148 X 210 X 8.1 (H)mm

D20S-9
D25S-9
D30S-9
D33S-9
D35C-9

D20/25/30/33S-9, D35C-9

Operation & Maintenance Manual

SB2503E04

DOOSAN

SB2503E04
12. 2022

Operation & Maintenance Manual

D20S-9, D25S-9, D30S-9, D33S-9, D35C-9

FDA2A, FDA2B, FDA2C, FDA2D, FDA2E

DM02-LEF03 De-Tier/ DM02-MFF07 Stage V

Forklifts

Doosan Industrial Vehicle Co., Ltd.
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SB2503E04

Operation & Maintenance Manual

Forklifts

D20S-9, D25S-9, D30S-9, D33S-9, D35C-9

FDA2A, FDA2B, FDA2C, FDA2D, FDA2E

DM02-LEF03 De-Tier/ DM02-MFF07 Stage V

Translation of the original instruction

2211

⚠ WARNING

Do not start, operate or service this machine unless you have read and understood these instructions and received proper training.
Unsafe or improper use of the machine may cause serious injury or death.
Operators and maintenance personnel must read this manual and receive training before operating or maintaining the machine.
This manual should be kept with the machine for reference and periodically reviewed by the machine operator and by all personnel who will come into contact with it.

⚠ WARNING

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to ***www.P65warnings.ca.gov/diesel***.

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Foreword

Literature Information

This manual should be stored in the operator's compartment in the literature holder or seat back literature storage area.

This manual contains safety, operation, transportation, lubrication and maintenance information.

Some photographs or illustrations in this publication show details or attachments that can be different from your lift truck. Guards and covers might have been removed for illustrative purposes.

Continuing improvement and advancement of product design might have caused changes to your lift truck which are not included in this publication. Read, study and keep this manual with the lift truck.

Whenever a question arises regarding your lift truck, or this publication, please consult your DOOSAN dealer for the latest available information.

Safety

The Safety Section lists basic safety precautions. In addition, this section identifies the text and locations of warning signs and labels used on the lift truck.

Read and understand the basic precautions listed in the Safety Section before operating or performing lubrication, maintenance and repair on this lift truck.

Operator Restraint System (If Equipped)

This manual contains safety, operation and maintenance information for the DOOSAN operator restraint system. Read, study and keep it handy.

⚠ WARNING

Your DOOSAN truck comes equipped with an operator restraint system. Should it become necessary to replace the seat for any reason, it should only be replaced with another DOOSAN operator restraint system.

Photographs or illustrations guide the operator through correct procedures of checking, operation and maintenance of the DOOSAN operator restraint system.

SAFE and EFFICIENT OPERATION of a lift truck depends to a great extent on the skill and alertness on the part of the operator. To develop this skill the operator should read and understand the Safe Driving Practices contained in this manual.

Forklift trucks seldom tipover, but in the rare event they do, the operator may be pinned to the ground by the lift truck or the overhead guard. This could result in serious injury or death.

Operator training and safety awareness is an effective way to prevent accidents, but accidents can still happen. The DOOSAN operator restraint system can minimize injuries. The DOOSAN operator restraint system keeps the operator substantially within the confines of the operator's compartment and the overhead guard.

This manual contains information necessary for Safe Operation. Before operating a lift truck, make sure that the necessary instructions are available and understood.

Operation

The Operation Section is a reference for the new operator and a refresher for the experienced one.

This section includes a discussion of gauges, switches, lift truck controls, attachment controls, transportation and towing information.

Photographs and illustrations guide the operator through correct procedures of checking, starting, operating and stopping the lift truck.

Operating techniques outlined in this publication are basic. Skill and techniques develop as the operator gains knowledge of the lift truck and its capabilities.

Maintenance

The Maintenance Section is a guide to equipment care. The illustrated, step-by-step instructions are grouped by servicing intervals. Items without specific intervals are listed under “When Required” topics. Items in the “Maintenance Intervals” chart are referenced to detailed instructions that follow.

Maintenance Intervals

Use the service hour meter to determine servicing intervals. Calendar intervals shown (daily, weekly, monthly, etc.) can be used instead of service hour meter intervals if they provide more convenient servicing schedules and approximate the indicated service hour meter reading. Recommended service should always be performed at the interval that occurs first.

Under extremely severe, dusty or wet operating conditions, more frequent lubrication than is specified in the “Maintenance Intervals” chart might be necessary.

Perform service on items at multiples of the original requirement. For example, at “Every 500 Service Hours or 3 Months”, also service those items listed under “Every 10 Service Hours or Daily”.

Environment Management

Note that Doosan Industrial Vehicle is ISO 14001 certified which is harmonized with ISO 9001. Periodic ENVIRONMENTAL AUDITS & ENVIRONMENTAL PERFORMANCE EVALUATIONS have been made by internal and external inspection entities. LIFE-CYCLE ANALYSIS has also been made through out the total product life. ENVIRONMENT MANAGEMENT SYSTEM includes DESIGN FOR ENVIRONMENT from the initial stage of the design. ENVIRONMENT MANAGEMENT SYSTEM considers environmental laws & regulations, reduction or elimination of resource consumption as well as environmental emission or pollution from industrial activities, energy saving, environment-friendly product design(lower noise, vibration, emission, smoke, heavy metal free, ozone depleting substance free, etc.), recycling, material cost reduction, and even environmentally oriented education for the employee.

Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards and use common sense. Persons must also have the necessary training, skills and tools before attempting to perform these functions.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or other persons.

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “WARNING” as shown below.

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is involved.

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

Operations that may cause product damage are identified by NOTICE labels on the product and in this publication.

DOOSAN cannot anticipate every possible circumstance that might involve a potential hazard, and common sense is always required. The warnings in this publication and on the product are therefore not all inclusive. Before any tool, procedure, work method or operating technique not specifically recommended by DOOSAN is used, you must be sure that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

The information, specifications, and illustration in this publication are on the basis of information available at the time it was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service given to the product. Obtain the complete and most current information before starting any job. DOOSAN dealers have the most current information available.

Safety

The safety rules and regulations in this section are representative of some, but not all rules and regulations that apply to lift trucks. Rules and regulations are paraphrased without representation that they have been reproduced verbatim.

Please refer to 29 CFR 1910.178 in the Code of Federal Regulations, the National Fire Protection Association No. 505 (NFPA), American National Standards Institute/Industrial Truck Standards Development Foundation, ANSI/ITSDF B56.1 Safety Standard for Low lift and High Lift Trucks, UL 558 Fire Safety Standard for Internal Combustion Engine-Powered Industrial Trucks and subsequent revisions for a complete list of rules and regulations as to the safe operation of powered industrial lift trucks. Since regulations vary from country to country outside of U.S.A., operate this lift truck in accordance with local regulations.

DOOSAN lift trucks are manufactured in accordance with the National Fire Protection Association (NFPA) No. 505 and the American National Standards Institute, Inc. / Industrial Truck Standards Development Foundation (ANSI/ITSDF) B56.1, Safety Standard for Low and High Lift Trucks and, for European models, according to the regulations and standards laid down in EU Machinery Directive 2006/42/EC and EMC directive 2014/30/EU.

The most effective method of reducing the risk of serious injury or death to you or others is for you to know how to properly operate this lift truck, to be alert and to avoid actions or conditions that could cause accidents.

Do not operate a lift truck if it is in need of maintenance, repair or appears to be unsafe in any way. Report all unsafe conditions immediately to your supervisor, then contact your authorized lift truck dealer. Do not attempt any adjustments or repairs unless trained and authorized to do so.

Warning Signs and Labels

There are several specific safety signs on your lift truck. Their exact location and description of the hazard are reviewed in this section. Please take the time to familiarize yourself with these safety signs.

Make sure that you can read all warning and instruction labels. Clean or replace these labels if you cannot read the words or see the pictures. When cleaning the labels use a cloth, water and soap. Do not use solvent, gasoline, etc.

You must replace a label if it is damaged, missing or cannot be read. If a label is on a part that is replaced, make sure a new label is installed on the replaced part. See your dealer for new labels.

Training Required To Operate or Service Warning

Located on the right side of the steering wheel.

⚠ WARNING

Improper operation or maintenance could result in injury or death. Do not operate or work on the lift truck unless you are properly trained. Read and understand the Operation and Maintenance Manual. Additional manuals are available from DOOSAN Lift Truck dealers.

This label also provides allowable lift truck capacity information.

General Warning to Operator

Located on the right side of the operator's seat (STD).

Located on the overhead guard. (If Convenience Package Equipped).

