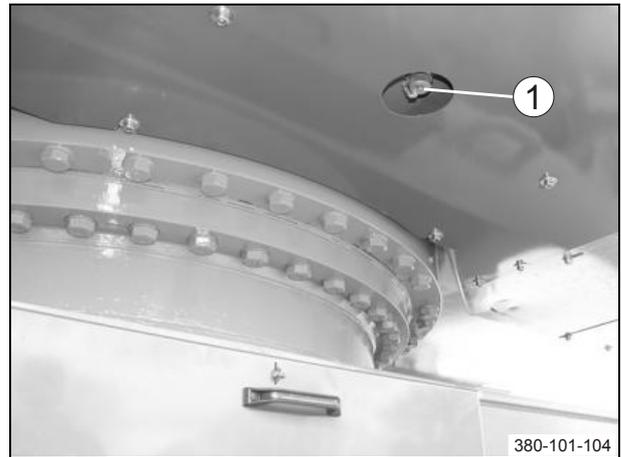


Fig. 195 Fuel drain plug

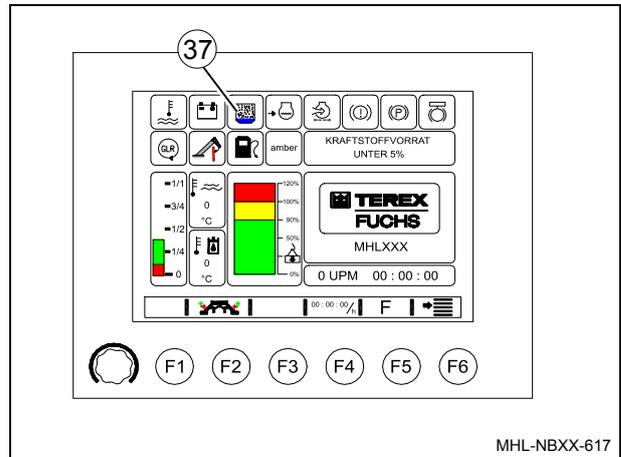


Fig. 196 Water in fuel

7.9.2.7 Venting the fuel system

- ▶ Use the hand pump (193/6) until fuel which is free of bubbles flows out through the opened vent plug (193/1) of the fuel prefilter cover. Collect any fuel that leaks out and dispose of it in compliance with environmental regulations.
- ▶ Tighten the vent plug (25 Nm).

ATTENTION



If the diesel engine has not started after max. 30 seconds, turn the ignition key to position "I" or "0", and wait for at least 30 seconds before repeating the start-up procedure.

ATTENTION



Do not drive the diesel engine at full throttle right away. Drive with restraint until the engine reaches operating temperature.

7.9.3 Air cleaner

ATTENTION

All maintenance work on the air filter pipe must be carried out with the engine switched off! Do not start the diesel engine whilst the main cartridge and safety cartridge are removed.

Maximum engine protection against premature wear caused by dust is only possible if the air cleaner is maintained at regular intervals.

The air cleaner is designed to offer maximum protection at long maintenance intervals.

Maintenance includes replacing filter elements.

For safety reasons, we do not recommend washing out filter elements.

The air cleaner needs to be serviced as soon as the indicator (197/39) lights up continuously. The indicator may light up briefly, but this is circumstantial and is usually caused by the engine speed being increased too quickly.

Smoky exhaust fumes and perceptibly lower engine power can also be signs of a clogged filter.

The corresponding main cartridge will need to be replaced.

We strongly recommend replacing the main cartridge (fig. 199/1) when the maximum permissible intake negative pressure is achieved or at least once a year, whichever is sooner.

Installing and removing cartridges too frequently may damage the seals between the filter element and the filter body.

The safety cartridge needs to be replaced with every fifth change of the main cartridge or at least once a year, whichever is sooner.

Before installing a new element, the seals and seal surface in the housing must be cleaned carefully.

The discharge slot on the dust emptying valve (198/5) should be opened by hand once a week to ensure it does not jam due to high relative humidity and dust.

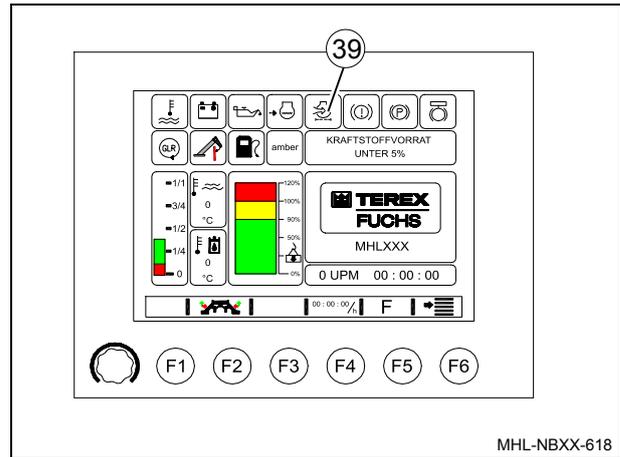


Fig. 197 Air filter clogging

7.9.3.1 Changing cartridges

⚠ WARNING



Danger of injury due to falling

- Before replacing the filter, make sure that suitable equipment for this purpose (e.g. a pedestal) is at hand.

In an emergency: Administer first aid, seek treatment from a doctor

Replacing the main cartridge

- ▶ Open the support brackets (198/1) and remove the cover (198/2) with the dust emptying valve (198/5).
- ▶ Carefully turn and tip the dirty main cartridge (199/1) to remove it, then dispose of the cartridge.
- ▶ Record the maintenance job performed on the safety cartridge (199/2).
- ▶ Clean the inside of the air filter body and the sealing surface in the housing with damp cloths. Do not blow off the housing with compressed air.
- ▶ Check the new main cartridge for damage.

ATTENTION



Do not install damaged main cartridges. The diesel engine can be damaged if dust is able to get into it.

- ▶ Install the main cartridge by turning it slightly into the filter body. Check to make sure it is seated correctly.
- ▶ Install the cover with the dust emptying valve below and fasten the support brackets (198/1).

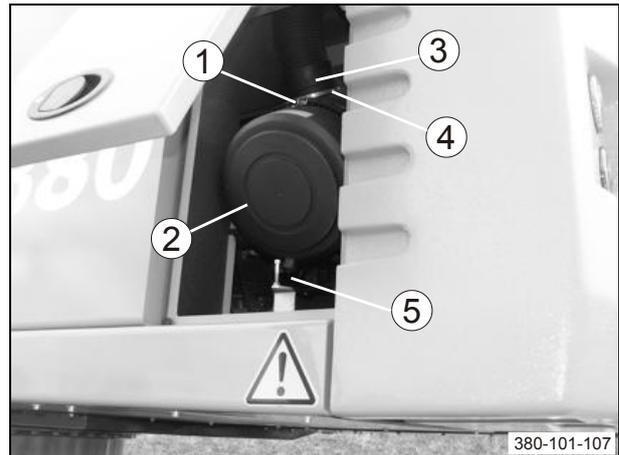


Fig. 198 Dust collector

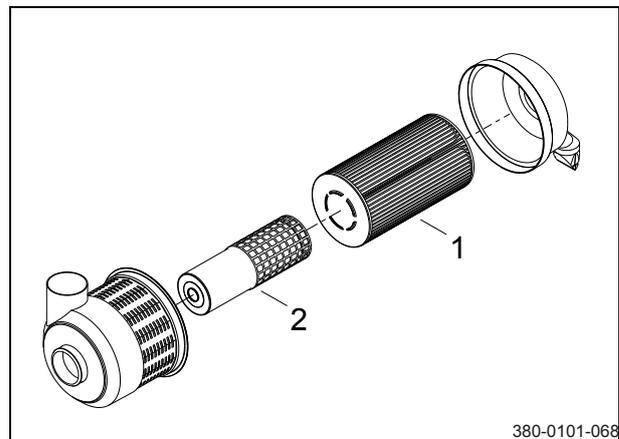


Fig. 199 Filter replacement

7.9.3.2 Cleaning the main cartridge

ATTENTION



Only blow out the main cartridge - never wash it or brush it out. When blowing out, take care to ensure that dust does not land on the inside of the main cartridge.

The main cartridge can be cleaned up to 5 times if necessary. The main cartridge must be replaced once it reaches its maximum service life of one year, at the latest. A record must be kept of the number of times it is cleaned.

For cleaning, a pipe with the end bent at 90° should be attached to the compressed-air pistol. The pipe must be long enough to reach the floor of the cartridge. Blow out the main cartridge from the inside to the outside with dry compressed air (max. 5 bar) by moving the pipe up and down in the cartridge. Continue until no more dust escapes (200).

Check the clean main cartridge for damage to the paper bellows and rubber seals. Tears and perforations in the paper bellows can be determined using a torch.

ATTENTION



Do not install damaged main cartridges. The diesel engine can be damaged if dust is able to get into it.

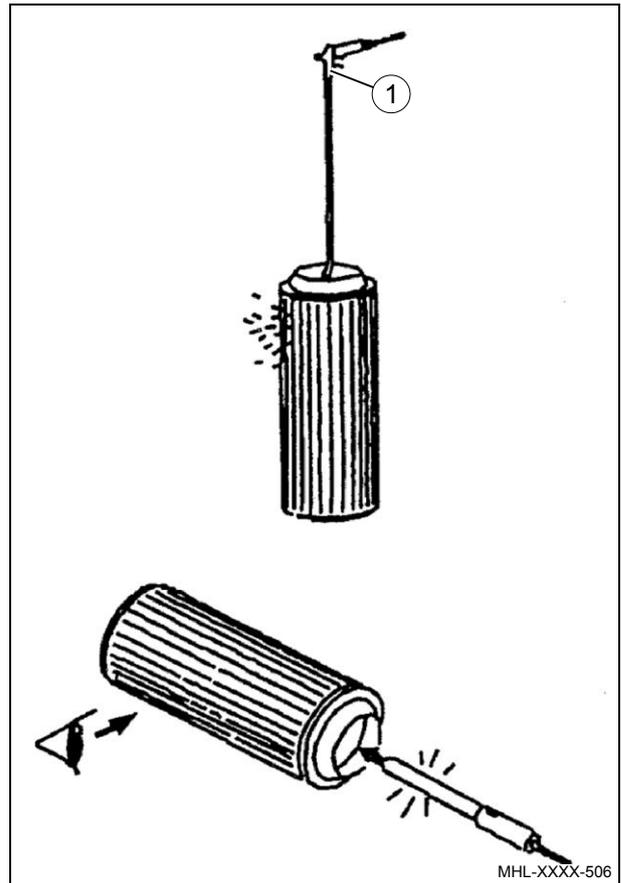


Fig. 200 Cleaning the main cartridge
1 Maximum 5 bar compressed air

7.9.3.3 Replacing the safety cartridge

ATTENTION



*Do not clean the safety cartridge and, once it has been removed, **do not use it again.***

- ▶ Open the support brackets (198/1) and remove the cover (198/2) with the dust emptying valve (198/5).
- ▶ Carefully turn and tip the main cartridge (199/1) to remove it.
- ▶ The safety cartridge (199/2) is located inside the main cartridge.
- ▶ Carefully turn and tilt the safety cartridge to remove it, then dispose of it in compliance with environmental regulations.
- ▶ Clean the inside of the air filter body and the sealing surface in the housing with damp cloths.
- ▶ Turn the new safety cartridge slightly to install it in the main cartridge.
- ▶ Install the main cartridge by turning it slightly into the filter body. Check to make sure it is seated correctly.
- ▶ Install the cover with the dust emptying valve below and fasten the support brackets (198/1).

7.9.3.4 Checking the clean air line

The clean air line between the filter output and the engine intake pipe (198/3) must be checked for damage and leaks every time the filter element is replaced.

If necessary, tighten the clamping bracket bolts (198/4).

7.9.4 Cooling system

The machine is equipped with separate coolers for combined water/charge air cooling and the hydraulic oil.

7.9.4.1 Coolant level

i Chapter 7.6.3.1 Coolant level in the engine cooling circuit

7.9.4.2 Checking the antifreeze

i Chapter 7.6.3.2 Checking the antifreeze

7.9.4.3 Cleaning the cooler

i Chapter 7.6.5 Cleaning the cooler

7.9.4.4 Changing the coolant in the combined water-charge air cooler

i Replace as described in chapter 7.8.3 Maintenance and inspection plan

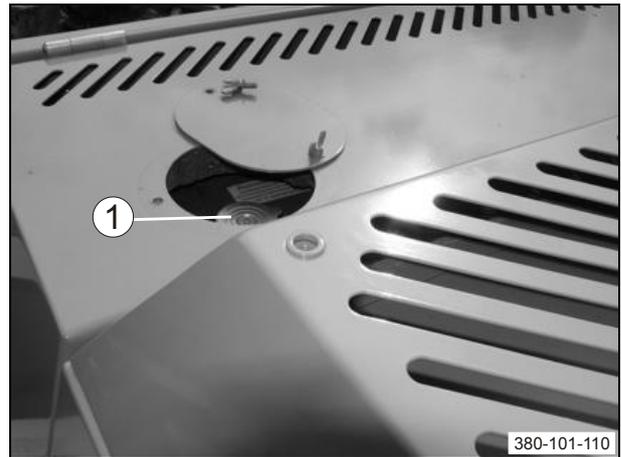


Fig. 201 Cooling system sealing cover



Fig. 202 Coolant drain plug on cooler

⚠ WARNING



Burns due to hot fluids and surfaces

- All work on the cooling system (e.g. opening the cooler cap, removing hoses) is only to be carried out when the diesel engine and the coolant have cooled down.
- Wear suitable protective clothing and safety goggles.

In an emergency: Administer first aid, seek treatment from a doctor

ATTENTION



Collect old coolant with a suitable reservoir. Do not allow it to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

- ▶ Park the machine on level ground.
- ▶ Place a basin under the diesel engine and cooler to collect the coolant.
- ▶ First release the pressure from the cooling system cover (201/1) and then from the cooler.
- ▶ Unscrew the protective cap from the drain valve (202/1).
- ▶ Open the drain valve on the cooler (202/1), drain coolant and dispose of it in compliance with environmental regulations.

