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GRADER

Workshop Manual

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THIS ALERT SYMBOL SIGNALS IMPORTANT MESSAGES INVOLVING YOUR SAFETY.

Read and heed carefully the safety instructions listed and follow the precautions recommended to avoid potential risks and to safeguard your health and your safety.

You will find this symbol in the text of this Manual referred to the following key words:

WARNING - Cautions directed to avoid improper repair interventions involving potential consequences for the safety of the personnel performing the repairs.

DANGER - These warnings qualify specifically potential dangers for the safety of the operator or other persons directly or indirectly involved.

IMPORTANT NOTICE

All maintenance and repair interventions explained in this Manual **must be performed exclusively by the Service Organisation of the Manufacturer**, observing strictly the instructions explained using, whenever necessary, the recommended specific tools.

Whoever performs the operations reported without following exactly the precautions is responsible on his own, for the damages that may result.

Neither the Factory nor any Organisations in its Distribution Network, including but not limited to national, regional or local distributors, are responsible for any liability arising from any damage resulting from defects caused by parts and/or components not approved by the Factory for use in maintaining and/or repairing products manufactured or merchandised by the Factory.

In any case, no warranty of any kind is made or shall be imposed with respect to products manufactured or merchandised by the Factory, when failures are caused by the use of parts and/or components not approved by the Factory.

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home or on the road, are caused by the failure of some individuals to follow simple and fundamental safety rules and precautions. For this reason **MOST ACCIDENTS CAN BE PREVENTED** by recognising the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering in the reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident. The complete observance of one simple rule would prevent many serious accidents.

The rule is simple: never attempt to clean, lubricate or maintain a machine while it is in motion.



WARNING

Prior to engaging in any maintenance, adjustment or repair operation on machines having hydraulically, mechanically, and/or cable controlled equipment (such as shovels, loaders, dozers, excavators etc.) be certain the equipment is lowered to the ground.

If it is necessary to have the equipment partially or fully raised to gain access to certain items, be sure the equipment is suitably supported by means other than the devices used for controlling the equipment.

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FOR THE READER

This Workshop Manual is written for the **Repair-Technician**. It provides important information on how to perform skilful repairs.

We recommend to consult the **Workshop Manual** and also the Motor-Grader Operation and Maintenance Instruction Manual before initiating any repair-work operation. Utilize the **Workshop Manual** as well as the **Operation and Maintenance Instruction Manual** and the **Parts Catalog** as a prompt-book and adviser, even if the Motor-Grader technique is become familiar.

By means of the Workshop Manual the expert technician will be able to carry out a skilful repair-work operation.

USE

The Workshop Manual refers to the initial Machine configuration. Structural changes or rebuilding operations are not described in this Handbook.

In this Workshop Manual the following information can be found:

- Safety Instructions;
- Technical Data and Special Tools;
- Functional Description;
- Performance Testing;
- Troubleshooting and Failure Correction;
- Repair Instructions.

In the Section **Safety Instructions** the recommended procedures are described, so that through the relevant compliance with, a risk of accident for the User and for the personnel responsible of the maintenance operations on the machine can be avoided.

In the Section **Technical Data** the Service Data, the change tables and lists of the needed Special Tools and Maintenance materials are indicated.

In other Sections, for each mechanical group, when available can be found:

- a functional description with information concerning the operation of the essential devices and equipments;

- information for carrying out the performance tests on the machine;
- troubleshooting, information concerning the recognition and correction of failures on the machine,
- technical information necessary for carrying out the Service and Repair operations on the Machine, the equipment necessary for the maintenance operations, the information concerning the Standards to be applied in the Maintenance operations, the Procedures for the Removal and Installation operations as well as for Disassembly and Assembly operations.

By means of the index contents a desired information can be easily achieved.

For a better understanding the illustration of the part will be displayed.

Therefore differences in arrangement of the Grader are possible, whenever the latter involves the univocal capability of the information.

REPAIR OPERATIONS

Carry out the necessary repair works as soon as possible. This procedure will avoid the maintenance costs while increasing the availability of your Motor-Grader.