⚠ WARNING

Only trained and authorized personnel may operate this machine. For safe operation, read and follow the operation and maintenance Manual furnished with this lift truck and observe the following warnings:

1. **Before starting machine. Check all controls and warning devices for proper operation.**
2. **Refer to machine identification plate for allowable machine capacity. Do not overload. Operate machines equipped with attachments as partially loaded machines when not handling a load.**
3. **Put directional control or shift lever in neutral before "ON - OFF" switch is turned on.**
4. **Start, turn and brake smoothly. Slow down for turns, slippery or uneven surfaces. Extremely poor surfaces should be repaired. Avoid running over loose objects or holes in the roadway surfaces. Use extreme caution when turning on inclines.**
5. **Travel with load as low as possible and tilted back. If load interferes with visibility, travel with load trailing.**
6. **On grade operations travel with load up grade.**
7. **Watch out for pedestrians and obstructions. Check overhead clearances.**
8. **Do not permit riders on forks or machine at any time.**
9. **Do not allow anyone to stand or pass under the elevated portion of any machine.**
10. **Be sure operating surface can safely support machine.**
11. **Operate machine and attachments only from operator's position.**
12. **Do not handle unstable or loosely stacked loads.**
13. **Use minimum tilt when picking up or depositing a load.**
14. **Use extreme care when handling long, high or wide loads to ensure stability and durability of the truck.**
15. **Forks should be completely under load and spread apart as far as load permits.**
16. **Machine should be equipped with overhead guard or equivalent protection. Where load requires it, use load backrest extension. Use extreme caution if operating without these devices.**
17. **Parking - Lower lifting mechanism to floor. Put directional control or shift lever in neutral. Set parking/secondary brake. Turn "ON - OFF" switch off. Chock wheels if machine is on incline. Disconnect battery when storing electric machines.**
18. **Observe safety rules when handling fuel for engine powered machine and when changing batteries for electric machines.**
19. **Avoid overuse of the inching pedal as this may cause the automatic transmission oil to overheat or the clutch to slip. Do not use as a footrest or for long periods of time.**
20. **If user operates continuously pushing work or both brake pedal and accelerator pedal were depressed at the same time, it may cause the automatic transmission oil to overheat or the clutch to slip.**

Pressure Warning

⚠ WARNING

Contents under pressure may be hot. Allow to cool before opening.

Located on the radiator top tank by the radiator cap.

Hand Placement Warning

⚠ WARNING

No hands. Do not place hands in this area. Do not touch, lean on, or reach through the mast or permit others to do so.

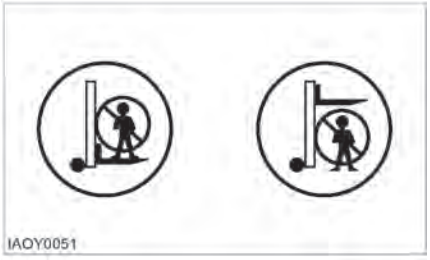
Located on the mast.

No Standing On Fork Warning

No Standing Under Fork Warning

⚠ WARNING

Do not stand or ride on the forks. Do not stand or ride on a load or pallet on the forks. Do not stand or walk under the forks.



Located on the lift cylinder.

Load Backrest Must Be In Place Warning

⚠ WARNING

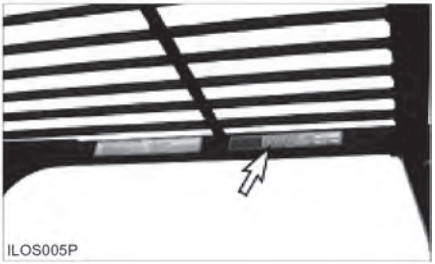
Operation without this device in place may be hazardous.

Located on the load backrest.

Overhead Guard Must Be In Place Warning

⚠ WARNING

Operation without this device in place may be hazardous. This guard conforms to A.N.S.I.B56.1 and F.E.M.Section IV. This design has been tested with an impact of appropriate valve.



Located on the Overhead Guard.

No Riders Warning

⚠ WARNING

To avoid personal injury, allow no riders. A lift truck is designed for only one operator and no riders.

Located beside the operator's station (STD) or on front of the hood (Convenience Package).

Moving Fan Warning

⚠ WARNING

To avoid personal injury, stay clear of moving fan.

Located inside the engine compartment cover.

Electronic Parking Brake

Push the front side of the parking brake switch to engage the brake.

Push the rear side of the parking brake switch to release the brake.

Applying the parking brake puts the transmission in NEUTRAL. The parking brake must be applied when leaving the lift truck and when starting the engine. If the operator leaves the seat without applying the parking brake, an audible alarm will sound.

⚠ WARNING

When leaving machine apply parking brake!
Parking brake is not automatically applied.
Alarm will sound if parking brake is not applied.

⚠ WARNING

Correct adjustment is necessary to provide adequate braking. See the MAINTENANCE section for adjustment procedures. The lift truck may creep at engine idle and can cause damage, injury or death. Always apply the parking brake when leaving the lift truck. The parking brake is NOT automatically applied.

General Hazard Information

Attach a “Do Not Operate” or similar warning tag to start switch or controls before servicing or repairing the lift truck.

Do not start or service the lift truck when a “DO NOT OPERATE” or similar warning tag is attached to the start switch or controls.

Wear a hard hat, protective glasses and other protective equipment as required by job conditions.

Know the width of your attachments so proper clearance can be maintained when operating near fences, boundary obstacles, etc.

Do not wear loose clothing or jewelry that can catch on controls or other parts of the lift truck.

Keep the lift truck, especially the deck and steps, free of foreign material such as debris, oil tools and other items which are not part of the lift truck.

Secure all loose items such as lunch boxes, tools and other items which are not part of the lift truck.

Know the appropriate work-site hand signals and who gives them. Accept signals from one person only.

Always use the overhead guard. The overhead guard is intended to protect the lift truck operator from overhead obstructions and from falling objects.

A truck that is used for handing small objects or uneven loads must be fitted with a load backrest.

If the lift truck must be operated without the overhead guard in place due to low overhead clearance, use extreme care. Make sure there is no possibility of falling objects from any adjacent storage or work area. Make sure the load is stable and fully supported by the carriage and the load backrest extension (if equipped).

Do not raise loads any higher than necessary and never raise a load higher than 1830 mm (72 in) with the overhead guard removed.

Always use load backrest extension when the carriage or attachment does not fully support the load. The load backrest extension is intended to prevent the load or any part of the load from falling backwards into the operator's station.

When operating the lift truck, do not depend only on flashing lights or back-up alarm (if equipped) to warn pedestrians.

Always be aware of pedestrians and do not proceed until the pedestrians are aware of your presence and intended actions and have moved clear of the lift truck and/or load.

Do not drive lift truck up to anyone standing in front of an object.

Obey all traffic rules and warning signs.

Keep hands, feet and head inside the operator station. Do not hold onto the overhead guard while operating the lift truck. Do not climb on any part of the mast or overhead guard or permit others to do so.

Do not allow unauthorized personnel to ride on the forks or any other part of the lift truck, at any time.

When working in a building or dock, observe floor load limits and overhead clearances.

NOTICE

Inhaling Freon gas through a lit cigarette or other smoking method or inhaling fumes released from a flame contacting Freon can cause bodily harm or death.

Do not smoke when servicing air conditioners or wherever Freon gas may be present.

The Machine contains 0.35kg of HFC-134a, of which the CO2 equivalent value is 0.501 tons.

The GWP of HFC-134a is 1,430.

This is only for the trucks with air-conditioner option.

The above capacity information written on the film is attached to the truck.

Never put maintenance fluids into glass containers.

Use all cleaning solutions with care.

Do not use steam, solvent, or high pressure to clean electrical components.

Report all needed repairs.

Inspect the part of the chain that is normally operated over the crosshead roller. When the chain bends over the roller, the movement of the parts against each other causes wears.

Inspect to be sure that chain link pins do not extend outside of the bore hole.

If any single link pin is extended beyond its connecting corresponding link, it should be suspected of being broken inside of its bore hole.

Inspect the chain anchor and the anchor links for wear.

Do not change any factory set adjustment values (including engine rpm setting) unless you have both authorization and training. Especially Safety equipment and switches may not be removed or adjusted incorrectly. Repairs, adjustments and maintenances that are not correct can make a dangerous operating condition.

For any checkup, repair, adjustments, maintenance and all other work concerning your forklift truck, please contact your DOOSAN dealer. Please be aware that Doosan assumes no responsibility for any secondary damages resulting from improper handling, insufficient maintenance or faulty repairs. Use of Doosan genuine parts is recommended when servicing parts.

Operation Information

Mounting and Dismounting

Mount and dismount the lift truck carefully.

Clean your shoes and wipe your hands before mounting.

Use both hands and face the lift truck when mounting and dismounting.

Use the handgrips for mounting and dismounting.

Do not try to climb on or off the lift truck when carrying tools or supplies.

Do not use any controls as handholds when entering or leaving the operator's station.

Never get on or off a moving lift truck. Never jump off the lift truck.

Keep hands and steering wheel free of slippery material.

Before Starting the Lift Truck

Perform a walk-around inspection daily and at the start of each shift. Refer to the topic “Walk-around Inspection” in “Every 10 Service Hours or Daily” section of this manual.

Adjust the seat so that full brake pedal travel can be obtained with the operator's back against the seat back.

Make sure the lift truck is equipped with a lighting system as required by conditions.

Make sure all hydraulic controls are in the HOLD position.

Make sure the direction control lever is in the NEUTRAL position.

Make sure the parking brake is engaged.

Make sure no one is standing and/or working on, underneath or close to the lift truck before operating the lift truck.

Operate the lift truck and controls only from the operator's station.

Make sure the lift truck horn, lights, backup alarm (if equipped) and all other devices are working properly.

Check for proper operation of mast and attachments. Pay particular attention to unusual noises or erratic movement which might indicate a problem.

Make sure service and parking brakes, steering, and directional controls are operational.

Make sure all personnel are clear of lift truck and travel path.

Refer to the topic “Lift Truck Operation” in the “Operation Section” of this manual for specific starting instructions.