- ▶ Unscrew the coolant drain plug (203/1) on the cylinder block and drain off the coolant. Collect the drained coolant in a suitable container. Dispose of the coolant in compliance with environmental regulations.
- ▶ If necessary, rinse the cooling system with clean water.
- ▶ Reinstall coolant drain plug (203/1) on the diesel engine.
- ▶ Close the drain valve on the cooler (202/1).
- ▶ Screw the protective cap onto the drain valve (202/1).
- ▶ Open the vent point (204/1) two turns.
- ▶ Fill the cooling system with coolant.
 - ❏ Chapter 3.15 Fuels, lubricants and coolants
Chapter 7.6.3.2 Checking the anti-freeze.
- ▶ Seal the cooler with the cap (201/1).
- ▶ Close the vent point (204/1).
- ▶ Start the diesel engine and allow it to run for a short time. Always monitor the motor temperature when the engine is running!
- ▶ Stop the diesel engine and allow to cool down. Check the coolant level and top up (several times, if necessary). Check the tightness of the cooling system.
- ▶ Start the diesel engine and run it up to the operating temperature.
- ▶ Switch on the heating and allow it to heat up.
- ▶ Stop the diesel engine and allow to cool down.
- ▶ Perform venting at the vent point (204/1).
- ▶ Check the coolant level and top up (several times, if necessary).
- ▶ Check the tightness of the cooling system.

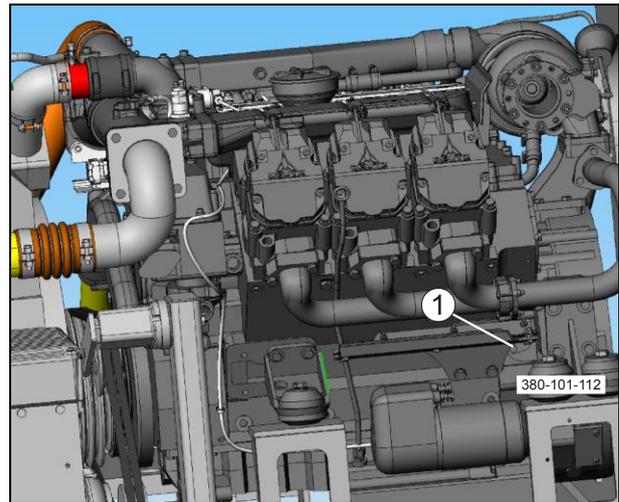


Fig. 203 Coolant drain plug on the cylinder block

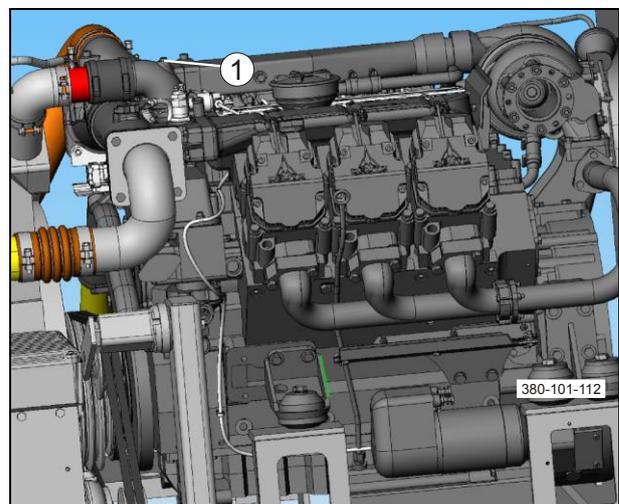


Fig. 204 Vent point

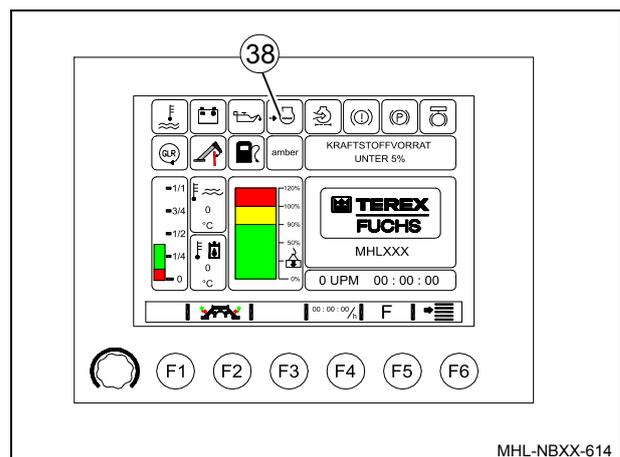


Fig. 205 Coolant level

ATTENTION



If the coolant level indicator (205/38) lights up, bring the diesel engine to idle immediately and then turn it off.

Check the coolant level and top up if necessary.

7.9.5 Checking V-belt / ribbed V-belt

-  Replace as described in chapter 7.8.3 Maintenance and inspection plan.

|  WARNING | |
|--|---|
|  | <p>Danger of injury due to rotating parts</p> <ul style="list-style-type: none"> • V-ribbed belts should be checked and tightened only when the diesel engine is stopped. • Secure the engine against being started without authorization. <p>In an emergency: Administer first aid, seek treatment from a doctor.</p> |

| ATTENTION |
|---|
| <p><i>We recommend using a V-ribbed belt tension measuring instrument to check the V-belt tension.</i></p> <p><i>Follow the manufacturer's operating instructions when carrying out the test.</i></p> |

Checking without a tension measuring device

Press down on the V-ribbed belt with your thumb at the centre of the longest free length and measure the sag of the belt.

When medium thumb pressure of approx. 45 N (about 4.5 kg) is applied, the V-ribbed belt sag should equal 13 mm.

If a V-ribbed belt exhibits tears or if it is contaminated with oil, coolant, grease etc., it must be replaced.

7.9.5.1 Tensioning V-belts of generator

- ▶ Switch off the diesel engine and remove the ignition key.
- ▶ Disconnect the power supply using the battery isolator switch.
- ▶ Loosen the screws (206/1) and fastening screws (206/2), but do not screw them out completely.
- ▶ Loosen counter nut (206/3) of adjusting bolt (206/4). Tighten adjusting bolt (206/4) clockwise until the V-belt (206/5) has reached the required belt tension.
- ▶ Tighten screw (206/1) and fastening screws (206/2), as well as counter nut (206/3) of tensioning bolt.
- ▶ Check the tension again.
- ▶ Switch the battery isolator switch on.

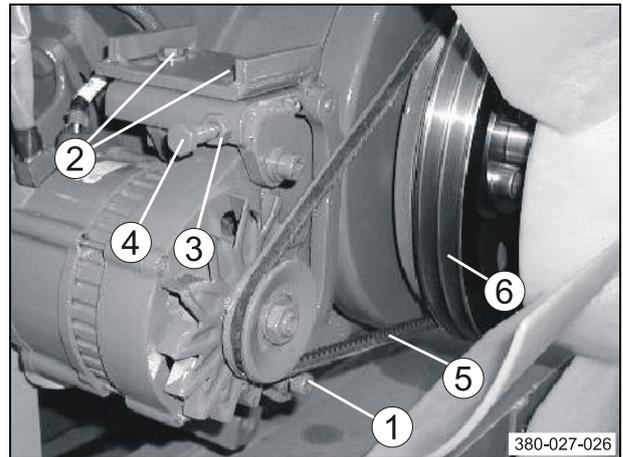


Figure 206 Tensioning and replacing V-belts

7.9.5.2 Replacing the belts alternator on the generator

- ▶ Switch off the diesel engine and remove the ignition key.
- ▶ Switch the battery isolator switch off.
- ▶ Unscrew the nuts (207/1) on the fan and remove the fan in front of the cooler.
- ▶ Loosen the screws (207/1) and fastening screws (207/2), but do not screw them out completely.
- ▶ Loosen counter nut (207/3) of adjusting bolt (207/4). Unscrew adjusting bolt (207/4) until the V-belt (207/5) can be lifted above the pulley (207/6) and removed.
- ▶ Fit and tension the new V-belt.
- ▶ Chapter 7.9.5.1 Tensioning V-belts of generator
- ▶ Tighten the screw (207/1) and fastening screws (207/2), as well as the lock nut (207/3) of the adjusting bolt.
- ▶ Install the fan impeller.
- ▶ Check the correct function of the fan blade.
- ▶ ⚠ For the test run, close all openings to the engine compartment!
- ▶ Switch the battery isolator switch on.
- ▶ Perform a trial run.
- ▶ Check the tension of the new V-belt after 15 minutes with the battery isolator switch turned off, and adjust if necessary.

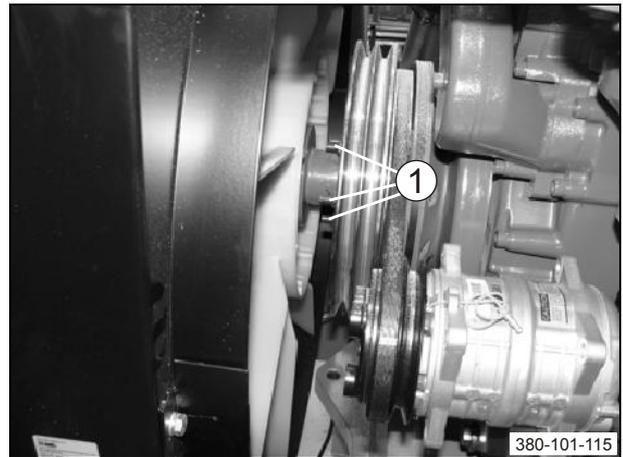


Fig. 207 Unscrewing the fan impeller

7.9.5.3 Replacing and tensioning the V-belt for the air conditioning compressor

- ▶ Switch off the diesel engine and remove the ignition key.
- ▶ Switch the battery isolator switch off.
- ▶ Unscrew the nuts (207/1) on the fan and remove the fan in front of the cooler.
- ▶ Loosen the fastening screws (208/1-3) but do not screw them out completely.
- ▶ Use a suitable tool (e.g. a tire lever) to swing the air conditioning compressor far enough so the V-belt can be removed.
- ▶ Fit a new V-belt.
- ▶ Use a suitable tool (e.g. a tire lever) to swing the air conditioning compressor far enough so that the correct V-belt tension is reached.
- ▶ Tighten the fastening screws (208/1-3).
- ▶ Install the fan impeller.
- ▶ Check that the ventilator works correctly.
- ▶ ⚠ For the test run, close all openings to the engine compartment!
- ▶ Switch the battery isolator switch on.
- ▶ Perform a trial run.
- ▶ Check the tension of the new V-belt after 15 minutes with the battery isolator switch turned off, and adjust if necessary.

7.9.6 Checking and adjusting valve lash

- ▣ Carry out maintenance as described in chapter 7.8.3 Maintenance and inspection plan.

Valve lash must be tested according to the operating instructions provided by the diesel engine manufacturer, and adjusted if necessary.

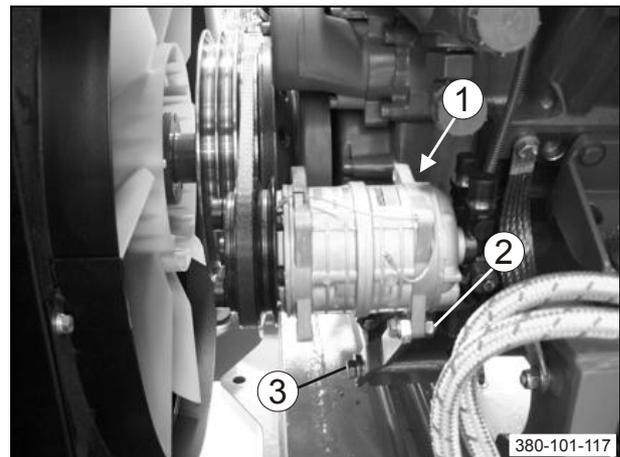


Fig. 208 Tensioning and replacing the V-belt for the air conditioning compressor

7.9.7 Venting the hydraulic pump

The hydraulic pump must be vented in order to work on the pump or if the oil in the hydraulic system needs to be changed.

Loosen the leakage oil hose (209/1) and let the air escape. As soon as hydraulic oil flows out, reconnect the leakage oil hose.

Before the pump is restarted after being repaired or replaced, the same connection should be used to fill the pump housing with hydraulic fluid.

7.9.8 Venting the pilot control

The pilot control must be vented if the pilot control oil circuit has been opened during maintenance or repair work.

The pilot control can be vented by loosening the venting screws (measuring connections) positioned on the control caps of the valves on the control block and on the control caps of the valves on the hydraulic swing gear motor.

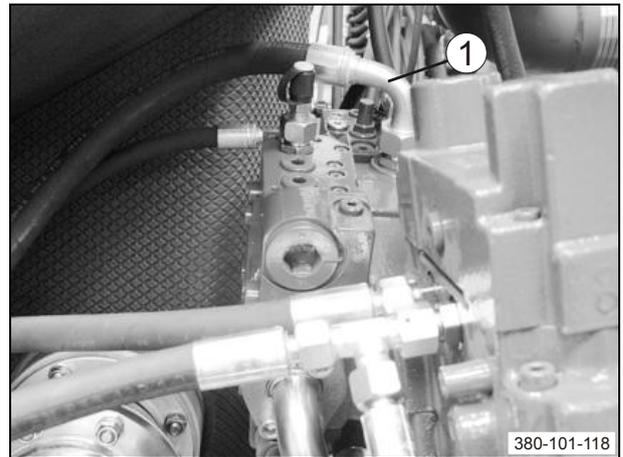


Fig. 209 Venting the hydraulic pump

7.9.9 Venting the brake

i Carry out maintenance as described in chapter 7.8.3 Maintenance and inspection plan.

ATTENTION



Collect old oil with a suitable reservoir. Do not allow it to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

- ▶ Run the diesel engine at medium speed.
- ▶ Apply the parking brake (211/65).
- ▶ Press and lock the service brake pedal (211/16).
- ▶ Remove the cap from the ventilation valve (210/1) and fit a suitable hose.
- ▶ Direct the hose into a container.
- ▶ Loosen the ventilation valve slightly using a key (W/F 9) and keep it open until hydraulic fluid which is free from bubbles flows into the container.
- ▶ Tighten the ventilation valve and refit the dust cap.
- ▶ Vent the other three brakes as described.