Pay always attention during all works to the Workshop Manual warnings and cautions and to the Operation and Maintenance Instruction Manual.

The Service Assistance will gladly carry out for you the works not described in the Workshop Manual.

Always utilize the **Original Spare Parts** only.

FURTHER INFORMATION MATERIAL

Please notice the supplementary information consulting the following Handbooks:

- **Operation and Maintenance Instruction Manual**;
- **Parts Catalog**.

NOTES:

SECTION 0

SAFETY INSTRUCTIONS



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FUNDAMENTAL SAFETY INSTRUCTIONS

WARNINGS AND SYMBOLS

The following signs are used in the manual to designate instructions of particular importance:

	Precautionary rules and measures designed to protect the machine operator and other persons from life-threatening danger or injuries and to prevent extensive damage.
	Information and precautionary measures designed to prevent damage to the machine or other property.

DESIGNATED USE

The machine has been built with state of the art technology and in accordance with the officially recognised safety regulations. Nevertheless, its use may constitute a risk to life and limb for the operator or third parties, or cause damage to the machine and other property.


The machine must be used only in technically perfect condition in accordance with its designated use and the instructions set out in the operating manual, and only by safety-conscious persons who are fully aware of the risks involved in operating the machine. Important notices are to be found at the beginning of the chapters. Functional disorders should be rectified immediately, especially those which could affect safety conditions.

The grader is intended mainly for:

- Creating fine-graded surfaces;
- Clearing away top soil;
- Tearing up old road surfaces and hard ground;
- Cutting slopes;
- Clearing away ice and snow;
- Gathering, spreading, mixing and compacting materials.

The grader can also be used with other working equipment for special purposes. The technical data offer clear instructions in this respect.

Designated use includes following the operating instructions and fulfilling the inspection and maintenance conditions.

	<p>Using the machine for purposes other than or extending beyond those stated above, e.g.:</p> <ul style="list-style-type: none"> - for the transportation of persons; - as a working platform; - for pulling or transporting loads without the working equipment being approved for such purposes is considered contrary to the designated use. <p>Improper use may involve a life-threatening risk for operators or other personnel or may cause injury or extensive damage.</p>
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The manufacturer/supplier cannot be held liable for any damage arising out of improper use. The risk involved in improper use lies entirely with the user.

Noise emission specification in accordance with the 3rd Ordinance of the Machine Safety Act (18/01/1991) and EC Machine Directive, 89/392/EEC.

If the earth-moving machine is operated in accordance with its designated use, the installation of driver's seats complying with ISO 7096 ensures that the considered vibration accelerations a_{zw} (measured as per ISO 2631, Part 1) fulfil the requirements of protecting the driver against wholebody vibration.

ORGANIZATIONAL MEASURES

The operating instructions must always be at hand at the place of use of the machine, e.g. by stowing them in the tool compartment or tool-box provided for such purpose.

In addition to the operating instructions, observe and instruct the user in all other generally applicable legal and other mandatory regulations relevant to accident prevention and environmental protection.

These compulsory regulations may also deal with the handling of hazardous substances, issuing and/or wearing of personal protective equipment or traffic regulations.

The operating instructions must be supplemented by instructions covering the duties involved in supervising and notifying special organizational features, such as job organization, working sequences or the personnel entrusted with the work.

Personnel entrusted with work on the machine must have read the operating instructions and in particular the chapter on safety before beginning work. Reading the instructions after work has begun is too late. This applies especially to persons working only occasionally on the machine, e.g. during setting up or maintenance.

Check - at least from time to time - whether the personnel is carrying out the work in compliance with the operating instructions and paying attention to risks and safety factors.

For reasons of security, long hair must be tied back or otherwise secured, garments must be close-fitting and no jewellery, such as rings, may be worn. Injury may result from being caught up in the machinery or from rings catching on moving parts.

Use protective equipment wherever required by the circumstances or by law.

Observe all safety instructions and warnings attached to the machine.

See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.

In the event of safety-relevant modifications or changes in the behaviour of the machine during operation, stop the machine immediately and report the malfunction to the competent authority/person.