Starting the Lift truck

Do not start the engine or move any of the controls if there is a “DO NOT OPERATE” or similar warning tag attached to the start switch or controls.

Before Operating the Lift Truck

Test brakes, steering controls, horn and other devices for proper operation. Report any faulty performance. Do not operate lift truck until repaired.

Learn how your lift truck operates. Know its safety devices. Know how the attachments work. Before moving the lift truck, look around. Start, turn and brake smoothly.

An operator must constantly observe his lift truck for proper operation.

Operating the Lift Truck

Always keep the lift truck under control.

Obey all traffic rules and warning signs.

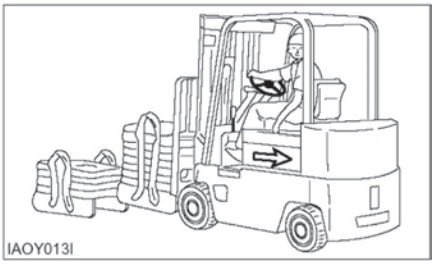
Never leave the lift truck with the engine operating, or with the parking brake disengaged.

Operate the engine only in a well-ventilated area.

Lower a mast, with or without load, before turning or traveling. Tip over could result. Watch out for overhead obstructions.

Always observe floor load limits and overhead clearance.

Start, turn, and brake smoothly. Slow down for turns, grades, slippery or uneven surfaces.



Use special care when operating on grades. Do not angle across or turn on grades. Do not use lift truck on slippery grades. Travel with forks downgrade when unloaded. Travel with load upgrade.

Do not overload, or handle offset, unstable, or loosely stacked loads. Refer to load capacity plate on the lift truck. Use extreme caution when handling suspended, long, high or wide load.

Tilt the elevated load forward only when directly over unloading area and with load as low as possible.

Do not stunt ride or indulge in horseplay.

Always look and keep a clear view of the path of travel.

Travel in reverse if load or attachment obstructs visibility. Use extreme caution if visibility is obstructed.

Stay in designated travel path, clear of dock edges, ditches, other drop-offs and surfaces which cannot safely support the lift truck.

Slow down and use extra care through doorways, intersections and other location where visibility is reduced.

Slow down for cross aisles, turns, ramps, dips, uneven or slippery surfaces and in congested areas, avoid pedestrians, other vehicles, obstruction, pot holes and other hazards or objects in the path of travel.

Always use overhead guards except where operation conditions do not permit. Do not operate lift truck in high stacking areas without overhead guards.

When stacking, watch for falling objects. Use load backrest extension and overhead guard.

Refer to the topic “Operation Techniques” in the “Operation Section” of this manual.

Loading or Unloading Trucks/Trailers

Do not operate lift trucks on trucks or trailers which are not designed or intended for that purpose. Be certain truck or trailer brakes are applied and wheel chocks in place (or be certain unit is locked to the loading dock) before entering onto trucks or trailers.

If trailer is not coupled to tractor, make sure the trailer landing gear is properly secured in place. On some trailers, extra supports may be needed to prevent upending or corner dipping.

Be certain dock plates are in good condition and properly placed and secured. Do not exceed the rated capacity of dock boards or bridge plates.

Lift Truck Parking

When leaving the operator station, park the lift truck in authorized areas only. Do not block traffic.

- **Park the lift truck level, with the forks lowered and the mast tilted forward until the fork tips touch the floor.**
- **Move the direction control lever to NEUTRAL.**
- **Engage the parking brake.**
- **Turn the key switch off and remove the key.**
- **Turn the disconnect switch to OFF (if equipped).**
- **Do operate the disconnecting switch after 30 seconds from start key-off. (if equipped)**
- **Otherwise Engine Control Unit (ECU) can be damaged.**
- **Block the drive wheels when parking on an incline.**

Maintenance Information

Perform all maintenance unless otherwise specified as follows:

- **Park the lift truck in authorized areas only.**
- **Park the lift truck level, with the forks lowered and the mast tilted forward until the fork tips touch the floor.**
- **Place the transmission controls in neutral.**
- **Engage the parking brake.**
- **Stop the engine.**
- **Remove the start switch key and turn the disconnect switch OFF (if equipped).**
- **Block the drive wheels when parking on an incline.**

Pressure Air

Pressure air can cause personal injury. When using pressure air for cleaning, wear a protective face shield, protective clothing and protective shoes.

The maximum air pressure must be below 205 kPa (30 psi) for cleaning purposes.

Fluid Penetration

Always use a board or cardboard when checking for a leak. Escaping fluid under pressure, even a pinhole size leak, can penetrate body tissue, causing serious injury, and possible death. If fluid is injected into your skin, it must be treated by a doctor familiar with this type of injury immediately.

Crushing or Cutting Prevention

Support equipment and attachments properly when working beneath them. Do not depend on hydraulic cylinders to hold it up. Any attachment can fall if a control is moved, or if a hydraulic line breaks.

Never attempt adjustments while the lift truck is moving or the engine is running unless otherwise specified.

Where there are attachment linkages, the clearance in the linkage area will increase or decrease with movement of the attachment.

Stay clear of all rotating and moving parts.

Keep objects away from moving fan blades.

They will throw or cut any object or tool that falls or is pushed into them.

Do not use a kinked or frayed wire rope cable. Wear gloves when handling the wire rope cable.

Retainer pins, when struck with force, can fly out and injure nearby persons. Make sure the area is clear of people when driving retainer pins.

Wear protective glasses when striking a retainer pin to avoid injury to your eyes.

Chips or other debris can fly off objects when struck. Make sure no one can be injured by flying debris before striking any object.

Falling Objects Protective Structure (FOPS)

This is an attached guard located above the operator's compartment and secured to the lift truck.

To avoid possible weakening of the Falling Objects Protective Structure (FOPS), consult a DOOSAN dealer before altering, by adding weight to, welding on, or cutting or drilling holes into the structure.

The overhead guard is not intended to protect against every possible impact. The overhead guard may not protect against some objects penetrating into the operator's station from the sides or ends of the lift truck.

The lift truck is equipped with an overhead guard and FOPS as standard. If there is a possibility of overhead objects falling through the guard, the guard must be equipped with smaller holes or a Plexiglas cover.

Any altering done that is not specifically authorized by DOOSAN invalidates DOOSAN's FOPS certification. The protection offered by this FOPS will be impaired if it has been subjected to structural damage. Structural damage can be caused by an overturn accident, by falling objects, etc.

Do not mount any item such as fire extinguishers, first aid kits and lights by welding brackets to or drilling holes in any FOPS structure. See your DOOSAN dealer for mounting guidelines.

Burn Prevention

Coolant

At operating temperature, the engine coolant is hot and under pressure. The radiator and all lines to heaters or the engine contain hot water or steam. Any contact can cause severe burns.

Steam can cause personal injury.

Check the coolant level only after engine has been stopped and the filter cap is cool enough to remove with your bare hand.

Remove the cooling system filter cap slowly to relieve pressure.

Cooling system additive contains alkali that can cause personal injury. Avoid contact with the skin and eyes and do not drink.

Allow cooling system components to cool before draining.

Oils

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact the skin.

At operation temperature, the hydraulic tank is hot and can be under pressure.

Remove the hydraulic tank filter cap only after the engine has been stopped and the filter cap is cool enough to remove with your bare hand.

Remove the hydraulic tank filter cap slowly to relieve pressure.

Relieve all pressure in air, oil fuel or cooling systems before any lines, fittings or related items are disconnected or removed.

Batteries

Batteries give off flammable fumes which can explode.

Do not smoke when observing the battery electrolyte levels.

Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.

Always wear protective glasses when working with batteries.

Fire or Explosion Prevention

All fuels, most lubricants and some coolant mixtures are flammable.

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

Do not smoke while refueling or in a refueling area.

Do not smoke in areas where batteries are charged, or where flammable materials are stored.

Batteries in series can be located in separate compartments. When using jumper cables always connect positive (+) cable to positive (+) terminal of battery connected to starter solenoid and negative (-) cable from external source to starter negative (-) terminal.

(If not equipped with starter negative (-) terminal, connect to engine block.)

See the Operation Section of this manual for specific starting instructions.

Clean and tighten all electrical connections. Check daily for loose or frayed electrical wires. Have all loose or frayed electrical wires tightened, repaired or replaced before operating the lift truck.

Keep all fuels and lubricants stored in properly marked containers and away from all unauthorized persons.

Store all oily rags or other flammable material in a protective container, in a safe place.

Do not weld or flame cut on pipes or tubes that contain flammable fluids. Clean them thoroughly with nonflammable solvent before welding or flame cutting on them.

Remove all flammable materials such as fuel, oil and other debris before they accumulate on the lift truck.

Do not expose the lift truck to flames, burning brush, etc., if at all possible.

Shields, which protect hot exhaust components from oil or fuel spray in the event of a line, tube or seal failure, must be installed correctly.

Do not operate in areas where explosive gases exist or are suspected.

Fire Extinguisher

Have a fire extinguisher-type BC and 1.5KG minimum capacity-on rear overhead guard leg with latch and know how to use it. Inspect and have it serviced as recommended on its instruction plate.

Ether

Ether is poisonous and flammable.

Breathing ether vapors or repeated contact of ether with skin can cause personal injury.

Use ether only in well-ventilated areas.

Do not smoke while changing ether cylinders.

Use ether with care to avoid fires.