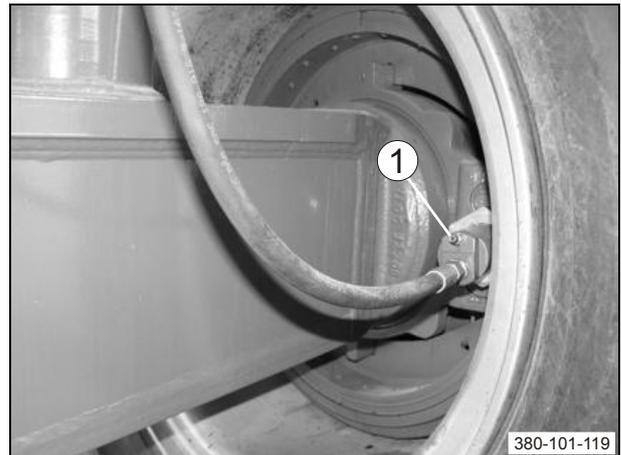


Fig. 210 Venting the brake

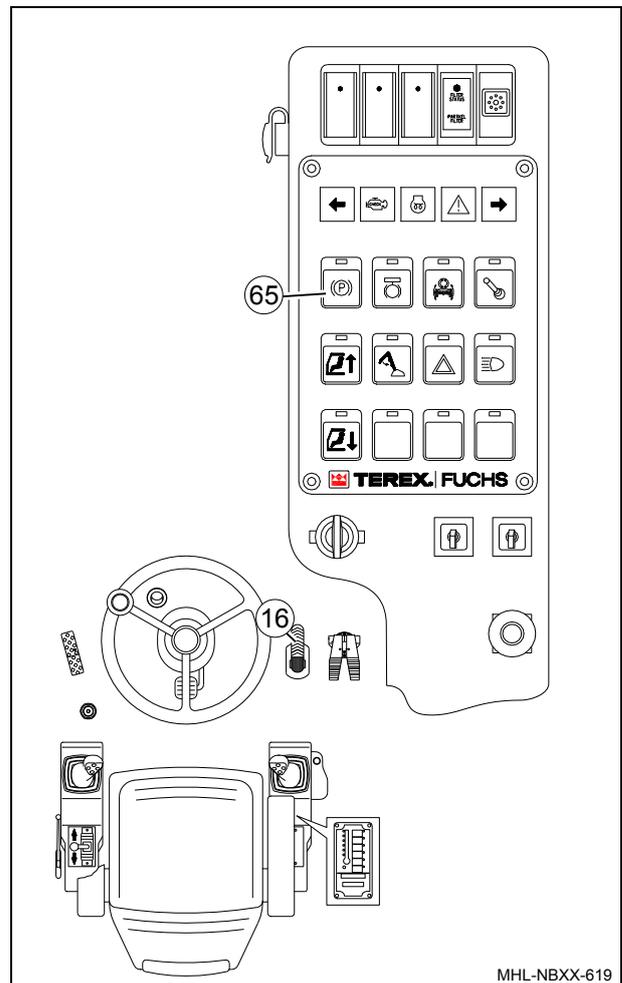


Fig. 211 Venting the brake

7.9.10 Venting the parking brake

i Carry out maintenance as described in chapter 7.8.3 Maintenance and inspection plan.

ATTENTION



Collect old oil with a suitable reservoir. Do not allow it to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

- ▶ Press and lock the service brake pedal (213/16).
- ▶ Release the parking brake (213/65).
- ▶ Run the diesel engine at medium speed.
- ▶ Open the vent plug (212/1) on the parking brake.
- ▶ When hydraulic oil which is free from bubbles flows out, close the vent plug (212/1).

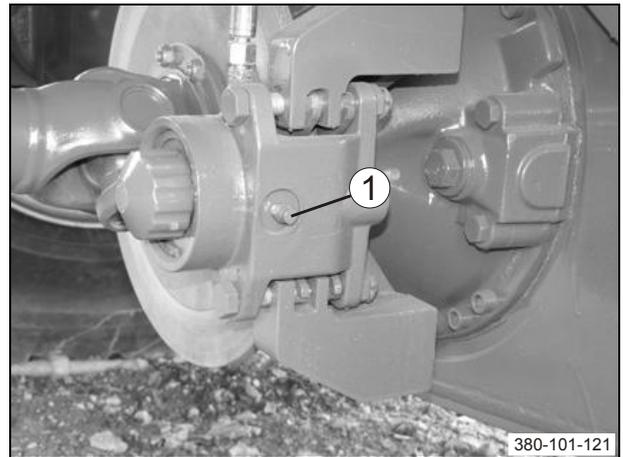


Fig. 212 Venting the parking brake

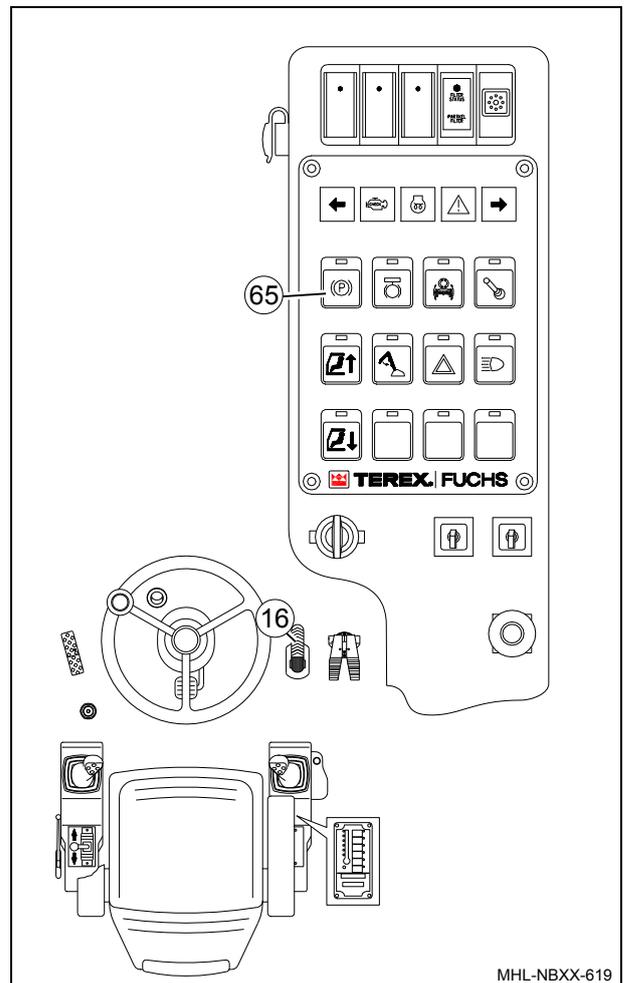


Fig. 213 Venting the parking brake

7.9.11 Adjusting the play of the parking brake

- i** Carry out maintenance as described in chapter 7.8.3 Maintenance and inspection plan.
- ▶ Release the parking brake (213/65).
 - ▶ Remove the screw cap (214/1).
 - ▶ Loosen the counter nut (214/3).
 - ▶ Screw in the threaded pin (214/2) until resistance is felt (brake pads (215/4) in contact with brake disk (215/5)).
 - ▶ Screw the threaded pin (214/2) back by half a turn.
 - ▶ Counter with nut (214/3).
 - ▶ Screw on the screw cap (214/1) hand-tight.

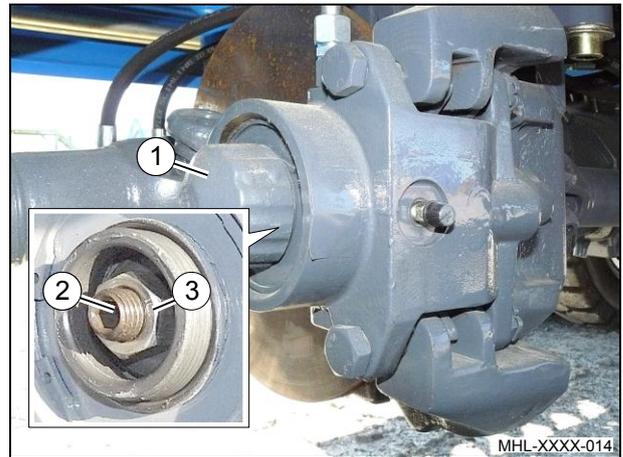


Fig. 214 Adjusting the parking brake

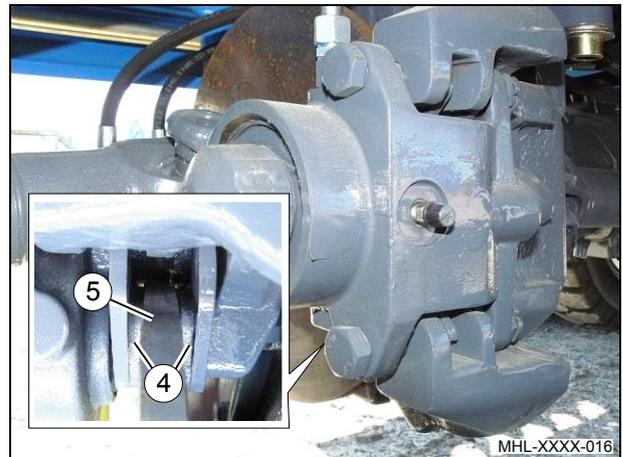


Fig. 215 Brake pads

7.9.12 Venting the oscillating axle cylinders

ATTENTION



Collect old oil with a suitable reservoir. Do not allow it to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

- ▶ The oscillating axle must be released. If the oscillating axle is unlocked, the control light in the button toggle (216/78) and the indicator (216/45) light up and the message (216/47) "OSCILLATING AXLE UNLOCKED" appears in the multifunction display.
- ▶ Jack up the machine so that the wheels of the oscillating axle are off the ground.
- ▶ Engage the service brake (216/16).
- ▶ Release the parking brake (216/65).
- ▶ Run the diesel engine at medium speed.
- ▶ Open the vent plugs (217/1) one after the other, until hydraulic oil flows out that is free from bubbles.
- ▶ Close the vent plug (217/1).

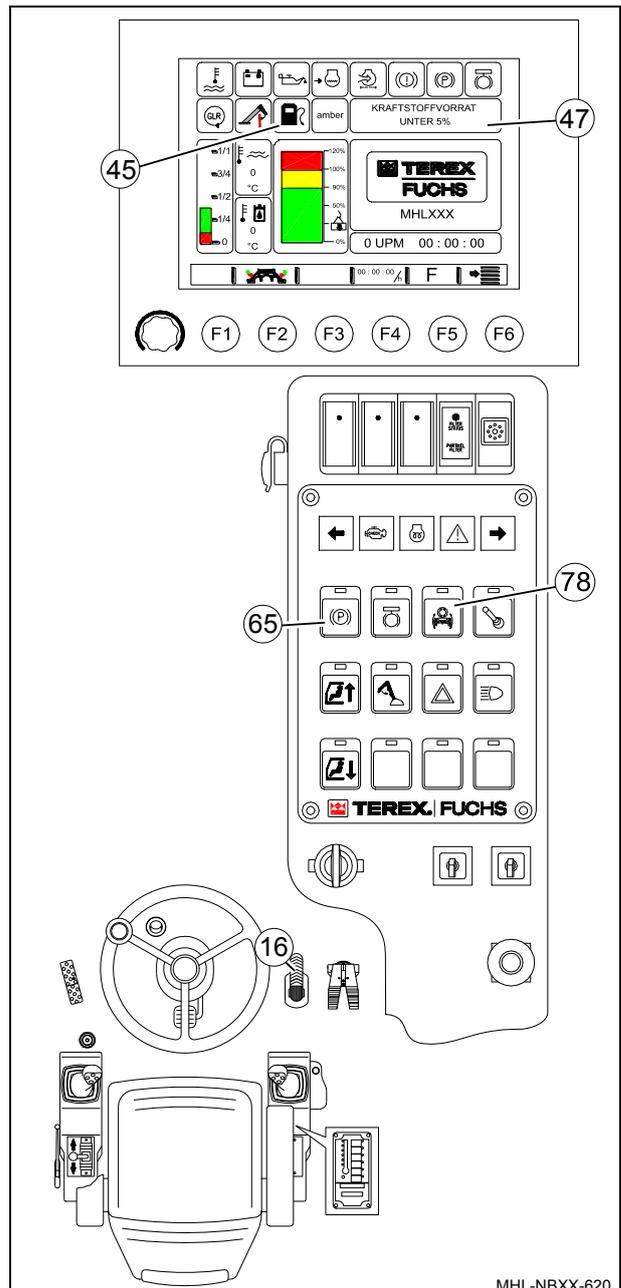


Fig. 216 Venting the oscillating axle cylinder

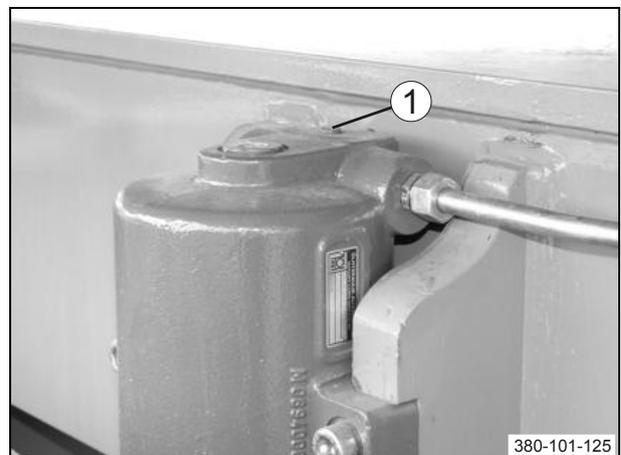


Fig. 217 Oscillating axle cylinder vent plug

7.9.13 Hydraulic system

i Filling quantities, oil quality, and oil change intervals: Chapter 3.15 Fuels, lubricants and coolants, Chapter 7.8.3 Maintenance and inspection plan, Chapter 7.2 Regular oil analyses

Maintenance work on the hydraulic system is limited mainly to the hydraulic fluid tank. No other assemblies in the system require special maintenance.