Never make any modifications, additions or conversions which might affect safety without the supplier's approval. This also applies to the installation and adjustment of safety devices and valves as well as to welding work on load-bearing elements.

Spare parts must comply with the technical requirements specified by the manufacturer. Spare parts from original equipment manufacturers can be relied upon to do so.

Replace hydraulic hoses within stipulated and appropriate intervals, even if no safety-relevant defects have been detected.

Adhere to prescribed intervals or those specified in the operating instructions for routine checks and inspections.

For the execution of maintenance work, tools and workshop equipment adapted to the task on hand are absolutely indispensable.

The personnel must be familiar with the location and operation of fire extinguishers.

Observe all fire-warning and fire-fighting procedures.

SELECTION AND QUALIFICATION OF PERSONNEL

BASIC RESPONSIBILITIES

Any work on and with the machine must be executed by reliable personnel only. Statutory minimum age limits must be observed.

Employ only trained or instructed staff and set out clearly the individual responsibilities of the personnel for operation, set-up, maintenance and repair.

Make sure that only authorized personnel works on or with the machine.

Define the machine operator's responsibilities - also with regard to observing traffic regulations - giving the operator the authority to refuse instructions by third parties that are contrary to safety.

Do not allow persons to be trained or instructed or persons taking part in a general training course to work on or with the machine without being permanently supervised by an experienced person.

Work on the electrical system and equipment of the machine must be carried out only by a skilled electrician or by instructed persons under the supervision and guidance of a skilled electrician and in accordance with electrical engineering rules and regulations.

Work on chassis, brake and steering systems must be performed by skilled personnel only, which has been specially trained for such work.

Work on the hydraulic system must be carried out only by personnel with special knowledge and experience of hydraulic equipment.

SAFETY INSTRUCTIONS GOVERNING SPECIFIC OPERATIONAL PHASES

Standard operation

Avoid any operational mode that might be prejudicial to safety.

Before beginning work, familiarize yourself with the surroundings and circumstances of the site, such as obstacles in the working and travelling area, the soil bearing capacity and any barriers separating the construction site from public roads.

Take the necessary precautions to ensure that the machine is used only when in a safe and reliable state.

Operate the machine only if all protective and safety-oriented devices, such as removable safety devices, emergency shut-off equipment, soundproofing elements and exhausters, are in place and fully functional.

Check the machine at least once per working shift for obvious damage and defects. Report any changes (incl. changes in the machine's working behaviour) to the competent organization/person immediately. If necessary, stop the machine immediately and lock it.

In the event of malfunctions, stop the machine immediately and lock it. Have any defects rectified immediately.

Start the machine from the driver's seat only.

During start-up and shut-down procedures always watch the indicators in accordance with the operating instructions.

Before setting the machine in motion, make sure that nobody is at risk.

Before starting work or travelling with the machine, check that the braking, steering, signalling and lighting systems are fully functional.

Before setting the machine in motion always check that the accessories have been safely stowed away.

When travelling on public roads, ways and places always observe the valid traffic regulations and, if necessary, make sure beforehand that the machine is in a condition compatible with these regulations. In conditions of poor visibility and after dark always switch on the lighting system.

Persons accompanying the driver must be seated on the passenger seats provided for this purpose.

When crossing underpasses, bridges and tunnels or when passing under overhead lines always make sure that there is sufficient clearance.

Always keep at a distance from the edges of building pits and slopes.

Avoid any operation that might be a risk to machine stability.

Never travel across slopes; always keep the working equipment and the load close to the ground, especially when travelling downhill.

On sloping terrain always adapt your travelling speed to the prevailing ground conditions. Never change to a lower gear on a slope but always before reaching it.

Before leaving the driver's seat always secure the machine against inadvertent movement and unauthorized use. Stop the engine.

SPECIAL WORK IN CONJUNCTION WITH USE OF THE MACHINE MAINTENANCE AND REPAIRS DURING OPERATION DISPOSAL OF PARTS AND CONSUMABLES

Observe the adjusting, maintenance and inspection activities and intervals set out in the operating instructions, including information on the replacement of parts and equipment. These activities may be executed by skilled personnel only.