Do not store replacement ether cylinders in living areas or in the operator's compartment.

Do not store ether cylinders in direct sunlight or at temperatures above 39°C (102°F).

Discard cylinders in a safe place. Do not puncture or burn cylinders.

Keep ether cylinders out of the reach of unauthorized personnel.

Lines, Tubes and Hoses

Do not bend or strike high pressure lines. Do not install bent or damaged lines, tubes or hoses.

Repair any loose or damaged fuel and oil lines, tubes and hoses. Leaks can cause fires. Contact your DOOSAN dealer for repair or replacement.

Check lines, tubes and hoses carefully. Do not use your bare hand to check for leaks. Use a board or cardboard to check for leaks. See Fluid Penetration in the Safety Section for more details. Tighten all connections to the recommended torque. Replace if any of the following conditions are found.

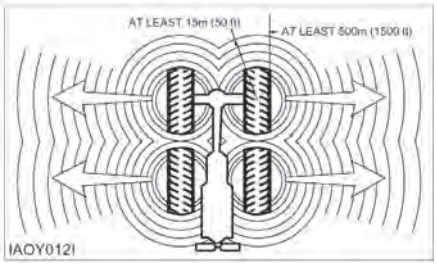
- **End fittings damaged or leaking.**
- **Outer covering chafed or cut and wire reinforcing exposed.**
- **Outer covering ballooning locally.**
- **Evidence of kinking or crushing of the flexible part of hose.**
- **Armoring embedded in the outer cover.**
- **End fittings displaced.**

Make sure that all clamps, guards and heat shields are installed correctly to prevent vibration, rubbing against other parts, and excessive heat during operation.

Tire Information

Explosions of air-inflated tires have resulted from heat-induced gas combustion inside the tires. The heat, generated by welding or heating rim components, external fire, or excessive use of brakes can cause gaseous combustion.

A tire explosion is much more violent than a blowout. The explosion can propel the tire, rim and axle components as far as 500 m (1500 ft) or more from the lift truck. Both the force of the explosion and the flying debris can cause personal injury or death, and property damage.



Do not approach a warm tire closer than the outside of the area represented by the shaded area in the above drawing.

Dry nitrogen (N_2) gas is recommended for inflation of tires. If the tires were originally inflated with air, nitrogen is still preferred for adjusting the pressure. Nitrogen mixes properly with air.

Nitrogen inflated tires reduce the potential of a tire explosion, because nitrogen does not support combustion. Also, nitrogen helps prevent oxidation and the resulting deterioration of rubber and corrosion of rim components.

Proper nitrogen inflation equipment and training in its use are necessary to avoid over-inflation. A tire blowout or rim failure can result from improper or misused equipment.

Stand behind the tread and use a self-attaching chuck when inflation a tire.

Servicing, changing tires and rims can be dangerous and should be done only by trained personnel using proper tools and procedures. If correct procedures are not followed while servicing tires and rims, the assemblies could burst with explosive force and cause serious personal injury or death. Follow carefully the specific information provided by your tire or rim servicing personnel or dealer.

DOOSAN forklift is equipped with wheels from different manufacturers.

Please re-use the original parts of the existing wheel, if there is no deformation of the wheel after checked. Mixing up new and old parts may cause incomplete assembly that might lead to unexpected dismantlement of parts and accident.

Operator Restraint System

Warning Signs and Labels

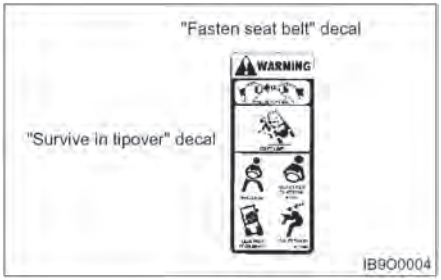
Your DOOSAN forklift has the following tipover warning decals.

Make sure that you can read all safety signs. Clean or replace these if you cannot read the words or see the pictures. When cleaning the labels use a cloth, water and soap. Do not use solvent, gasoline, etc. You must replace a label if it is damaged, missing or cannot be read. If a label is on a part that is replaced, make sure a new label is installed on the replaced part. See you DOOSAN forklift dealer for new labels.

The most effective method of preventing serious injury or death to yourself or others is to familiarize yourself with the proper operation of the lift truck, to be alert, and to avoid actions or conditions which can result in an accident.

⚠ WARNING

Tipover can occur if the truck is improperly operated. In the event of tipover, injury or death could result.



The “Survive in tipover” warning is located on the overhead guard. It shows the proper use of the operator restraint system.

Seat Adjustment

Adjust the seat before operating the lift truck. After adjusting, set the seat to make sure it is properly locked. Do not adjust the seat while the truck is in motion.

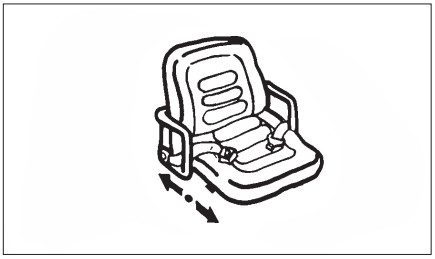
⚠ WARNING

Do not place your hand or fingers under the seat. Injury may occur as the seat moves up and down.

If Optional Suspension Seat (weight adjusting type) Equipped

Forward and Backward Adjustment

The seat can be adjusted by pushing the lever on the right side of seat.



Adjust the seat before operating the lift truck. After adjusting, set the seat to make sure it is properly locked. Do not adjust the seat while the truck is in motion.

Weight adjustment

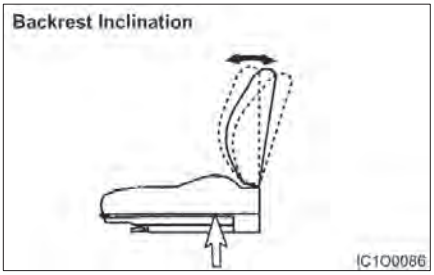
Pull the weight adjustment lever upwards and move right or left side.
Adjust to driver's weight in 7 steps (50 ~ 110 kg)

NOTICE

Do not place your hand or fingers under the seat. Injury may occur as the seat moves up and down.

Backrest Inclination

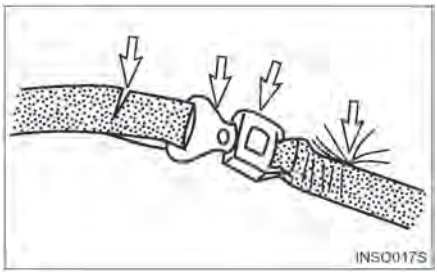
The backrest angle can be adjusted by using the lever on the left side of seat.



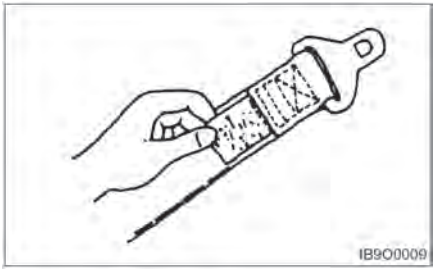
Seat Belt

The Operator Restraint System, Prevents the operator from jumping from the operator's compartment in the event of a forward or side tipover. The system is designed to keep the operator on the seat and in the operator's compartment in the event of a tipover.

Inspection



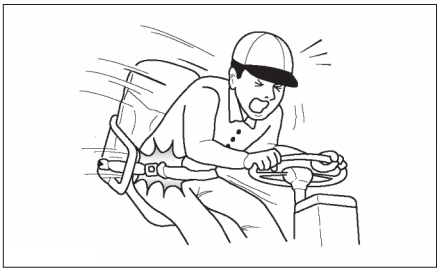
1. If the seat belt is torn, if pulling motion is interrupted during extension of the belt, or if the belt cannot be inserted into the buckle properly, replace the seat belt assembly.



2. Belt Maintenance - Every 500 service hours. Check that the belt fastening works properly and that winding device is free from run lock when jerked. Check that the belt is suitably fastened to the seat. Check that the seat is correctly secured to the hood and the chassis. On visual inspection, fastenings must be intact, otherwise, contact the safety manager.

⚠ WARNING

Your DOOSAN truck comes equipped with a DOOSAN operator restraint system. Should it become necessary to replace the seat for any reason, it should only be replaced with another DOOSAN operator restraint system.



3. In the event of a tipover, the seat and restraint system should be inspected for damage and replaced, if necessary.

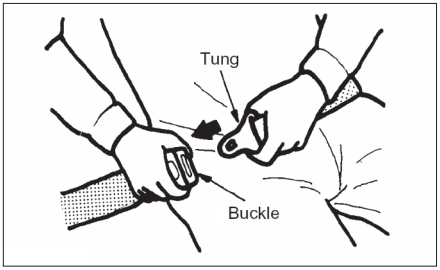
NOTE: Operator restraints shall be examined at the regular truck service intervals. It is recommended that they be replaced if any of the following conditions are found:

- **Cut or frayed strap**
- **Worn or damaged hardware including anchor points**
- **Buckle or retractor malfunction**
- **Loose stitching**

⚠ WARNING

The seat belt may cause the operator to bend at the waist. If you are pregnant or have suffered from some abdominal disease, consult a doctor before you use the seat belt.