The pipe and hose network must be inspected for leaks at regular intervals.

| ⚠ DANGER | |
|-----------------|---|
| | <p>Danger to life due to hydraulic oil</p> <ul style="list-style-type: none"> Do not use your bare hands to perform the inspection. A fine spray of liquid under high pressure can penetrate the skin and cause severe injuries. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

| ATTENTION | |
|------------------|--|
| | <p><i>Absolute cleanliness is particularly important for the hydraulic system. Because of this, recommended intervals for replacing the return filter element, for cleaning the oil cooler and for oil changes must be observed.</i></p> |

| ⚠ WARNING | |
|------------------|---|
| | <p>Danger of injury due to residual pressure and heat</p> <p>The pressure in the hydraulic system must be reduced before performing any work on the hydraulic system. Note the following points:</p> <ul style="list-style-type: none"> Set down the loading equipment. Switch off the diesel engine. Activate the four-way control lever in all directions (with the ignition key in the contact position). Then unscrew the ventilation filter (219/1) by one turn. <p>Hydraulic oil is hot at operating temperature and may be under pressure.</p> <ul style="list-style-type: none"> Avoid touching hot oil or parts carrying oil. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

7.9.13.1 Checking the hydraulic oil level

i Chapter 7.6.4 Checking the hydraulic oil level

7.9.13.2 Changing hydraulic fluid

ATTENTION

Change the hydraulic fluid at operating temperature.

- ▶ Retract all hydraulic cylinders.
- ▶ Switch off the diesel engine.
- ▶ Unscrew the ventilation filter (219/1).
- ▶ Place suitable oil drip pans below the engine.

⚠ WARNING



Burns due to hot fluids and surfaces

- Hot oil can cause burns if it comes into contact with the skin or eyes. Wear suitable protective clothing and safety goggles

In an emergency: Administer first aid, seek treatment from a doctor

- ▶ Remove the cover plate under the hydraulic tank. Loosen the sealing cap (218/1) on the drain valve of the hydraulic oil tank and drain the oil into clean containers.

ATTENTION



Collect old oil with a suitable reservoir. Do not allow it to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

- ▶ Close the sealing cap on the drain valve carefully. Screw the cover plate back on under the hydraulic tank.

⚠ WARNING



Danger of injury due to falling

- Before topping up the hydraulic oil, make sure that suitable equipment for this purpose (e.g. a pedestal) is at hand.

In an emergency: Administer first aid, seek treatment from a doctor

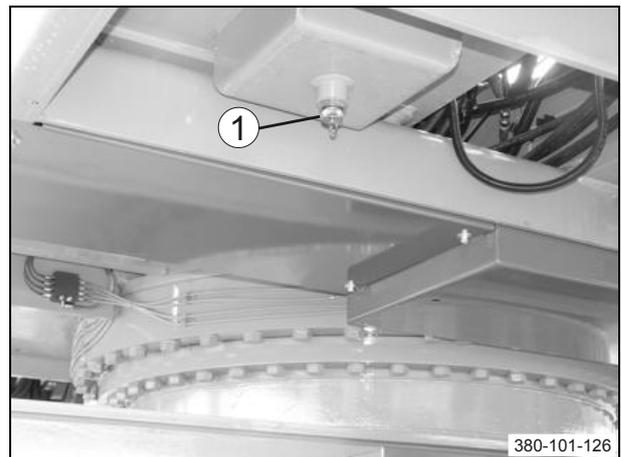


Fig. 218 Drain valve

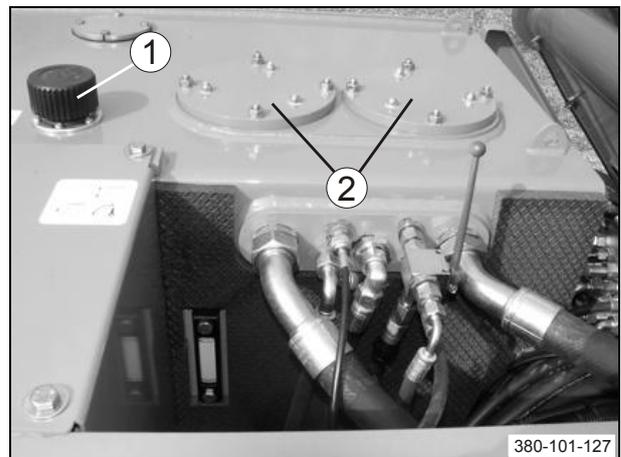


Fig. 219 Ventilation and return filter

- ▶ Open the covers (219/2) of the return filters and remove the complete filter (one or two return filters depending on the machine type).
- ▶ Rinse and clean the hydraulic tank if necessary.
- ▶ Add clean hydraulic oil through the opening of the ventilation filter (219/1). Vent hydraulic pump.
 - ⓘ Chapter 7.9.7 Venting the hydraulic pump
- ▶ Screw on the ventilation filter.
- ▶ Close the covers of the return filters and install the complete filter.

7.9.13.3 Hydraulic oil – return filter

i Replace as described in chapter 7.8.3 Maintenance and inspection plan.

ATTENTION



Replace the filter element after a test run if there is damage to the hydraulics or following major repair work.

Faulty hydraulic attachments can reduce the service life of the return filter.

The pressing force of the return filter must be routinely checked every time the return filter is opened or closed.

Replacing the filter element

WARNING



Danger of injury due to falling

- Before replacing the filter element, make sure that suitable equipment for this purpose (e.g. a pedestal) is at hand.

In an emergency: Administer first aid, seek treatment from a doctor

The part must be replaced as soon as the indicator (220/39) lights up continuously. The indicator may light up briefly, but this is circumstantial and is usually caused by the engine speed being increased too quickly.

ATTENTION

The same procedure applies to both return filters!

- ▶ Switch off the diesel engine.
- ▶ Use a tool to loosen the cover (221/1) of the return filter and then unscrew it.
- ▶ Check the condition and seal of the cover.
- ▶ Remove the return filter on the bow (221/6) from the hydraulic tank.
- ▶ Clean the O-ring (221/3) between the hydraulic tank and the return filter cover.

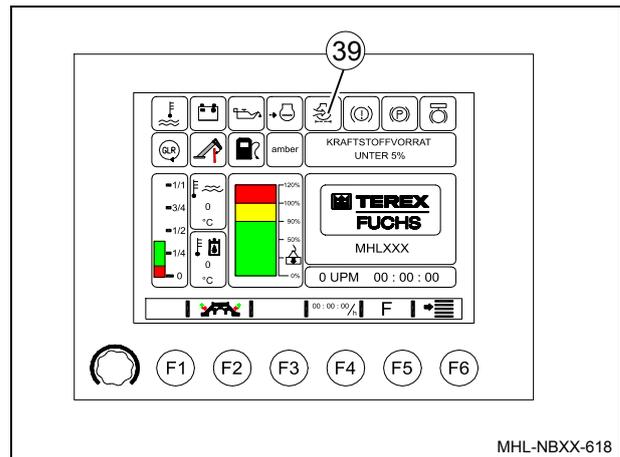


Fig. 220 Return filter clogging

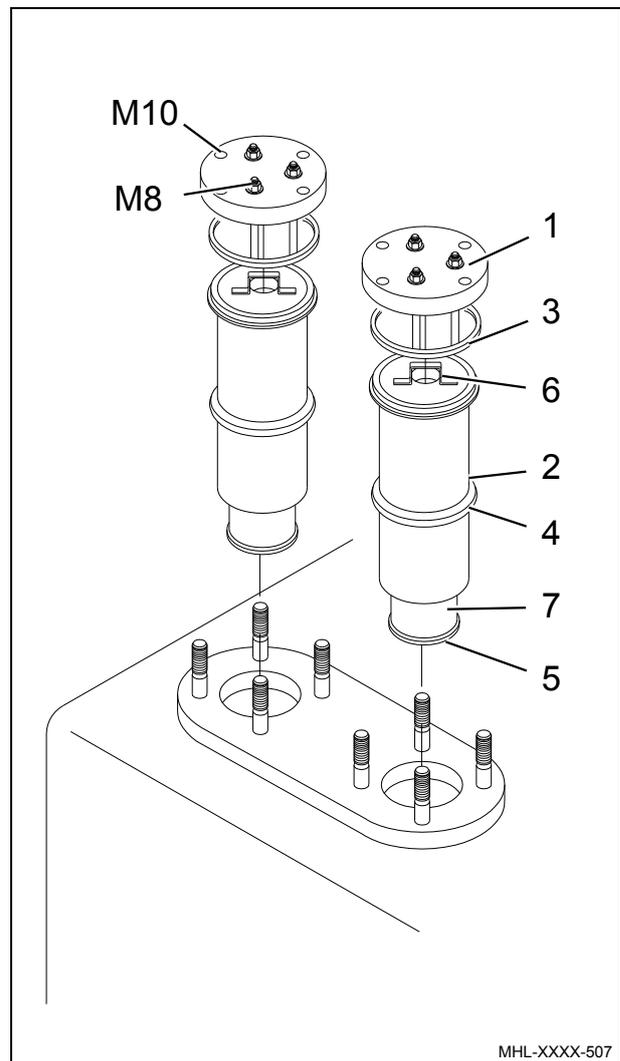


Fig. 221 Return filter

- ▶ Check the O-ring (221/4) and replace if necessary.
- ▶ Insert the new return filter into the hydraulic tank with the O-ring.
- ▶ Oil the cover seal slightly and place the cover of the return filter on the hydraulic tank with the O-ring.
- ▶ Check the distance between the hydraulic tank and the cover: The distance should be about 2 mm with the cover screws loosened.
- ▶ If necessary, adjust the distance using the three M8 set screws (221), and lock.
- ▶ Tighten the M10 cover nuts. As you do so, make certain the O-ring is correctly placed between the cover and the hydraulic tank.
- ▶ Check the filter for leaks.

7.9.13.4 Hydraulic oil – ventilation filter

- ❗ Replace as described in chapter 7.8.3 Maintenance and inspection plan.

Remove the breather (219/1), replace it with a new filter and tighten such that it is hand-tight.

ATTENTION

Replace the ventilation filter if it has become contaminated by hydraulic fluid mist.

7.9.13.5 Blocking off the hydraulic oil on the tank

To enable repairs to the intake line, the hydraulic pump or the hydraulic lines to be undertaken without having to drain the oil from the tank, the oil supply line to the main pump can be blocked off.

- ▶ Remove the fillister-head screw (222/1) on the retaining fixture.
- ▶ Remove the retaining fixture (222/2).
- ▶ Using a fork wrench, turn the square through 90° from the open position (223/1) to the shut-off position (223/2).

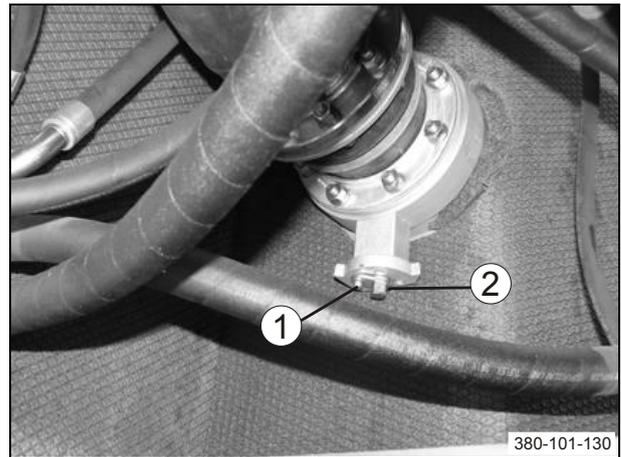
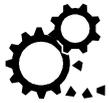


Fig. 222 Blocking off the hydraulic oil

ATTENTION



The marking on the end face of the square must lie at right angles to the passage.

When repair work is complete, it is essential to turn back the square to the open position (223/1) before the engine is switched on. Otherwise, the hydraulic pump will be damaged beyond repair when the engine starts up.

- ▶ Fasten the retaining fixture (222/2) once more with the fillister-head screw (222/1) and secure with Loctite "blue".

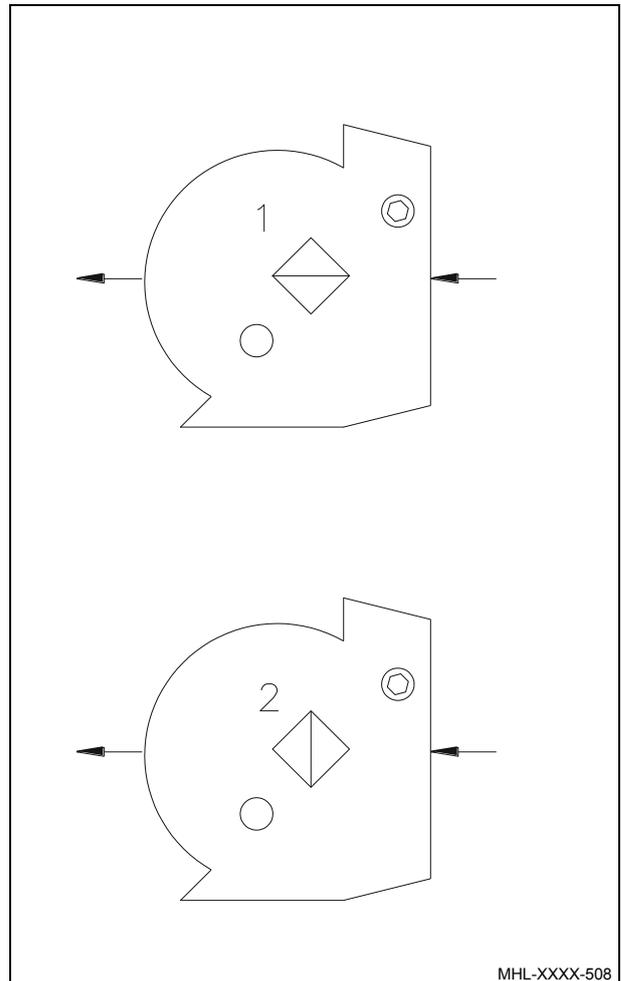


Fig. 223 Direction of flow

7.9.14 Changing axle and transmission oil

- i** Filling quantities, oil quality, and oil change intervals: chapter 3.15 Fuels, lubricants and coolants, chapter 7.8.3 Maintenance and inspection plan, chapter 7.2 Regular oil analyses

The axle oil must be changed at operating temperature.