Brief operating personnel before beginning special operations and maintenance work, and appoint a person to supervise the activities.

In any work concerning the operation, conversion or adjustment of the machine and its safety-oriented devices or any work related to maintenance, inspection and repair, always observe the start-up and shut-down procedures set out in the operating instructions and the information on maintenance work.

Ensure that the maintenance area is adequately secured.

If the machine is completely shut down for maintenance and repair work, it must be secured against inadvertent starting by:

- removing the ignition key;
- attaching a warning sign.

Carry out maintenance and repair work only if the machine is positioned on stable and level ground and has been secured against inadvertent movement and buckling.

To avoid the risk of accidents, individual parts and large assemblies being moved for replacement purposes should be carefully attached to lifting tackle and secured. Use only suitable and technically perfect lifting gear and suspension systems with adequate lifting capacity. Never work or stand under suspended loads.

The fastening of loads and the instructing of crane operators should be entrusted to experienced persons only. The marshaller giving the instructions must be within sight or sound of the operator.

For carrying out overhead assembly work always use specially designed or otherwise safety-oriented ladders and working platforms. Never use machine parts as a climbing aid.

Wear a safety harness when carrying out maintenance work at greater heights.

Keep all handles, steps, handrails, platforms, landings and ladders free from dirt, snow and ice.

Clean the machine, especially connections and threaded unions, of any traces of oil, fuel or preservatives before carrying out maintenance/repair. Never use aggressive detergents. Use lintfree cleaning rags.

Before cleaning the machine with water, steam jet (high-pressure cleaning) or detergents, cover or tape up all openings which - for safety and functional reasons - must be protected against water, steam or detergent penetration. Special care must be taken with electric motors and switchgear cabinets.

Ensure during cleaning of the machine that the temperature sensors of the fire-warning and firefighting systems do not come into contact with hot cleaning agents as this might activate the fire-fighting system.

After cleaning, remove all covers and tapes applied for that purpose.

After cleaning, examine all fuel, lubricant, and hydraulic fluid lines for leaks, loose connections, chafe marks and damage. Any defects found must be rectified without delay.

Always tighten any screwed connections that have been loosened during maintenance and repair.

Any safety devices removed for set-up, maintenance or repair purposes must be refitted and checked immediately upon completion of the maintenance and repair work.

Ensure that all consumables and replaced parts are disposed of safely and with minimum environmental impact.

WARNING OF SPECIAL DANGERS

Electric energy

Use only original fuses with the specified current rating. Switch off the machine immediately if trouble occurs in the electrical system.

When working with the machine, maintain a safe distance from overhead electric lines. If work is to be carried out close to overhead lines, the working equipment must be kept well away from them. Caution, danger! Check out the prescribed safety distances.

If your machine comes into contact with a live wire:

- do not leave the machine;
- drive the machine out of the hazard zone;
- warn others against approaching and touching the machine;
- have the live wire de-energized;
- do not leave the machine until the damaged line has been safely de-energized.

The electrical equipment of machines is to be inspected and checked at regular intervals.

Defects such as loose connections or scorched cables must be rectified immediately.

Gas, dust, steam and smoke

Operate internal combustion engines and fueloperated heating systems only on adequately ventilated premises. Before starting the machine on enclosed premises, make sure that there is sufficient ventilation.

Observe the regulations in force at the respective site.

Carry out welding, flame-cutting and grinding work on the machine only if this has been expressly authorized, as there may be a risk of explosion and fire.

Before carrying out welding, flame-cutting and grinding operations, clean the machine and its surroundings from dust and other inflammable substances and make sure that the premises are adequately ventilated (risk of explosion).

Hydraulic and pneumatic equipment

Check all lines, hoses and screwed connections regularly for leaks and obvious damage. Repair damage immediately. Splashed oil may cause injury and fire.

Depressurize all system sections and pressure pipes (hydraulic system, compressed-air system) to be removed in accordance with the specific instructions for the unit concerned before carrying out any repair work.