Fasten the Seat Belt

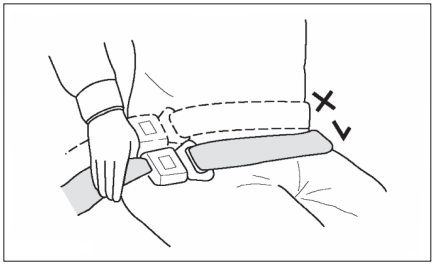


1. Grip the plate (connector) of the belt and pull the belt from the retractor. Then insert the plate into the slot of the buckle until a snap is heard. Pull on the belt to confirm it is latched.

2. Make sure the belt is not twisted.

⚠ WARNING

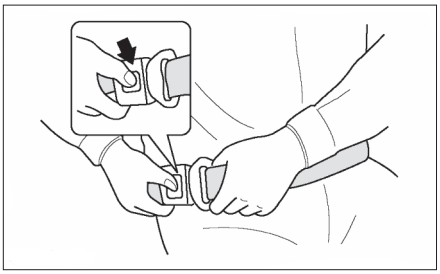
If you fasten the belt across your abdomen, the belt may injure your abdomen in an accident.



3. Be sure to fasten the belt across your hips, not across your abdomen.

NOTE: The belt is designed to automatically adjust to your size and movement. A quick pull on the belt will confirm that the automatic adjuster will hold the belt position in the event of an accident.

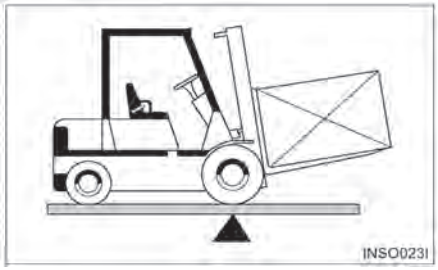
Release the Seat Belt



Push the button of the buckle to release the belt. The belt will automatically retract when released. Hold the plate of the belt and allow the belt to slowly retract.

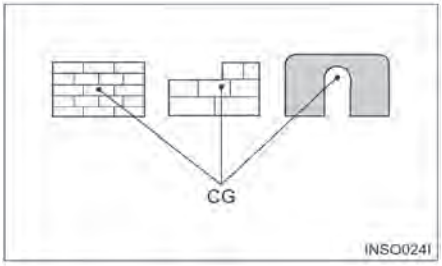
Avoiding Lift Truck Tipover

Lift Truck Stability



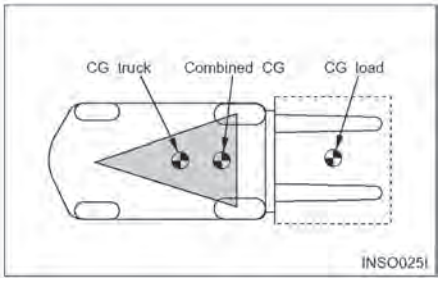
Counterbalanced lift truck design is based on the balance of two weights on opposite sides of a fulcrum (the front axle). The load on the forks must be balanced by the weight of the lift truck. The location of the center of gravity of both the truck and the load is also a factor. This basic principle is used for picking up a load. The ability of the lift truck to handle a load is discussed in terms of center of gravity and both forward and sideways stability.

Center of Gravity (CG)



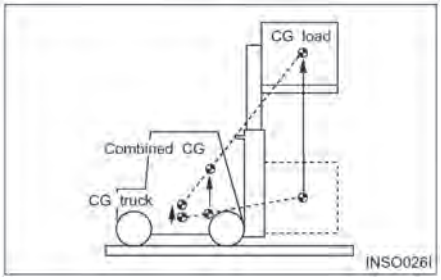
The point within an object, at which the whole weight of the object may be regarded as being concentrated, is called the center of gravity or CG. If the object is uniform, its geometric center will coincide with its CG. If it is not uniform, the CG could be at a point outside of the object. When the lift truck picks up a load, the truck and load have a new combined CG.

Stability and Center of Gravity



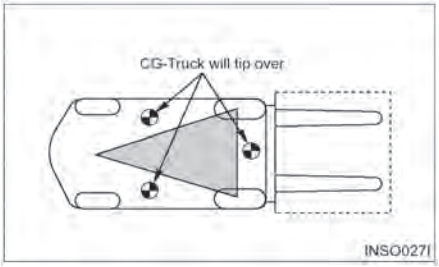
The stability of the lift truck is determined by the location of its CG; or, if the truck is loaded, the combined CG of the truck and load. The lift truck has moving parts and, therefore, has a CG that moves. The CG moves forward or backward as the mast is tilted forward or backward. The CG moves up or down as the mast moves up or down. The CG and, therefore, the stability of the loaded lift truck, are affected by a number of factors such as:

- **the size, weight, shape and position of the load**
- **the height to which the load is lifted**
- **the amount of forward or backward tilt**
- **tire pressure**
- **dynamic forces created when the lift truck is accelerated, braked or turned**
- **condition and grade of surfaces on which the lift truck is operated**



These same factors are also important for unloaded lift trucks. They tip over sideways easier than a loaded lift truck carrying its load in the lowered position.

Lift Truck Stability Base

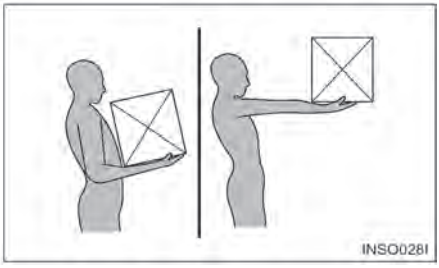


For the lift truck to be stable (not tip over forward or to the side), the CG must stay within the area of the lift truck stability base – a triangular area between the front wheels and the pivot of the steer wheels. If the CG moves forward of the front axle, the lift truck will tip forward. If the CG moves outside of the line on either side of the stability base, the lift truck will tip to the side.

⚠ WARNING

Dynamic forces (braking, acceleration, turning) also affect stability and can produce tipover even when the CG is within the stability triangle.

Capacity Load (Weight and Load Center)



The capacity load of the lift truck is shown on the capacity/nameplate riveted to the truck. It is determined by the weight and load center. The load center is determined by the location of the CG of the load.

The load center shown on the nameplate is the horizontal distance from the front face of the forks, or the load face of an attachment, to the CG of the load. The location of the CG in the vertical direction is the same as the horizontal dimension.

Remember that, unless otherwise indicated, the capacity load shown on the nameplate is for a standard lift truck with standard backrest, forks and mast, and having no special-purpose attachment. In addition, the capacity load assumes that the load center is no further from the top of the forks than it is from the face of the backrest. If these conditions do not exist, the operator may have to reduce the safe operating load because the truck stability may be reduced. The lift truck should not be operated if its capacity/nameplate does not indicate capacity load.

NOTE: If the load is not uniform, the heaviest portion should be placed closer to the backrest and centered on the forks.

NOTICE

1. Capacity/Nameplates originally attached to forklifts sold by DOOSAN shall not be removed, altered or replaced without DOOSAN's approval.
2. DOOSAN assumes no responsibility for lift trucks placed in service without a valid DOOSAN Nameplate.
3. If necessary to change your specification, contact your DOOSAN lift truck dealer.

Safety Rules

Only properly trained and authorized personnel should operate forklift trucks. Wear a hard hat and safety shoes when operating a lift truck. Do not wear loose clothing.

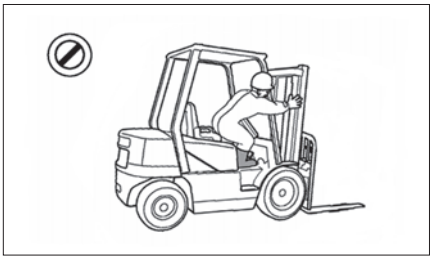
Inspect and check the condition of your forklift truck using the operator's check list before starting work. Immediately report to your supervisor any obvious defects or required repairs.

Do not operate your truck in unauthorized areas.

Know your forklift truck and think safety.

Do not compromise safety.

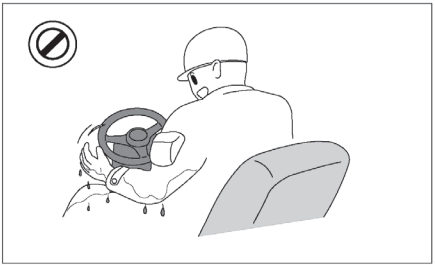
Follow all safety rules and read all warning signs.



Do not operate a lift truck unless you are in the operator's seat. Keep hands and feet inside the operator's compartment. Do not put any part of the body outside of the operator's compartment. Never put any part of body into the mast structure or between the mast and the truck.

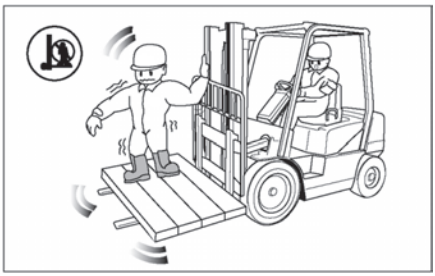
Do not start, stop, turn or change direction suddenly or at high speed. Sudden movement can cause the lift truck to tip over. Slow the speed of your truck and use the horn near corners, exits, entrances, and near people.

In case of a truck with the steering knob, do not operate the steering knob suddenly, to prevent accident caused by quick turning.



Never operate a lift truck with wet hands or shoes.