ATTENTION



Collect old oil with a suitable reservoir. Do not allow them to seep into the ground or water! Give to an authorized waste disposal company to dispose of in an environmentally-friendly manner.

ATTENTION

After filling the axles with oil, move the machine for approx. 5 minutes in order to ensure that the oil is distributed. Check the oil level again and top up if necessary.

7.9.14.1 Front axle differential

ATTENTION

The steering axle's wheel hubs and axle casings (differentials) have separate oil chambers.

Checking the axle oil level

- ▶ Remove the check and filler plug (224/1), check and top up with oil if necessary.

Changing axle oil

- ▶ Park the machine on level ground.
- ▶ Apply the parking brake.
- ▶ Open the check and filler plug (224/1).
- ▶ Open the drain plug (224/2) on the differential and drain oil.
- ▶ Flush out the axle if necessary.
- ▶ Carefully close the drain plug (224/2).
- ▶ Fill with oil through the check and filler plug (224/1) up to the bottom edge of the bore.
- ▶ Carefully close the check and filler plug.

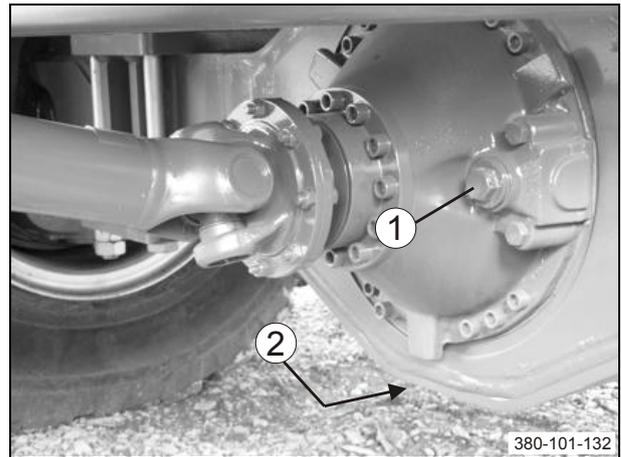


Fig. 224 Front axle differential

7.9.14.2 Rear axle differential

Checking the axle oil level

- ▶ Remove the check and filler plug (225/1), check and top up with oil if necessary.

Changing axle oil

- ▶ Park the machine on level ground.
- ▶ Apply the parking brake.
- ▶ Open the check and filler plug (225/1).
- ▶ Open the drain plug (225/2) on the differential and drain oil.
- ▶ Flush out the axle if necessary.
- ▶ Carefully close the drain plug (225/2).
- ▶ Fill with oil through the check and filler plug (225/1) up to the bottom edge of the bore.
- ▶ Carefully close the check and filler plug.

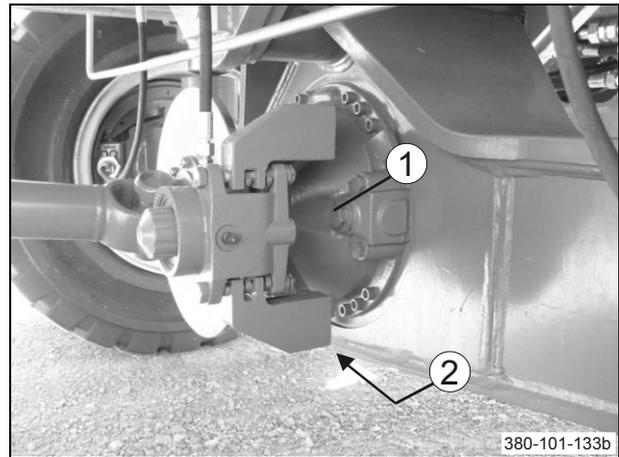


Fig. 225 Rear axle differential

7.9.14.3 Wheel hub

ATTENTION

The wheel hubs and axle casings (differentials) have separate oil chambers.

Checking the oil level

- ▶ Turn the wheel until the drain plug (226/2) on the hub is at the bottom.
- ▶ Remove the check and filler plug (226/1), check and top up with oil if necessary.

Changing the oil

- ▶ Turn the wheel until the drain plug (226/2) on the hub is at the bottom.
- ▶ Open the check and filler plug (226/1).
- ▶ Open the drain plug and drain the oil.
- ▶ Rinse if required.
- ▶ Carefully close the drain plug.
- ▶ Fill with oil through the check and filler plug (226/1) up to the bottom edge of the opening.
- ▶ Carefully close the check and filler plug.

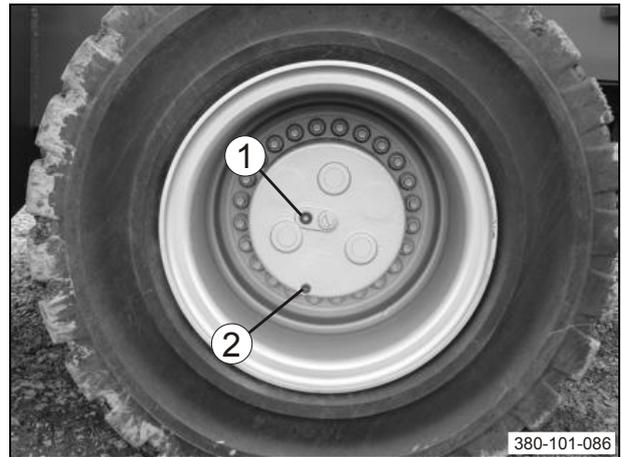


Fig. 226 Wheel hub

7.9.14.4 Transfer gear



Figure 227 Transfer gear

Checking the oil level

- ▶ Park the machine on level ground.
- ▶ Check transfer gear oil level in sight glass (227/3) and top up if necessary.

Changing the oil

- ▶ Park the machine on level ground.
- ▶ Open the check and filler plug (227/1).
- ▶ Open the drain plug (227/2) and drain the oil. Rinse the transmission if required.
- ▶ Carefully close the drain plug (227/2).
- ▶ Fill with oil through the check and filler plug (227/1). Check transfer gear oil level in sight glass (227/3).
- ▶ Carefully close the check and filler plug.

7.9.14.5 Swing gear

ATTENTION

The procedure is the same for both swing gears.

- ▶ Park the machine on level ground.
- ▶ Unscrew the cover (228/2) on the oil filler.
- ▶ Unscrew the service opening cover (228/4).
- ▶ Connect the drain hose to the shuttle valve (228/3). Open the valve and drain the oil.
- ▶ Carefully close the valve. Remove the drain hose from the shuttle valve (228/3).
- ▶ Screw on the service opening cover (228/4).
- ▶ Add new oil.
- ▶ Check the oil level with the oil level dipstick (228/1).
- ▶ Seal the oil filler with the cover (228/2).

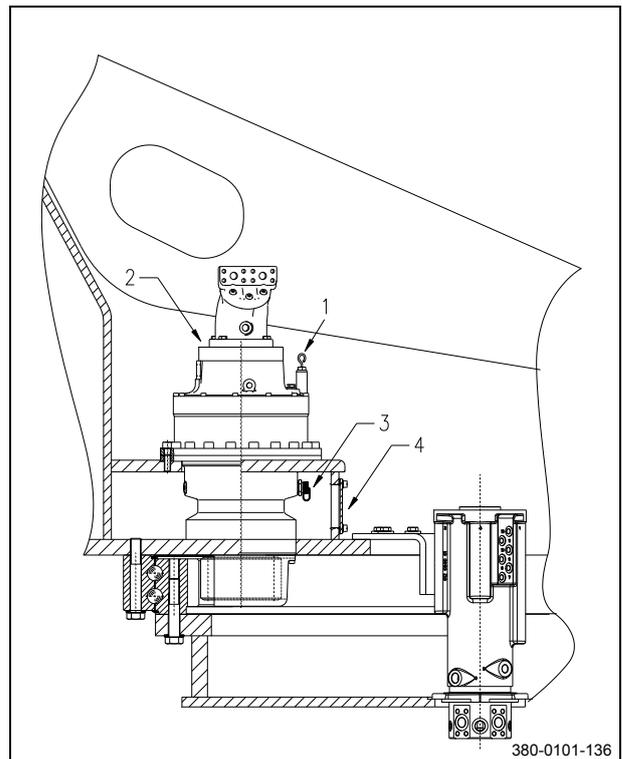


Fig. 228 Swing gear

7.9.15 Slewing joint

7.9.15.1 Checking the fastening of the slewing joint

ATTENTION



In the case of new fastenings, the screws should be checked after 100 operating hours. The bearing surfaces of the screw heads must be bare metal, i.e. absolutely free of grease and paint. The thread and the screw head must not be damaged.

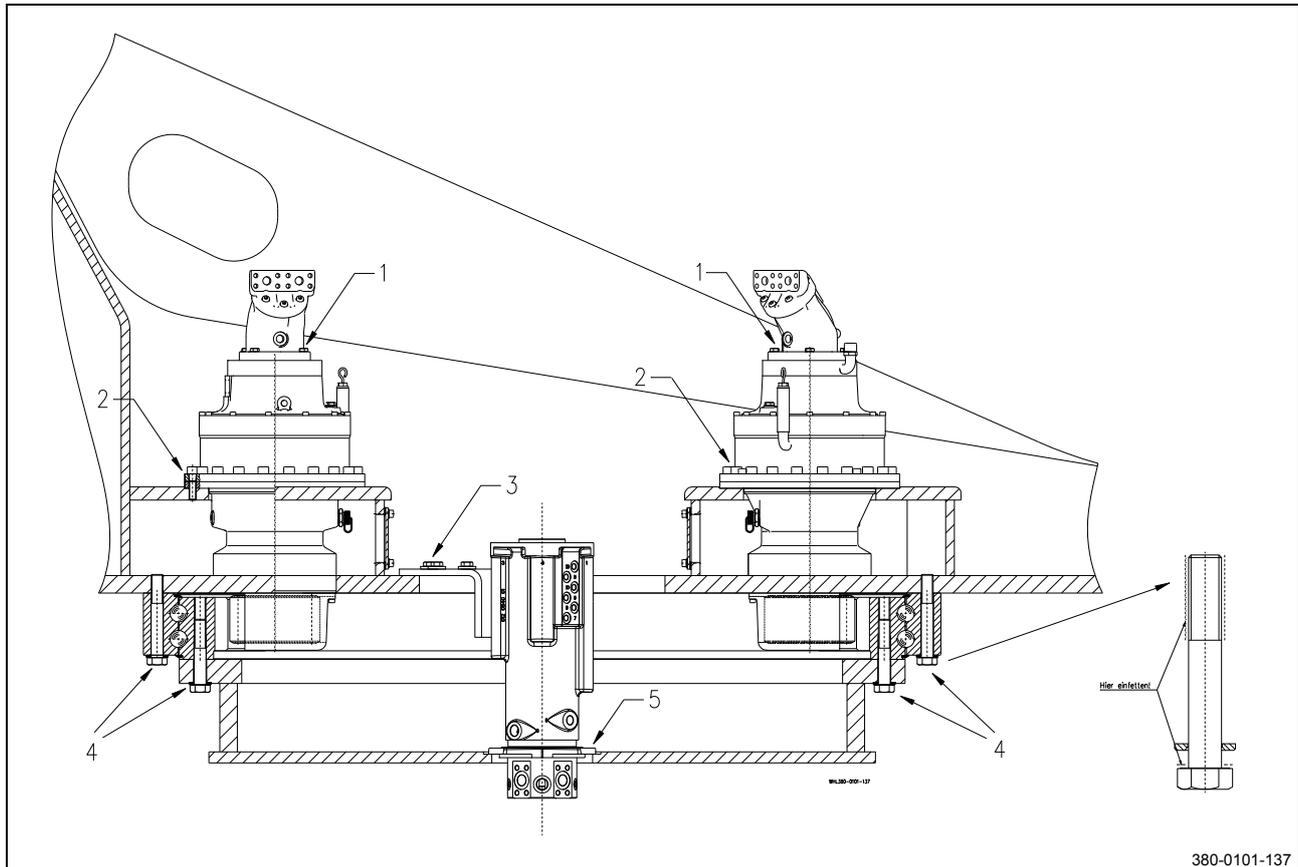


Fig. 229 Tightening torque

| Item No | Tightening torque | Item No | Tightening torque |
|---------|-------------------|---------|-------------------|
| 1 | 85 Nm | 4 | 1,500 Nm |
| 2 | 195 Nm | 5 | 210 Nm |
| 3 | 210 Nm | | |

ATTENTION



Use only original TEREX | Fuchs screws when replacing the slewing ring screws (229/4). Grease the slewing ring screws (229/4) on the thread and under the screw head with multi-purpose grease before screwing them in.

7.9.16 Slip ring bodies (optional)

A slip ring body is located on the rotary transmission to supply power to the undercarriage. The slip ring body is sensitive to moisture. A layer of oxide, which inhibits the flow of current, can form on conducting surfaces. Electrical consumers in the undercarriage will no longer receive an adequate supply of electrical current, which can result in malfunctions.

To counteract this effect, the following jobs should be performed every 500 operating hours:

Unscrew the lock nuts and remove the slip ring body housing. Clean oxidation off the slip rings (use a cleaning spray if necessary). Replace worn out (eaten through) cable lugs and spray "Cramolin" contact spray on all slip ring elements.

Set the housing in place and tighten each lock nut to the same extent.

7.10 Care and cleaning

ATTENTION

The machine must be cleaned on a suitable surface with an oil separator.