Hydraulic and compressed-air lines must be laid and fitted properly. Ensure that no connections are interchanged. The fittings, lengths and quality of the hoses must comply with the technical requirements.

Noise

During operation, all sound baffles of the machine must be closed.

Always wear the prescribed ear protectors.

Oil, grease and other chemical substances

When handling oil, grease and other chemical substances, observe the product-related safety regulations.

Be careful when handling hot consumables (risk of burning or scalding).

**TRANSPORTING AND TOWING
RECOMMISSIONING**

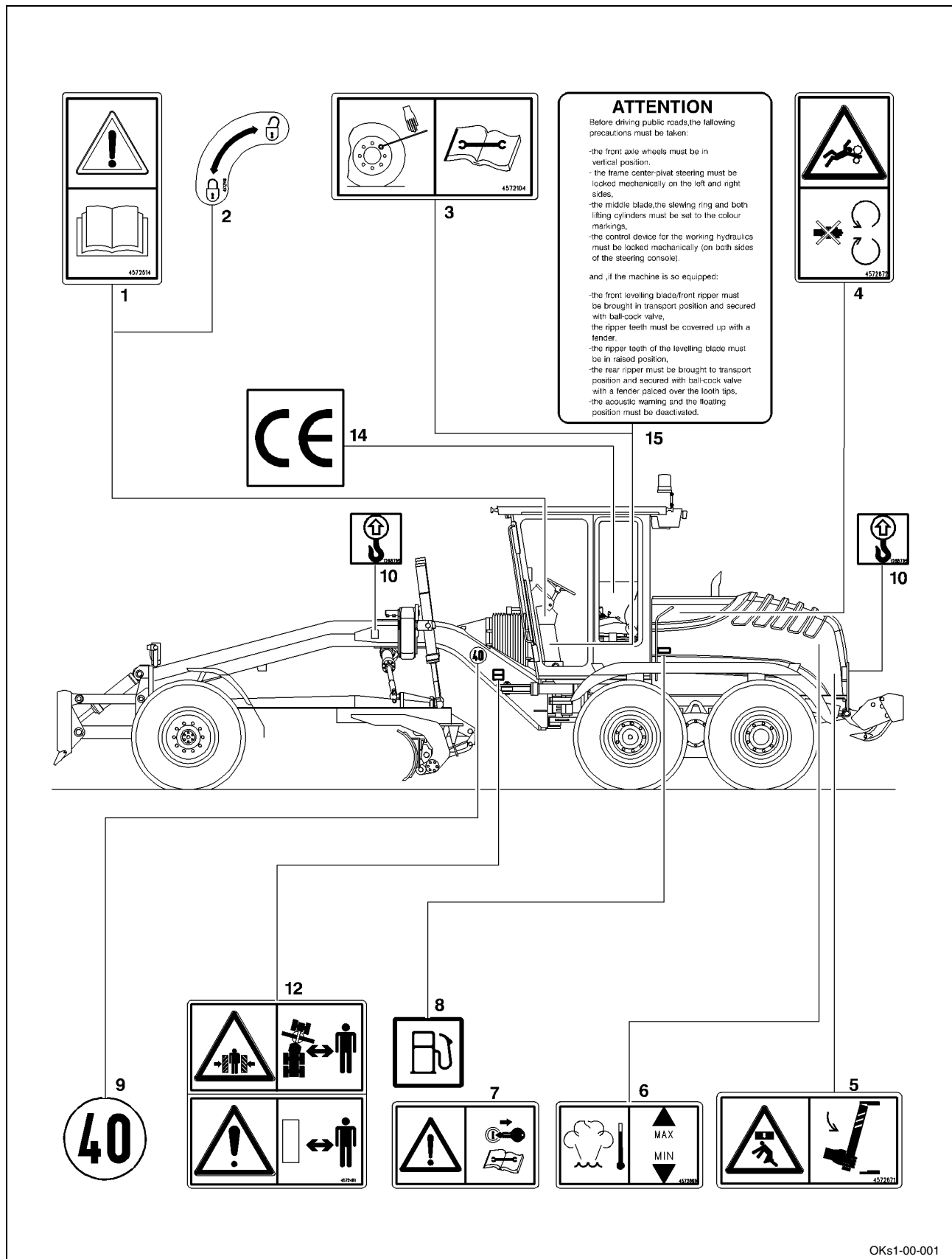
The machine must be towed, loaded and transported only in accordance with the operating instructions.