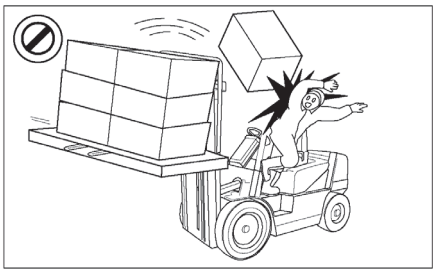
Never hold any controls with grease on your hands. Your hands or feet will slide off of the controls and cause an accident.



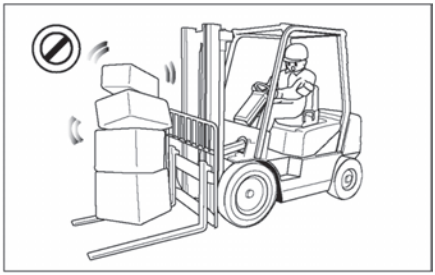
Do not raise anyone on the forks of your lift truck.

Do not let other people ride on the truck.

Lift trucks are designed to carry loads, not people.



Do not operate your truck without the load backrest extension and overhead guard. Keep the load against the backrest with the mast tilted backward



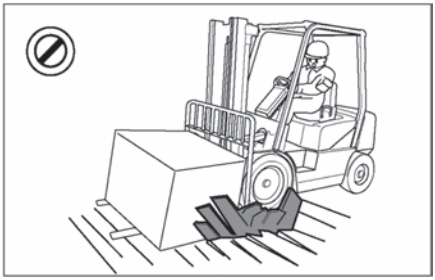
Do not lift or move loads that are not safe. Do not pick up an off center load. Such a load increases the possibility of a tipover to the side.

Make sure loads are correctly stacked and positioned across both forks. Always use the proper size pallet. Position the forks as wide as possible under the load.

Position loads evenly on the forks for proper balance. Do not lift a load with one fork.

Do not overload. Always handle loads within the rated capacity shown on the capacity plate.

Do not add extra counterweight to the truck. An overload can cause the truck to roll over and cause injury to personnel and damage to the lift truck.



Do not drive on soft ground.

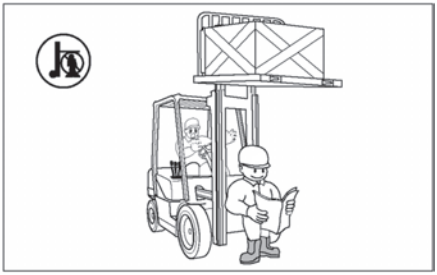
Observe all signs, especially those on maximum permitted floor loadings, elevator capacities and clearance heights.

Handle loads carefully and check them closely for stability and balance.

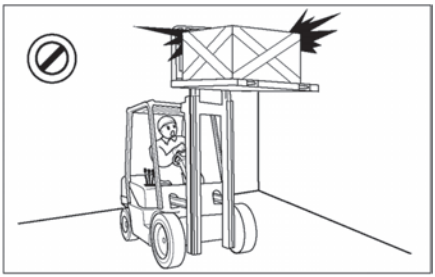
Do not drive on slippery surfaces.

Sand, gravel, ice or mud can cause a tipover.

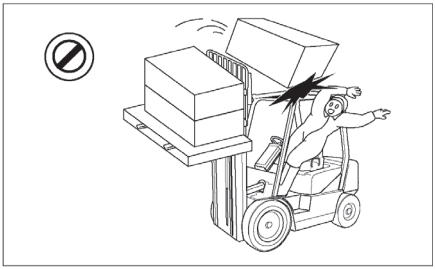
If unavoidable, slow down.



Do not permit anyone to stand or walk under the load or lifting mechanism. The load can fall and cause injury or death to anyone standing below.



Look out for overhead obstructions when raising or stacking loads. Do not travel with a raised load. Do not travel with the mast raised. The lift truck can roll over and cause injury or death to you or other personnel.

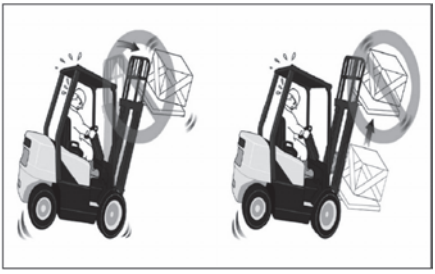


Do not move loose loads that are higher than the load backrest.

Be alert for falling loads when stacking.

Travel with the load tilted back and the forks as low as possible.

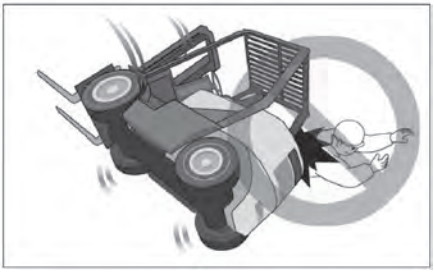
This will increase stability to the truck and load and permit better visibility for you.



Do not elevate the load with the mast tilted forward.

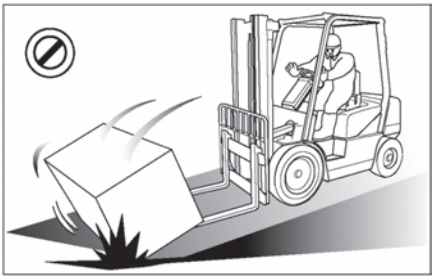
Do not tilt the elevated loads forwards.

This will cause the lift truck to tip over forward.



Do not jump off if your truck starts to tip over.

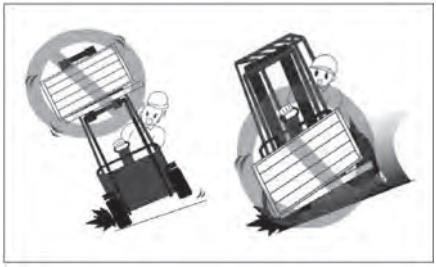
Stay in your seat to survive.



Go up ramps in forward direction and down ramps in reverse direction when moving loads.

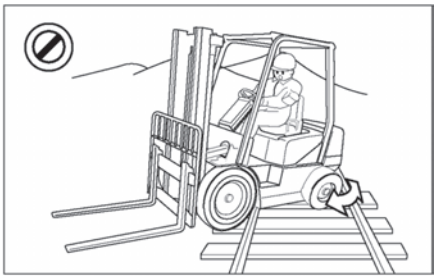
Never elevate a load with the forklift truck on an incline.

Go straight off and straight down. Use an assistant when going up or down a ramp with a bulky load.



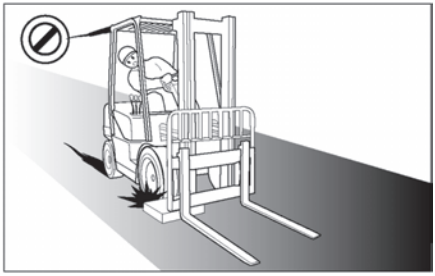
Do not stack or turn on ramps.

Do not attempt to pick-up or deposit a load unless the lift truck is level. Do not turn on or drive across an incline.



Do not go over rough terrain. If unavoidable, slow down.

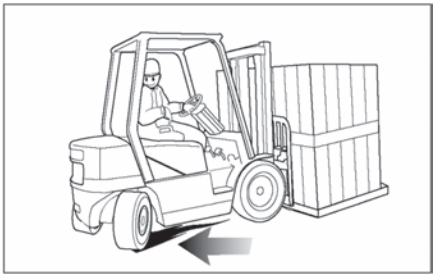
Cross railroad tracks slowly and diagonally whenever possible. A railroad crossing can give a loaded forklift truck a real jolt. For smoother crossing, cross the railroad diagonally so one wheel crosses at a time.



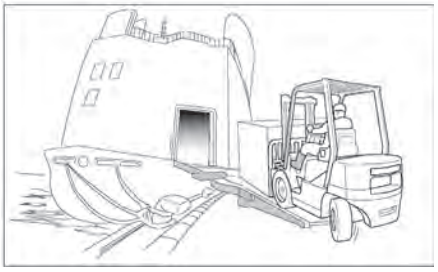
Avoid running over loose objects.

Look in the direction of travel. Look out for other persons or obstructions in your path of travel.

An operator must be in full control of his lift truck at all times.

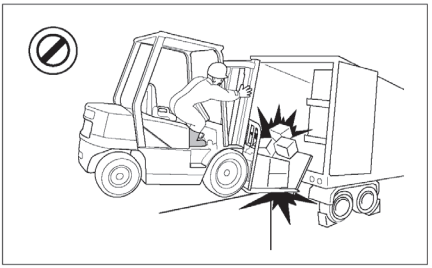


Do not drive in forward direction when loads restrict your visibility. Operate your lift truck in reverse to improve visibility except when moving up a ramp.



Be careful when operating a lift truck near the edge of a loading dock or ramp. Maintain a safe distance from the edge of docks, ramps and platforms. Always watch tail swing.

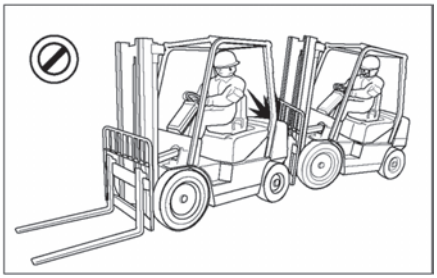
The truck can fall over the edge and cause injury or death.



Do not operate on bridge plates unless they can support the weight of the truck and load.

Make sure that they are correctly positioned.