- ▶ The machine must not be cleaned with a high-pressure cleaner in the first two months after being put into operation or painted. This will allow the paint to cure completely.
 - ▶ Do not use aggressive detergents to clean the machine. We recommend using commercially available cleaning agents for passenger cars.
 - ▶ When cleaning with a high-pressure cleaner, the hot water jet must not exceed a temperature of 80°C and a spray pressure of 70 bar. The nozzle must be at least 30 cm away from the machine.
 - ▶ The slewing ring of the machine must **not** be cleaned with a high-pressure cleaner, otherwise the seals will be damaged.
 - ▶ Propshafts with maintenance-free bearing bushings must also not be cleaned with a high-pressure cleaner. Doing so could have a detrimental effect on the three-lip seal.
 - ▶ Linings (insulating materials, etc.) must not be directly exposed to water or high-pressure jets.
 - ▶ When cleaning with water or high-pressure stream, take care not to spray electrical components such as solenoid valves, pressure switches, connectors etc., as well as the central electrical system.
 - ▶ If the engine is cleaned with water or high-pressure jets, do not expose sensitive engine parts (e.g. the generator, cabling, oil pressure switch, etc.) directly to the jet. Do not aim water jets at exhaust gas and air cleaner openings.
- ▶ The machine must be lubricated according to the lubrication schedule after every wet cleaning operation. All work movements and travel functions must be carried out. In the case of machines with a central lubrication system, three lubricating processes must be triggered manually.
1. Manual lubrication:
Chapter 7.7.4.1 Triggering an additional lubrication pulse.

7.10.1 Rear view camera

The glass (230/1) in the rear view camera should be cleaned if dirty.

| ⚠ DANGER | |
|---|---|
|  | <p>Danger to life due to obscured view</p> <p>Dirty or damaged glass reduces the quality of the camera image and the area which can be seen.</p> <p><i>If the camera image is poor:</i></p> <ul style="list-style-type: none"> • Clean glass immediately. • If the camera image is still poor, have the rear view camera repaired. • In the case of missing images or poor quality of the display, the backup must be stopped immediately. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

- Use a clean, soft cloth (such as one used to clean reading glasses) to remove loose dust.
- Use a standard, liquid glass cleaner to remove stubborn dirt. Do not use aggressive fluids (spirits).

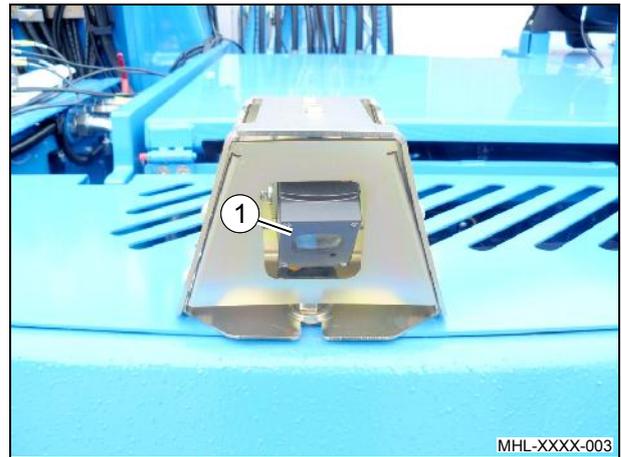
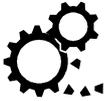


Fig. 230 Rear view camera

7.11 Shutdown

7.11.1 Preserving the machine for temporary shutdown

ATTENTION



In order to prevent damage (corrosion, etc.) being sustained in storage during shutdown periods lasting longer than three months, certain preservation measures must be taken.

Preservation measures:

- ▶ We recommend keeping the machine in a dry, dust-free room during the storage period.
- ▶ Clean the inside and outside of the machine thoroughly, including the engine.
- ▶ Lubricate the machine according to the lubrication schedule.
- ▶ Check the oil levels of all assemblies such as transmissions, etc., and top up if necessary.
- ▶ Check the hydraulic fluid level and top up if necessary.
- ▶ Repair paint damage.
- ▶ Fill the diesel tank in order to prevent corrosion of the tank walls.
- ▶ Check the antifreeze level in the coolant and adjust if necessary.
- ▶ Perform all the preservation measures listed in the diesel engine operating instructions.
- ▶ Treat the bare piston rods of the hydraulic cylinders with a commercially available corrosion protection agent.
- ▶ Remove and clean the batteries and store them as specified in a dry room that does not freeze during winter. Coat connections with pole grease.
- ▶ Seal off the air intake opening of the air cleaner system and the exhaust pipe opening.

7.11.2 During shutdown

Once the machine has been out of use for six months, all assemblies must be brought to operating temperature and set in motion for approx. 15 minutes.

First, the layer of corrosion protection must be cleaned off the piston rods of the hydraulic cylinders, and the openings of the air filter pipe and the exhaust pipe must be freed.

Once the machine has been set in motion, it must be preserved again as described above.

7.11.3 After shutdown

Proceed as follows when putting the machine back into operation:

- ▶ Clean the layer of corrosion protection off the piston rods of the hydraulic cylinders.
- ▶ Free the air filter pipe and the exhaust gas opening.
- ▶ Check the condition of the air cleaner main cartridge and safety cartridge and replace if necessary.
- ▶ Clean the machine with a neutral detergent.
- ▶ Check the batteries. If necessary, charge and install them.
- ▶ Follow the instructions in the diesel engine operating instructions for putting the diesel engine back into operation.
- ▶ Lubricate the machine according to the lubrication schedule.

7.11.4 Once the machine has been out of use for more than half a year

- ▶ Change the oil in assemblies such as the transmission, etc.
- ▶ Replace the hydraulic fluid filters (return and ventilation filters).

7.12 Disposal

⚠ DANGER**Serious or fatal injuries due to moving parts and residual energies**

- Only specialists authorized and trained by the manufacturer may undertake removal work.
- Observe the national safety standards for dismantling machinery.
- Wear safety clothing.
- Relieve pressure in hydraulic system.
- Individual hydraulic components are under high residual pressure. Only open disconnection points or components following consultation with the manufacturer.
- Pressure accumulators are filled with nitrogen and are pressurized. Do not open!
- The air conditioning system is filled with refrigerant. Observe the manufacturer's safety instructions.
- Secure moving parts against slipping and toppling down before and during dismantling.
- Store removed components in a safe place.

In an emergency: Administer first aid, seek treatment from a doctor

⚠ WARNING**Danger of injury due to battery acid**

- Remove battery and protect against damage.

In an emergency: Rinse eyes or skin immediately with fresh water. Seek treatment from a doctor immediately.

ATTENTION

Collect fuels, lubricants and coolants in suitable reservoirs. Do not allow them to seep into the ground or water! Give to an authorized waste disposal company to sort and dispose of in an environmentally-friendly manner.

| | | |
|----------|--|------------|
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8 Malfunction

8.1 General

Warning and fault messages:

- Various faults are indicated by corresponding LEDs or messages on the multifunction display.
 -  Chapter 4 Display and control elements.
- Some warning functions are also supported by an audible signal (buzzer).

Detecting and correcting malfunctions and errors:

- ▶ Malfunctions are often caused by incorrect operation or maintenance of the machine. Each time a malfunction occurs, you should therefore read the corresponding chapter in the operating instructions carefully again.
- ▶ Analyze the cause of the malfunction and correct it immediately.
- ▶ If you contact your TEREX | Fuchs dealer or Customer Service, please describe the malfunction and all accompanying circumstances as precisely as possible. Exact information makes it possible to find the cause of the malfunction quickly and eliminate it. Precise information about the machine type and vehicle ID number are also required.
- ▶ Do not perform any work for which you have not been trained and instructed.

ATTENTION



If you cannot detect or remedy the cause of the malfunction using the malfunction table, contact your dealer or a TEREX | Fuchs service engineer.

8.2 Diesel engine

All defects and faults in the diesel engine must be inspected as described in the separate Deutz operating instructions.

During the warranty period, malfunctions must be dealt with by the responsible service agent or a specialist workshop.

8.3 Lowering the loading equipment when the engine has shut down

If the diesel engine has shut down, you can lower the loading equipment by means of the four-way control levers, assuming that the necessary pilot pressure is available. The ignition must be switched on.

 Chapter 5.1.1 ISO control system

The machine can be equipped with hose rupture safety devices as an option which will keep the loading equipment in position if a hose or line breaks. Controlled lowering is possible.

8.4 Emergency control

The machine is equipped with an emergency control system. Please contact your dealer or a TEREX | Fuchs service engineer for more detailed information.

|  WARNING | |
|--|--|
|  | <p>Danger of injury due to unexpected machine movements.</p> <ul style="list-style-type: none">• You should only use emergency control to move the machine out of the danger zone.• Move the machine with care and be prepared for unexpected movements.• Inform all persons who operate or maintain the machine about the change in operation.• Any damage to the machine which requires the use of the emergency control must be made good immediately. <p>In an emergency: Administer first aid, seek treatment from a doctor</p> |

8.5 Malfunctions in the central electrical system

The fuses for the individual electrical circuits and various relays are located in the central electrical system (231/1) on the uppercarriage.

In the event of a malfunction, check the fuses. If they do not exhibit any defects, contact your dealer or a service engineer.

i Fuses: Chapter 9 Appendix.

8.5.1 Fuse test

The central electrical system includes a pushbutton (232/1) that can be activated to perform a fuse test when the ignition is turned on.

Faulty fuses are indicated by LEDs (232/2) lighting up red.

8.6 Malfunctions in the magnet system

ATTENTION

The malfunction display is only active when the diesel engine is running and the generator is turning.

- ▶ Check which malfunction is displayed in the operator device (233/1).
- ▶ Monitor the operating status using the LEDs (233/2).
- ▶ Switch off the machine and restart it to eliminate the error by means of a "RESET" if required.

If the malfunction occurs repeatedly, contact your dealer or a TEREX | Fuchs service engineer and tell them what you can see on the display.

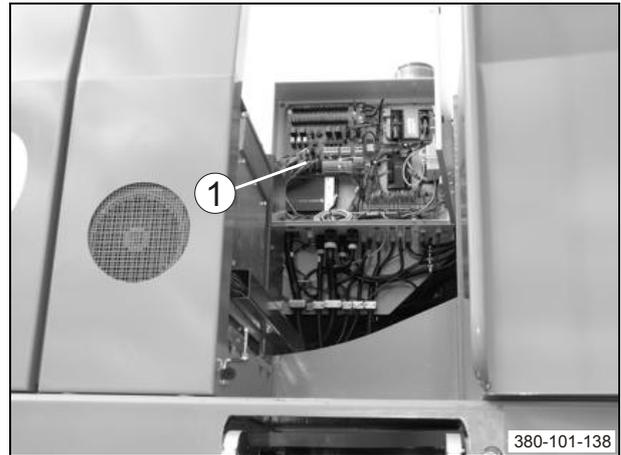


Fig. 231 Central electrical system

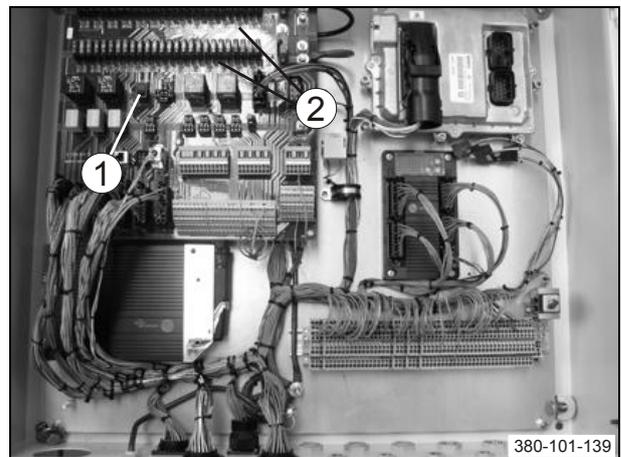


Fig. 232 Fuse test

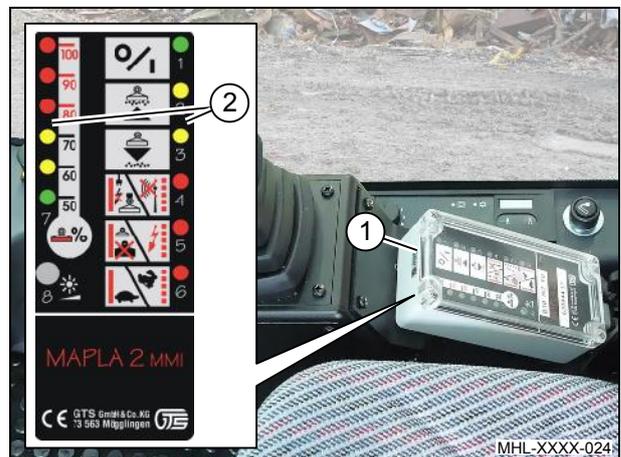


Fig. 233 Magnet system control device

8.7 Malfunctions in the load limit sensing control

Malfunctions of the load limit sensing control (BOSCH-Rexroth) are not indicated.

Verification of the load limit sensing control function is only possible for authorized service personnel. Fault diagnostics can be performed with the "BODEM" diagnostics software of BOSCH-Rexroth.

In order to ensure that the machine continues to operate in the event of malfunctions affecting load limit sensing control, load limit sensing control can be disconnected.

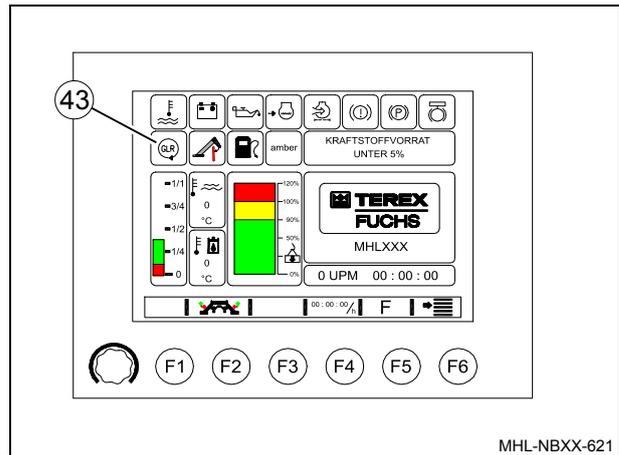


Fig. 234 Load limit sensing control

ATTENTION

The hydraulic pump is not controlled if the load limit sensing control is disconnected. This can overload the diesel engine to such an extent that it will come to a stop. This can make working conditions dangerous (e.g. risk of falling loads). Frequent overloading reduces the service life of the diesel engine.