For towing the machine observe the prescribed transport position, admissible speed and itinerary.

Use only appropriate means of transport and lifting gear of adequate capacity.

The recommissioning procedure must be strictly in accordance with the operating instructions.

WARNING AND INSTRUCTION SIGNS



OKs1-00-001



Always observe the warning and instruction signs attached to the machine.

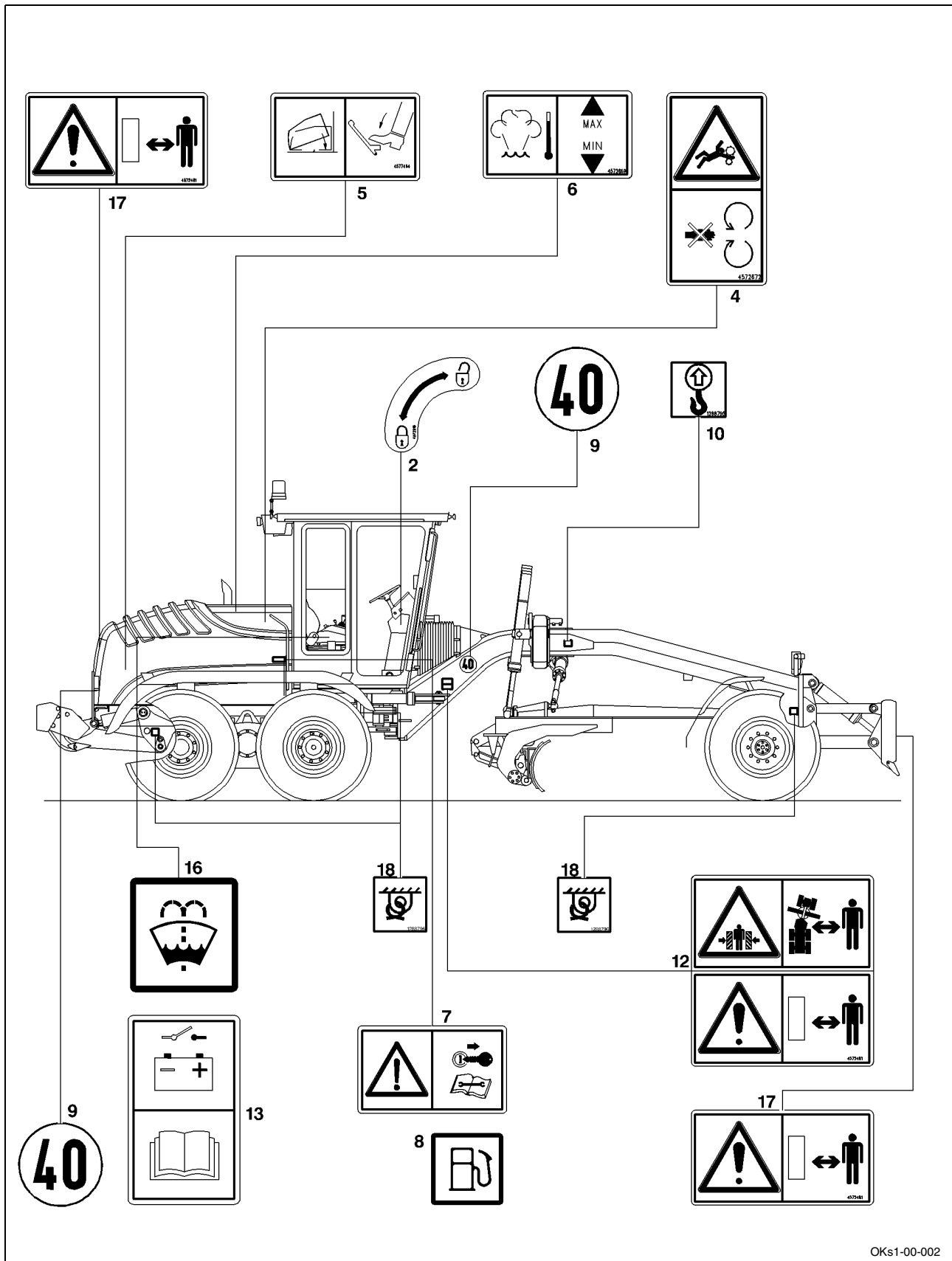
Keep signs clean and legible.