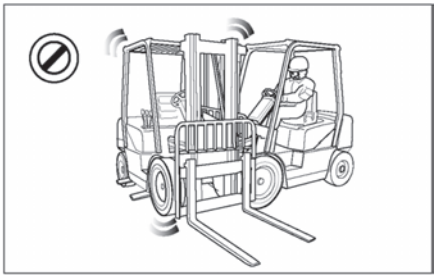
Put blocks on the vehicle you enter to keep it from moving.



Do not operate your truck close to another truck.

Always keep a safe distance from other trucks and make sure there is enough distance to stop safely.

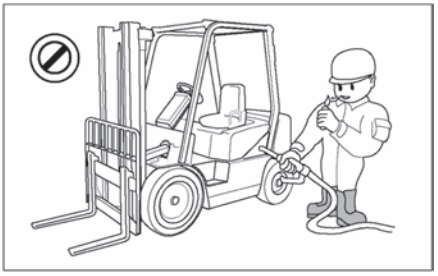
Never overtake other vehicles.



Do not use your lift truck to push or tow another truck.

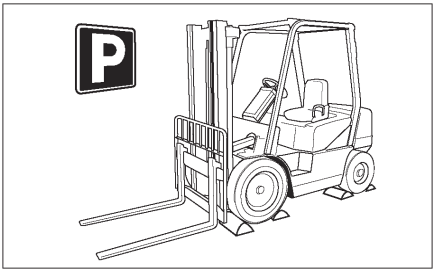
Do not let another push or tow your truck.

If a truck will not move, call a service technician.



Forklift trucks may only be refueled at specially reserved locations. Switch off the engine when refueling.

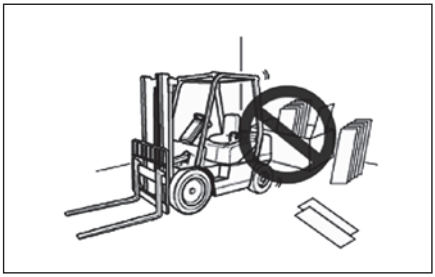
Smoking and handling of naked flames during refueling are strictly prohibited. This prohibition also applies during the changing of the LPG (liquefied propane gas) tank.Mop up spilt fuel and do not forget to close the fuel tank before restarting the engine.



Park your lift truck in authorized areas only. Fully lower the forks to the floor, put direction lever in NEUTRAL position, engage the parking brake, and turn the key to the OFF position. Remove the key and put blocks behind the wheels to prevent the truck from rolling. Shut off your forklift truck when leaving it unattended.

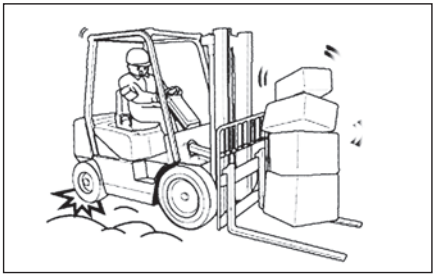
Check the condition of your forklift truck after the day's work.

Exhaust from all internal combustion engines contains carbon monoxide, a colorless, odorless, tasteless, poisonous gas. Exposure to carbon monoxide can cause serious injury or health problems, including death and avoid unnecessary idling of the engine. If nausea, dizziness or headaches are experienced stop the truck and seek fresh air.



Do not operate forklifts near flammable or combustible materials.

To avoid the discoloration, deformation or combustion of materials (such as lumber, veneer board, paper products and other similar items), always park at least 30 cm (12 inches) away from them.

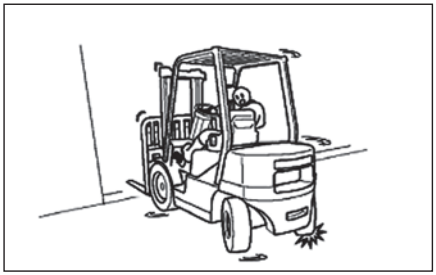


Forklift trucks are not cars. They often have small tires, no suspension, and are very heavy.

The forklift's center of gravity will also change when carrying loads.

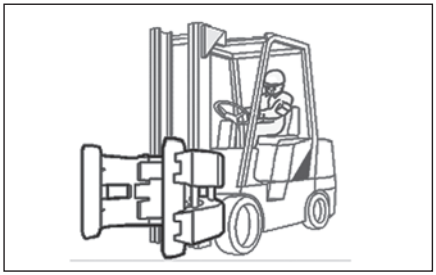
Avoid uneven bumps, pot holes and other hazards whenever possible.

Carrying a load suspended on a chain or a cable may unbalance a truck. Take extra care around pedestrians with a suspended load as it may sway or even strike them.



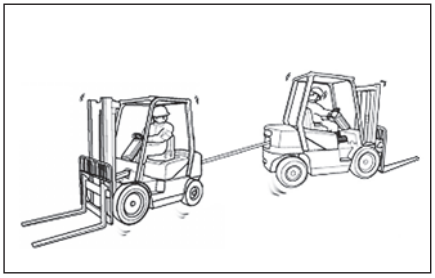
An unloaded forklift may be easier to tip over than a loaded truck.

When traveling without a load, the risk of lateral overturn is greater.



There are many special attachments available to replace the forks on a lift truck.

All carry safety implications and special training in their operation is highly recommended.



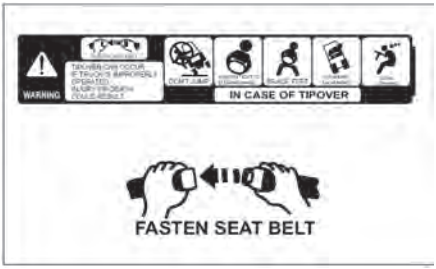
The counterweight draw bar should not be used for towing the forklift or for towing another forklift.

Towing is only advised in emergencies, by trained operators and at low speed, no faster than 2 km/h, to a convenient location for repair.

How to Survive in a Tipover

⚠ WARNING

In the event of a tipover, the risk of serious injury or death will be reduced if the operator is using the operator restraint system and follows the instructions provided.



Always use operator restraint system.

Don't jump.

Hold on tight.

Brace your feet and keep them within the operator's compartment.

Lean away from the direction of fall.

Lean forward.

Declaration of Conformity

We,

Manufacturer
Doosan Industrial Vehicle Co., Ltd.
468, Injung-Ro, Dong-Gu, Incheon, Korea 22503

Authorized Representative, Compiler of Technical File According to 2006/42/EC and **Keeper** of Technical File According to 2000/14/EC
Doosan Industrial Vehicle Europe N.V., Mr. Chankyo Chung,
Europark-Noord 36 A, 9100 Sint-Niklaas, Belgium

herewith declare
that the following equipment conforms with the appropriate requirements of the Directives 2006/42/EC(Machinery Directive), Exhaust gas REGULATION (EU)2016/1628(Stage-V), 2000/14/EC as amended by 2005/88/EC(Noise Emission in the environment by equipment for use outdoors), and 2014/30/EU (EMC Directive) based on its design and type, as brought into circulation by us

Type : Lift Truck, Combustion-engine driven, Counterbalanced
Function : Lifting and Moving materials
Family : D20 / 25 / 30 / 33S-9, D35C-9 Series
Model / Commercial Name :
Serial Number :
Net installed power [kW] : 45.6 kW
Measured sound power level representative for this type : 102 dB(A)
Guaranteed sound power level for this equipment : 102 dB(A)

Conformity assessment procedure According to 2000/14/EC : Annex V

Applicable EC Directives : 2006/42/EC, 2014/30/EU, 2000/14/EC, (EU)2016/1628
Applicable harmonized standard : EN 16307-1:2020, EN ISO 3691-1:2015/A1:2020, EN 1175:2020
EN 12895:2015/A1:2019

SINT-NIKLAAS BELGIUM, December 29, 2022
Place and date of the declaration

C. K. Chung

Signature (for the Authorized Representative)
Signatory's name : **C. K. Chung**
Signatory's title : Vice president
Doosan Industrial Vehicle Europe N.V

Declaration of Conformity

We,

Manufacturer
Doosan Industrial Vehicle Co., Ltd.
468, Injung-Ro, Dong-Gu, Incheon, Korea 22503

Authorized Representative and Compiler of Technical File According to Supply of Machinery (Safety) Regulations 2008 and **Keeper** of Technical File According to Noise Emission in the Environment by Equipment for use Outdoors Regulation 2001
Doosan Industrial Vehicle UK Ltd. Mr. Chankyo Chung
12 Kilvey Road, Brackmills Industrial Estate, Northampton, NN4 7BQ, UK

herewith declare
that the following equipment conforms with the appropriate requirements of the Directives Supply of Machinery (Safety) Regulations 2008 (Machinery Directive), Exhaust gas REGULATION (EU)2016/1628(Stage-V), Noise Emission in the Environment by Equipment for use Outdoors Regulations 2001, and Electromagnetic Compatibility Regulations 2016 (EMC Directive) based on its design and type, as brought into circulation by us.