Therefore, when load limit sensing control is disconnected, the machine should only be moved for short periods of time and under reduced load. Load limit sensing control must be repaired immediately by an authorized service engineer.

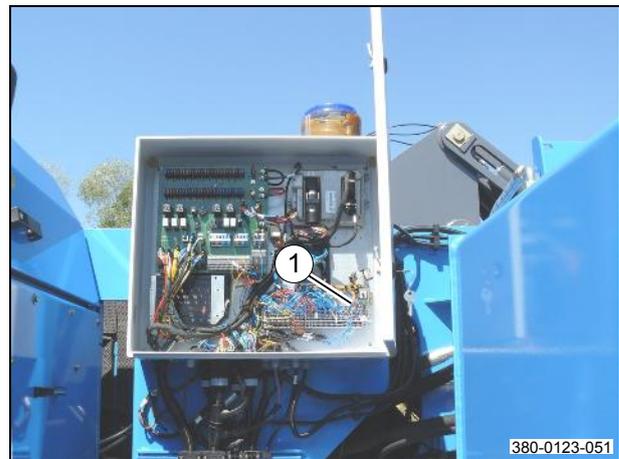


Fig. 235 Terminal block in central electrical system

8.7.1 Disconnecting load limit sensing control

Load limit sensing control is disconnected via the isolating blade terminals in the lower section of the terminal blocks in the central electrical system (235/1).

- ▶ Switch off the machine.
- ▶ Insert a screwdriver of an appropriate size and type into the recess (236/1) and carefully fold the isolating blade terminal out of the contact position (236/2).
- ▶ Fold out the other isolating blade terminal (236/3) in the same way.
- ▶ Start the machine. The indicator will remain lit, but load limit sensing control has been taken out of operation (234/43).
- ▶ Carefully move the machine without overloading the diesel engine.

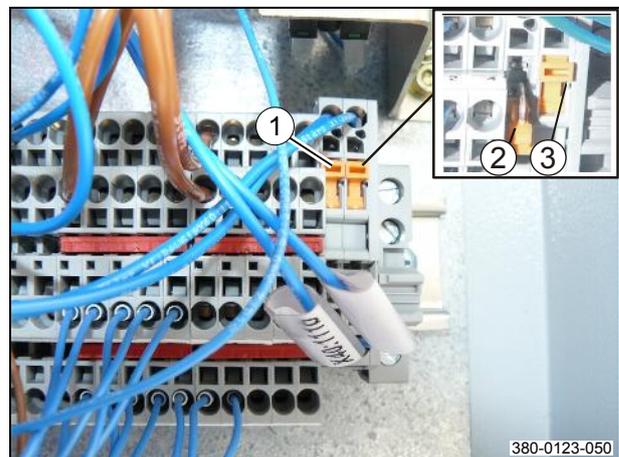


Fig. 236 Isolating blade terminals

8.7.2 Activating load limit sensing control

Once the malfunctions affecting load limit sensing control have been corrected, deactivation must be reversed.

- ▶ Switch off the machine.
- ▶ Fold the isolating blade terminals in and press them back into the contact position.
- ▶ Switch on the ignition. The indicator (234/43) is no longer lit.
- ▶ Start the machine.

If the indicator (234/43) no longer lights up in any operating conditions, it means that there are no errors affecting the system.

8.8 Table of malfunctions

| Possible cause | | Remedy |
|---|--|--|
| 8.8.1 No steering | | |
| 1 | Oil supply to pump interrupted. | Check and repair suction line. |
| 2 | Hydraulic pump defective. | Have the pump examined by a specialist for mechanical damage. Replace the entire hydraulic pump. |
| 3 | Priority valve defective. | Have the priority valve checked by a specialist; repair or replace as required. |
| 4 | Steering control unit defective. | Have the steering control unit checked by a specialist; repair or replace as required. |
| 5 | Rotary transmission or steering cylinders defective. | Repair, replace. |
| 6 | Mechanical fault. | Repair. |
| 8.8.2 No brake pressure | | |
| 1 | Oil supply to pump interrupted. | Check and repair suction line. |
| 2 | Hydraulic pump defective. | Have the pump examined by a specialist for mechanical damage. Replace the entire hydraulic pump. |
| 3 | Rotary transmission or shut-off valve defective. | Have the transmission or valve checked by a specialist; repair or replace as required. |
| 8.8.3 Insufficient braking power | | |
| 1 | Rotary transmission or foot brake valve defective. | Have the transmission or valve checked by a specialist; repair or replace as required. |
| 2 | Wear on the brake discs. | Repair. |
| 3 | Oil loss in brake system. | Check, repair. |
| 4 | Discontinuous buzzing tone. | Malfunction in service brake system. Lowest brake pressure range of 85 bar not reached. Check and repair. |
| 8.8.4 Parking brake cannot be released | | |
| 1 | No brake pressure. | Check oil supply to pump and shut-off valve, repair or replace. |
| 2 | Disc brake sticking. | Check, repair. |
| 3 | Parking brake valve defective. | Check and repair or replace. |
| 4 | Oil loss in parking brake system. | Check, repair. |
| 5 | Rotary transmission defective. | Check, repair. |

| Possible cause | | Remedy |
|--|--|--|
| 8.8.5 No driving function | | |
| 1 | Faulty drive motor. | Check the drive motor. |
| 2 | Insufficient hydraulic fluid in tank. | Top up hydraulic oil to mark on viewing glass. |
| 3 | Hydraulic pump has failed. | Have the pump examined by a specialist for mechanical damage. Replace the entire hydraulic pump. |
| 4 | Pump drive is faulty. | Replace the pump drive. Examine to discover cause of fault. |
| 5 | Main pressure relief valve is faulty or set incorrectly. | Have the main pressure relief valve replaced by a specialist. |
| 6 | No control pressure. | Have a specialist check the pilot pressure and locate the problem. |
| 7 | Solenoid valve defective. | Have the solenoid valve checked by a specialist; repair or replace as required. |
| 8 | Power supply to solenoid valve interrupted. | Have the power supply to the solenoid valve checked by a specialist and repaired if necessary. |
| 9 | Mechanical connection to axle interrupted. | Check, repair. |
| 10 | Service or parking brake engaged. | Release brakes. |
| 8.8.6 Sluggish acceleration and deceleration, too little pull | | |
| 1 | Engine does not have sufficient power. | Check the diesel engine. |
| 2 | One of the brakes is sticking. | Check, correct fault. |
| 3 | Main pressure relief valve is faulty or set incorrectly. | Have the pressure checked by a specialist. Adjust the main pressure relief valve and replace if necessary. |
| 4 | Oil loss in rotary transmission. | Replace rotary transmission seal. |
| 5 | Air cleaner clogged. | Clean air cleaner and replace if necessary. |
| 6 | High pressure level is too low. | Check high pressure, replace or adjust HP valves as necessary. |
| 7 | Pump does not travel fully. | Have the pump checked by a specialist; adjust if necessary. |
| 8 | Internal damage to variable displacement pump or engine. | Have the units replaced by a specialist. |

| Possible cause | | Remedy |
|---|--|---|
| 8.8.7 Loading equipment is not working | | |
| 1 | All travel and work functions are disabled. | Enable travel and work functions  5.1.7 Disabling all travel and work functions |
| 2 | Armrest switch faulty. | Check the armrest switch and repair or replace if necessary. |
| 3 | Oil supply to hydraulic pump interrupted. | Check the lines. |
| 4 | Hydraulic pump has failed. | Have the hydraulic pump checked by a specialist, replace complete pump if necessary. |
| 5 | Main pressure relief valve has failed or is set incorrectly. | Have the main pressure relief valve checked by a specialist, replace complete pump if necessary. |
| 6 | Engine temperature above 110°C. | Allow engine to cool  4.7 Monitoring the machine during operation |
| 8.8.8 Machine has reduced power | | |
| 1 | Engine has insufficient power. | Check the diesel engine. |
| 2 | Hydraulic oil level is too low. | Top up hydraulic oil to mark on sight glass. |
| 3 | Pump is taking in air. | Retighten the hose connections. Replace the O-ring or seals. |
| 4 | Working pressure too low. | Have the main pressure relief valve adjusted by a specialist; replace pump if necessary. |
| 5 | Fine mode not set to 0. | Check the load limit sensing control. Check if fine mode is set to 0; set to 0 if necessary. |
| 8.8.9 Machine is working too slowly and hydraulic fluid is getting hot | | |
| 1 | Main pressure relief valve set too low or faulty. | Have the main pressure relief valve adjusted by a specialist; replace pump if necessary. |
| 2 | Hydraulic pump has impermissible degree of wear. | Replace hydraulic pump. |
| 3 | Incorrect hydraulic fluid. | Hydraulic fluid must be of the recommended quality. |
| 4 | Hydraulic oil level is too low. | Top up hydraulic oil to mark on sight glass. |
| 5 | Oil cooler dirty or faulty. | Clean oil cooler, check and replace if necessary. |
| 6 | Air in hydraulic system. | Vent the pilot control. Tighten connections with engine off and system relieved of pressure. |

| Possible cause | | Remedy |
|--|---|---|
| 8.8.10 Hydraulic fluid exceeds max. permissible temperature | | |
| 1 | Thermostat in fan motor defective. | Replace thermostat and check fan speed. |
| 2 | Hydraulic oil level is too low. | Top up hydraulic oil to mark on sight glass. |
| 3 | Oil cooler dirty or faulty. | Clean oil cooler, check and replace if necessary. |
| 8.8.11 Swinging motion of the uppercarriage cannot be stopped | | |
| 1 | Defective swing brake. | Replace foot switch seal (optional), replace discs. |
| 2 | Secondary valves faulty or set incorrectly. | Adjust secondary valves, replace if necessary. |
| 3 | Swing gear motor or swing gear defective – internal wear. | Replace the hydraulic motor. |
| 8.8.12 Hydraulic cylinders sustaining losses | | |
| 1 | Seals in hydraulic cylinders are worn. | Replace the seals. |
| 2 | Secondary valves faulty or set incorrectly. | Check secondary valves; replace if necessary. Check hose rupture safety valves. |
| 8.8.13 Malfunctions in the electrical system | | |
| 1 | Exterior and/or interior lighting not working. | Check cables, connections, bulbs and fuses. |
| 2 | Windscreen wiper not working. | Check cables, connections and fuses. Examine windscreen wiper for mechanical damage. Corrosion on contacts between windscreen and cab. Replace complete windscreen wiper if necessary. Close the windscreen and lock it into place correctly. |
| 3 | Horn not working. | Check the cables, connections and fuses. If necessary, replace the entire horn and have a specialist find out what caused the defect. |
| 4 | Warning/indicator instruments not working accurately. | Have an expert locate the source of the problem/malfunction and eliminate it. |
| 5 | Starting system does not work satisfactorily. | Check the generator (V-belt tension). Check the charge capacity of the batteries. Test starter functions. Check the connection and condition of the power and grounding cables. Have the function of the ignition lock checked and replace if necessary. Check the battery isolator switch. |

| Possible cause | | Remedy |
|---|--|---|
| 8.8.14 Malfunctions in the magnet system | | |
| 1 | In the event of malfunctions in the magnet system, e.g. no magnetizing or no demagnetizing function: | Check the V-belt on the generator drive. Have the fuses checked by a specialist and correct defects. |
| 8.8.15 Work attachments | | |
| 1 | Grab not opening or closing, or opening and closing too slowly. | Check quick coupling, replace if necessary. |
| 2 | Grab not rotating. | Check the quick coupling and the electrical connection between the microswitch and the solenoid valve. Check the fuses. |

9 Appendix9.1
9.1 Arrangement of fuses..... 9.1
9.2 Conversion factors 9.4

9 Appendix

9.1 Arrangement of fuses

| ⚠ WARNING | |
|---|---|
|  | <p>Danger of injury due to malfunctions</p> <ul style="list-style-type: none"> • Use only original fuses. • Electrical fuses must never be bypassed or repaired. <p>In an emergency: Switch off machine, administer first aid, seek treatment from a doctor</p> |