Replace signs immediately if they have become illegible.

New warning and instruction signs can be ordered from the Spare-Parts Service. The Part nos. required for orders can be found in the Parts Catalog of your machine.

LEFT SIDE

1. The machine must not be started up unless the Operation and Maintenance Instructions Manual have been read and understood
2. The equipment can be secured at this point against inadvertent activation
3. Check wheel nuts at regular intervals; see Operation and Maintenance Instructions Manual
4. **Risk of injury** through hot or rotating components in the engine compartment. Never open engine hood until engine is stationary
5. **Risk of injury** through engine hood slamming closed.
Open engine hood until the safety rod engages in the lock position.
Read Operation and Maintenance Instructions Manual before carrying out any repair / servicing work
6. **Risk of injury** through hot coolant. Open cap on radiator only after the radiator has cooled down - Coolant level indicators
7. **Risk of injury** by unauthorized starting of the machine. Before undertaking any work on the machine shut off the engine and withdraw the key
8. Fuel tank, fill in diesel only
9. This sign indicates the admissible maximum speed for driving on public roads
10. Fixing points for fastening chains and ropes for machine transport
12. **Risk of injury** through crushing. Never start up the machine without ensuring that nobody is standing within the range of the center-pivot joint
Risk of injury through crushing. Never start up the machine without ensuring that nobody is standing in the area between the machine and a nearby obstacle
14. The CE sign indicates that this machine has been built in conformity with the European prescriptions for the safety of machines. L_{WA} is the level of noise emissions specified in dB_A (in acc. with standard 2000/14/EC)
15. **Driving on public roads.** This sign specifies measure to be taken before driving on public roads.



Carefully read personal and machine SAFETY INSTRUCTIONS (at the beginning of this manual)



Always observe the warning and instruction signs attached to the machine.

Keep signs clean and legible.

Replace signs immediately if they have become illegible.

New warning and instruction signs can be ordered from the Spare-Parts Service. The Part nos. required for orders can be found in the Parts Catalog of your machine.

RIGHT SIDE

2. The equipment can be secured at this point against inadvertent activation
4. **Risk of injury** through hot or rotating components in the engine compartment. Never open engine hood until engine is stationary
5. **Risk of injury** through engine hood slamming closed. Close engine hood by disengaging the safety bar with your foot. Read Operation and Maintenance Instructions Manual before carrying out any repair / servicing work
6. **Risk of injury** through hot coolant. Open cap on radiator only after the radiator has cooled down - Coolant level indicators
7. **Risk of injury** by unauthorized starting of the machine. Before undertaking any work on the machine shut off the engine and withdraw the key
8. Fuel tank, fill in diesel only
9. This sign indicates the admissible maximum speed for driving on public roads
10. Fixing points for fastening chains and ropes for machine transport
12. **Risk of injury** through crushing. Never start up the machine without ensuring that nobody is standing within the range of the center-pivot joint
Risk of injury through crushing. Never start up the machine without ensuring that nobody is standing in the area between the machine and a nearby obstacle
13. **Damage** to the alternator, regulator and electronic modules may result from the battery being disconnected while the engine is running. Always stop the engine before disconnecting and removing batteries
16. Screen washer. Filler opening of screen-washer reservoir. Top up with water
17. **Risk of injury** through crushing. Never start up the machine without ensuring that nobody is standing in the area between the machine and a nearby obstacle
18. Fixing points for fastening chains and ropes for machine transport.

NOTES:

Carefully read personal and machine SAFETY INSTRUCTIONS (at the beginning of this manual)