The following fuses and relays are located in the central electrical system (in the circuit diagram, location:+03a):

| Fuse number | Tripping current intensity | Terminal designation | Functionality |
|-------------|----------------------------|----------------------|--|
| F 1 | 50 A | Terminal 30 | Master fuse terminal 30 |
| F 2 | 70 A | Terminal 15 | Master fuse terminal 15 |
| F 3 | 3 A | Terminal 30 | -B54 Multifunction display |
| F 4 | 7.5 A | Terminal 30 | Side lights |
| F 5 | 15 A | Terminal 30 | Supplementary heating (optional) |
| F 6 | 5 A | Terminal 30 | Supplementary heating (optional) |
| F 7 | 15 A | Terminal 30 | Radio, socket, cigarette lighter, voltage converter, interior lighting |
| F 8 | 5 A | Terminal 30 | Reserve -X21 cab |
| F 9 | 20 A | Terminal 30 | +UB -B1 Out 8-13 |
| F 10 | 20 A | Terminal 30 | Refueling pump (optional) |
| F 11 | 5 A | Terminal 15 | -B68 CR2016 Central electrical system +UB, optional - B74 Fuchs Quick Connect (FQC), rear view camera |
| F 12 | 10 A | Terminal 15 | Tank sensor, throat depth stop limiting, dipperstick work zone extension, loading height limiting, overload warning device |
| F 13 | 3 A | Terminal 15 | CAN bus +UB |
| F 14 | 10 A | Terminal 15 | -B47 CR2016 Undercarriage |
| F 15 | 7.5 A | Terminal 15 | -B64 Multifunction button |
| F 16 | 5 A | Terminal 15 | -B54 Multifunction display |
| F 17 | 10 A | Terminal 15 | Main window wiper, lower window wiper (optional) |
| F 18 | 7.5 A | Terminal 15 | -B11 Load limit sensing control |
| F 19 | 5 A | Terminal 15 | Four-way control lever (right/left) |
| F 20 | 10 A | Terminal 15 | -B65 Cabin control panel |
| F 21 | 7.5 A | Terminal 15 | Air conditioning |
| F 22 | 5 A | Terminal 15 | Service ladder, grease lubrication system |
| F 23 | 7.5* A | Terminal 15 | Reserve K 12, K 13 |
| F 24 | 2 A | Terminal 15 | -B35 CR0020 Main control, central electrical system control +UB D-Sub X3 |
| F 25 | 5 A | Terminal 15 | Excitation voltage alternator D+, operating hours, joystick steering (optional), particulate filter (optional) |
| F 26 | 7.5 A | Terminal 15 | Reserve, Emergency control K 14, K 15 |

| Fuse number | Tripping current intensity | Terminal designation | Functionality |
|-------------|----------------------------|----------------------|--|
| F 27 | 10 A | Terminal 30 | Reserve, optional: particulate filter |
| F 28 | 15 A | Terminal 30 | Reserve |
| F 29 | 3 A | Terminal 30 | EMR3 +UB, main relay K 2 |
| F 30 | 25 A | Terminal 30 | EMR3 Main relay K 2 |
| F 31 | 5 A | Terminal 15 | Power relay K 1 |
| F 32 | 10 A | Terminal 15 | -A1 Air conditioning system condenser |
| F 33 | 10 A | Terminal 15 | -A1 Air conditioning system condenser |
| F 34 | 10 A | Terminal 15 | -A1 Air conditioning system condenser |
| F 35 | 15 A | Terminal 15 | -B47 CR2016 Undercarriage +UB, Group 1 and 2 outputs |
| F 36 | 15 A | Terminal 15 | Blower for air conditioning system |
| F 37 | 30 A | Terminal 15 | -A1 Air conditioning system condenser K 3 |
| F 38 | 10 A | Terminal 15 | -A1 Air conditioning system condenser K 4 |
| F 39 | 10 A | Terminal 15 | -B1 CR0303 VBo 01-03 |
| F 40 | 15 A | Terminal 15 | Radio, voltage converter, operator's seat |
| F 41 | 10 A | Terminal 15 | Sensors: hydraulic oil return filter, hydraulic oil temperature, hydraulic oil level, open/close grab, travel, auto-idling system, parking brake |
| F 42 | 10 A | Terminal 15 | -B1 CR0303 Cab floor control |
| F 43 | 7.5 A | Terminal 15 | Reserve, reversing fan mode (optional) |
| F 44 | 10 A | Terminal 15 | -B68 CR2016 Central electrical system, outputs group 2, optional: -B74 CR2016, outputs group 2 |
| F 45 | 15 A | Terminal 15 | -B35 CR0020 Main control |
| F 46 | 15 A | Terminal 15 | Working headlamps, dipperstick |
| F 47 | 15 A | Terminal 15 | -B35 CR0020 Main controller |
| F 48 | 15 A | Terminal 15 | Reserve switch cab, reserve |
| F 49 | 3 A | Terminal 15 | High pressure filter, swivel |
| F 50 | 15 A | Terminal 15 | Working headlamps, boom (optional) |
| F 51 | 7.5 A | Terminal 15 | -B37 EMR3 Control device, air differential pressure switch, EMR3 engine diagnostics plug |
| F 52 | 15 A | Terminal 15 | -B68 CR2016 Central electrical system, outputs group 1 |
| F 53 | 15 A | Terminal 15 | Reserve |
| F 54 | 15 A | Terminal 15 | Cab protection ventilation (optional) |

CR0020

Main control

CR0303

Cab floor control box

CR2016

Central electrical system 1 x standard, 1 x optional, 1 x optional undercarriage

The fuses and relays below are located in the junction box in the engine compartment (in the circuit diagram, location: +04):

| Fuse | Function |
|---------------|---------------------------------|
| F1-Mega 100 A | Generator B+ |
| F2-Mega 100 A | Preheat relay glow plugs |
| F3-Mega 100 A | Terminal 30 |
| F4-Midi 40 A | Ignition, diesel engine starter |

Arrangement of the relays

| Relay number | Functionality |
|--|---|
| Central electrical system (in the circuit diagram, location: +03) | |
| K 1 | Power relay terminal 15 |
| K 84 | Diesel engine starter |
| Central electrical system board (in the circuit diagram, location: 03a) | |
| K 2 | EMR3 Main relay (engine control unit) |
| K 3 | Air conditioning condenser blower |
| K 4 | Working headlamps, dipperstick (optional) |
| K 5 | Working headlamps, boom (optional) |
| K 6 | Optional: Fuchs Quick Connect (FQC) |
| K 8 | Air conditioning system |
| K 9 | Reserve |
| K 10 | Tank sensor |
| K 11 | Refueling pump (optional) |
| K 12 | Reserve |
| K 13 | Optional: Fuchs Quick Connect (FQC) |
| K 14 | Emergency control |
| K 15 | Emergency control |
| Engine compartment (in the circuit diagram, location: +04) | |
| K 2 | - |
| Control box, cab floor (in circuit diagram, location: +02c) | |
| K 1 | Wiper, main window |
| K 2 | Lower window wiper (optional) |
| K 3 | Air conditioning system |
| K 4 | Air conditioning system |

9.2 Conversion factors

Pressure

| | | | | |
|--------|---|-----------|---|------------|
| 1 bar | = | 100 Kpa | = | 14.5 psi |
| 10 psi | = | 68.95 Kpa | = | 0.6895 bar |

Flow

| | | |
|----------------------|---|------------|
| 1 rpm | = | 0.0353 cfm |
| 1 gallon (Brit.)/min | = | 0.1605 cfm |

Distances

| | | | | | | | | |
|------|---|----------|-----------|-----------|--------------|----------------|-----------|--------|
| 1 km | = | 39370 in | 3280.8 ft | 1093.6 yd | 0.62137 mile | 0.53996 n mile | 10^6 mm | 1000 m |
|------|---|----------|-----------|-----------|--------------|----------------|-----------|--------|

Weight

| | | | | |
|------|---|----------|---|----------|
| 1 kg | = | 2.205 lb | = | 35.27 oz |
|------|---|----------|---|----------|

Length

| | | | | | | |
|--------|---|----------|---|------------|---|------------|
| 1 m | = | 1000 mm | = | 39.38 inch | = | 3.281 ft |
| 1 inch | = | 25.4 mm | = | 0.0254 m | = | 0.08333 ft |
| 1 ft | = | 304.8 mm | = | 0.3048 m | = | 12 inch |

Output

| | | |
|----|---|------------|
| HP | = | kW x 1.341 |
| KW | = | HP x 0.746 |

Temperature

| | | |
|----|---|-----------------|
| °F | = | (°C x 9/5) + 32 |
| °C | = | (°F - 32) x 5/9 |

Volume

| | | | | | | |
|-------------------|---|---------------------|---|------------------------|---|--------------------------|
| 1 m ³ | = | 1000 liters | = | 35.31 ft ³ | = | 61,020 inch ³ |
| 1 ft ³ | = | 28.32 liters | = | 0.02832 m ³ | = | 1728 inch ³ |
| 1 l | = | 0.2642 gallons (US) | = | 0.2201 gallons (Brit.) | = | |
| 1 gallon (US) | = | 3.785 liters | = | 231 inch ³ | = | |
| 1 gallon (Brit.) | = | 4.544 liters | = | 277 inch ³ | = | |

10 Special equipment..... 10.1

- 10.1 4-point outrigger with enlarged stabilizer plates..... 10.1
 - 10.1.1 Switching principle 10.2
 - 10.1.2 Operation..... 10.3
- 10.2 Joystick control unit without steering wheel 10.4
 - 10.2.1.1 Steering and driving without steering wheel 10.4

10 Special equipment

The parts and functions described in this chapter are special equipment and differ from standard equipment. This description of special functions supplements the operating instructions. Chapters 1 to 9 of the operating instructions remain valid even if special equipment is installed.

10.1 4-point outrigger with enlarged stabilizer plates

The loading machine can be fitted with enlarged stabilizer plates as an option. This reduces the resultant surface pressure on outrigger surfaces such that handling work can be undertaken safely on surfaces with critical loads and without any follow-on damage.

Due to the larger dimensions of the outriggers, the uppercarriage cannot be freely rotated when the outrigger is fully retracted. A function which deactivates the outriggers in a safe position when retracted reduces the risk of collision. This can be bypassed on the multifunction display if necessary.

There is an inductive proximity switch (initiator) on each leg bearing for the "Outrigger retracted" stroke-limited position. The machine control unit stops further movement for every single leg bearing as soon as the proximity switch in question does not detect any metal.

10.1.1 Switching principle

The initiators only allow the respective leg bearing to be retracted if they detect metal.

This switching logic prevents the leg bearings from being retracted unintentionally into an area where there is potential for a collision with the uppercarriage even if a cable break were to occur on the proximity switch signal cables

The "Advance deactivation" can be manually bypassed through a selection in the outrigger menu in order to retract the outrigger to its limit position (e.g. in order to transport the machine).

When the control lever is moved, the activation direction (extend/retract outrigger) is detected by two pressure switches. The outriggers can therefore always be extended regardless of the position – while retraction is only possible when the proximity switch is assigned!

The menu can also be used at the same time to deselect the outriggers individually.

Deselected outriggers do not move when retracting and extending.

10.1.2 Operation

In the outrigger menu F 2 (see Fig. 237), the status indicator of the outrigger deselection will be shown. In this menu, each of the four outriggers can be deselected individually.

The status of the proximity switches is also displayed with the following meanings

- Green: Proximity switch is assigned (sees metal) outrigger is between "Extended" limit position and "Deactivation position".
- Orange: Proximity switch is not assigned (does not see metal) outrigger is in "Deactivation position".
- Red/orange flashing: Proximity switch is not assigned (does not see metal) outrigger is in "Deactivation position".

To bypass deactivation and therefore to retract the outrigger to its top limit position, move the control lever in the retract direction and at the same time press and hold down the multi-function button or F 2 key on the display. After 3 seconds all outriggers are automatically selected and then move to the top limit position. To do this the control lever should be moved further in the retract direction and/or F 2 must remain pressed!

As soon as the bypass is active (proximity switch display flashes red/orange), the rotary lock is automatically blocked. This block remains in place until all four outriggers are back in the proximity switch's "green zone", i.e. until all four proximity switches are assigned again (see metal). The rotary drive block remains in place even after ignition OFF/ON!

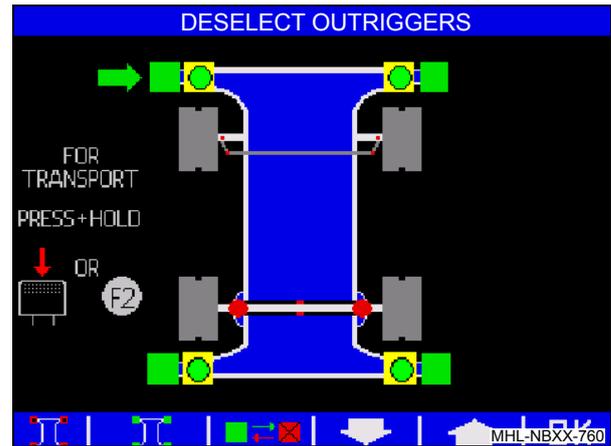


Fig. 237 Outrigger menu

10.2 Joystick control unit without steering wheel

10.2.1.1 Steering and driving without steering wheel

As an option the machine can be fitted with a joystick control unit for steering and driving without a steering wheel.

Joystick on left

- 1 Pushbutton for indicator (left)
- 2 Pushbutton magnet for On / OFF (optional)
- 3 Pushbutton for indicator (right)
- 4 Proportional steering mechanism
Move to right ⇒ right steering lock
Move to left ⇒ left steering lock
- 5 Pushbutton for horn
- 6 Not assigned

Joystick on right

- 1 Proportional travel sensor
Move up ⇒ forward direction of travel
Move down ⇒ backward direction of travel
- 2 Pushbutton for increasing the operating pressure
- 3 Pushbutton for lowering dozer blade (optional)
- 4 Pushbutton for raising dozer blade (optional)
- 5 Pushbutton for grab rotation (left)
- 6 Pushbutton for grab rotation (right)

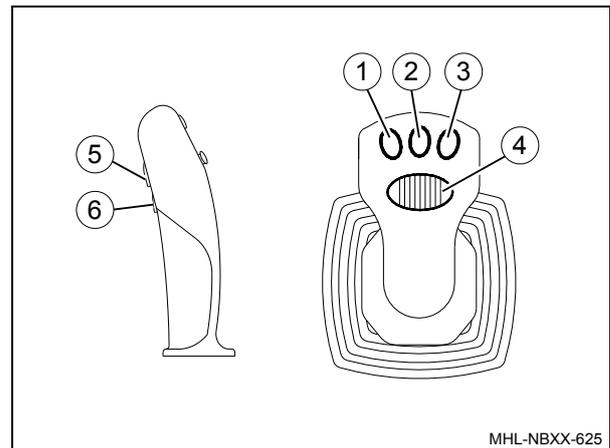


Fig. 238 Joystick on left

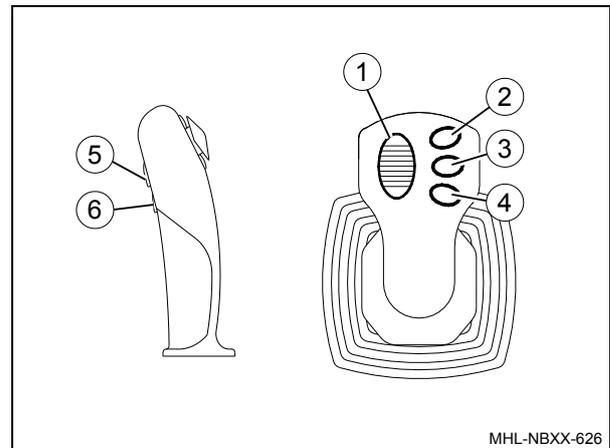


Fig. 239 Joystick on right



TEREX® | FUCHS

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