Type : Lift Truck, Combustion-engine driven, Counterbalanced

Function : Lifting and Moving materials

Family : D20 / 25 / 30 / 33S-9, D35C-9 Series

Model / Commercial Name :

Serial Number :

Net installed power [kW] : 45.6 kW

Measured sound power level representative for this type : 102 dB(A)

Guaranteed sound power level for this equipment : 102 dB(A)

Conformity assessment procedure According to Noise Emission in the Environment by Equipment for use Outdoors Regulations 2001 : Annex V

Applicable EC Directives : Supply of Machinery (Safety) Regulations 2008,
Electromagnetic Compatibility Regulations 2016
Noise Emission in the Environment by Equipment for use Outdoors Regulations 2001
Exhaust gas REGULATION (EU)2016/1628(Stage-V)

Applicable harmonized standard : BS EN 16307-1:2020, BS EN ISO 3691-1:2015/A1:2020
BS EN 1175:2020, BS EN 12895:2015/A1:2019

Northampton, NN4 7BQ, UK, December 29, 2022
Place and date of the declaration

C. K. Chung

Signature (for the Authorized Representative)
Signatory's name : **C. K. Chung**
Signatory's title : Vice president
Doosan Industrial Vehicle UK Ltd.

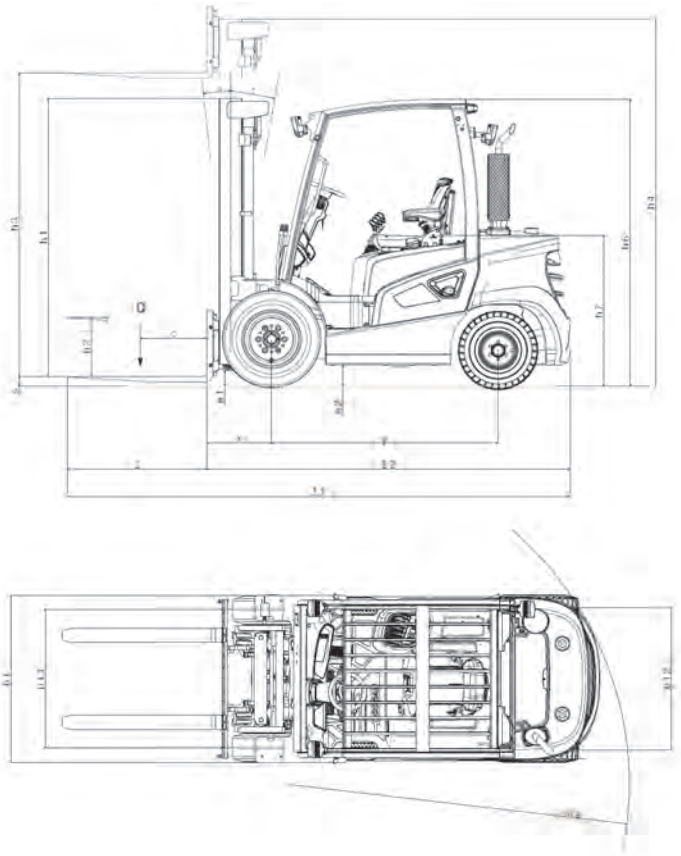
Specifications

Characteristics	1.1	Manufacturer			Doosan
	1.2	Model designation			D20S-9
	1.3	Drive: Diesel, Gasoline, LP			Diesel
	1.4	Operator type: Hand, Pedestrian, Standing, Seated, Order-picker			Seated
	1.5	Load Capacity	Q	kg	2,000
	1.6	Load Center	c	mm	500
	1.8	Load Distance: Center of Driveaxle to fork	x	mm	480
	1.9	Wheelbase	y	mm	1,700
Weight	2.1	Service weight		kg	3,830
	2.2	Axle Loading, Laden Front/Rear		kg	4,977/853
	2.3	Axle Loading, Unladen Front/Rear		kg	1,825/2,005
Tyres	3.1	Tyres: pneumatic (P), superelastic (SE), cushion (C)			P
	3.2	Tyre size, Front			7.00x15-12
	3.3	Tyre size, Reat			6.50x10-10
	3.5	Wheels, number Front/Rear (x = driven wheels)			2/2
	3.6	Tread, Front	b_{11}	mm	975
	3.7	Tread, Rear	b_{12}	mm	990
Dimensions	4.1	Tilt of Mast/Fork carriage Forward/Backward	α/β	°	6/10
	4.2	Height, Mast lowered	h_1	mm	2,190
	4.3	Free Lift	h_2	mm	147
	4.4	Lift	h_3	mm	3,230
	4.5	Height, Mast Extended	h_4	mm	4,490
	4.7	Height of Overhead Guard(Cabin)	h_6	mm	2,183
	4.8	Height of Seat	h_7	mm	1,026
	4.19	Overall Length	l_1	mm	3,624
	4.20	Length to Forkface	l_2	mm	2,574
	4.21	Overall Width	b_1/b_2	mm	1,170
	4.22	Fork Dimensions	s/e/l	mm	40x100x1,050
	4.23	Fork carriage ISO 2328, class/type A,B			II
	4.24	Fork carriage width	b_3	mm	1,103
	4.31	Ground Clearance, laden, below mast	m_1	mm	115
	4.32	Ground Clearance, center of wheelbase	m_2	mm	143
	4.34.1	Aisle withd for pallets 1,000 x 1,200 crossways	A_{st}	mm	3,910
	4.34.2	Aisle width for pallets 800 x 1,200 lengthways	A_{st}	mm	4,110
	4.35	Turning Radius	W_a	mm	2,230
	4.36	Internal Turning Radius	b_{13}	mm	640
Performance data	5.1	Travel Speed, Laden/Unladen		km/h	20/21
	5.2	Lift Speed, Laden/Unladen		m/s	0.61/0.65
	5.3	Lowering Speed, Laden/Unladen		m/s	0.51/0.45
	5.5	Drawbar pull, Laden/Unladen (@ 1.6km/h)		N	17,780/17,500
	5.6	Max. Drawbar pull, Laden/Unladen		N	19,860/19,400
	5.7	Gradeability, Laden/Unladen (@ 1.6km/h)		%	33.6/55.2
	5.8	Max. Gradeability, Laden/Unladen		%	38.1/63.5

	5.10	Service Brake			foot/hyd
Combustion Engine	7.1	Engine Manufacturer/type			DI/DM02VA STAGE-5
	7.2	Engine power according to DIN ISO1585		kW	45.6
	7.3	Rated Speed		min^{-1}	2,200
	7.3.1	Torque at 1/min		N•m	300Nm / 1,200~1,400
	7.4	Number of Cylinders/Displacement		$-/cm^3$	4/2,392
	7.5	Fuel Consumption according to VDI Cycle		l/h or kg/h	2.8
	7.10	Battery Voltage/normal capacity		V/Ah	12/110
Addition Data	10.1	Operating pressure for attachments		bar	156
	10.2	Oil volume for attachments		l/min	76.5
	10.4	Fuel Tank Capacity		l	58
	10.7	Sound level at the driver's ear according to EN 12 053		dB(A)	75

Characteristics	1.1	Doosan	Doosan	Doosan	Doosan
	1.2	D25S-9	D30S-9	D33S-9	D35C-9
	1.3	Diesel	Diesel	Diesel	Diesel
	1.4	Seated	Seated	Seated	Seated
	1.5	2,500	3,000	3,250	3,500
	1.6	500	500	500	500
	1.8	480	485	485	495
	1.9	1,700	1,700	1,700	1,700
Weight	2.1	4,030	4,530	4,615	4,720
	2.2	5,724/806	6,518/1,012	6,892/973	7,302/918
	2.3	1,780/2,250	1,780/2,750	1,760/2,855	1,755/2,965
Tyres	3.1	P	P	P	P
	3.2	7.00x15-12	28x9x15-12	28x9x15-12	250x15-18
	3.3	6.50x10-10	6.50x10-10	6.50x10-12	6.50x10-12
	3.5	2/2	2/2	2/2	2/2
Dimensions	3.6	975	982	982	1,026
	3.7	990	990	990	990
	4.1	6/10	6/10	6/10	6/10
	4.2	2,190	2,180	2,180	2,180
	4.3	147	152	152	152
	4.4	3,230	3,230	3,230	3,000
	4.5	4,490	4,490	4,490	4,260
	4.7	2,183	2,183	2,183	2,183
	4.8	1,026	1,026	1,026	1,026
	4.19	3,674	3,779	3,798	3,828
	4.20	2,625	2,730	2,749	2,779
	4.21	1,170	1,197	1,197	1,255
	4.22	40x100x1,050	45x125x1,050	45x125x1,050	45x125x1,050
	4.23	II	III	III	III
	4.24	1,103	1,115	1,115	1,115
	4.31	115	105	105	105
	4.32	143	143	143	143
	4.34.1	3,950	4,040	4,055	4,085
	4.34.2	4,150	4,240	4,255	4,285
	4.35	2,270	2,355	2,370	2,390
	4.36	640	641.5	641.5	652.5
Performance data	5.1	20/21	19/20	19/20	20/21
	5.2	0.60/0.65	0.59/0.65	0.51/0.56	0.50/0.56
	5.3	0.51/0.45	0.51/0.45	0.51/0.45	0.51/0.45
	5.5	17,770/17,640	18,470/18,080	18,360/18,100	17,380/17,070
	5.6	19,900/19,600	20,830/20,170	20,720/20,200	19,510/18,940
	5.7	28.7/49.3	25.7/44.1	24.1/42.2	22.3/40.4
	5.8	32.5/52.5	29.3/50.5	.27.4/48.1	25.2/45.7

	5.10	foot/hyd	foot/hyd	foot/hyd	foot/hyd
Combustion Engine	7.1	DI/DM02VA STAGE-5	DI/DM02VA STAGE-5	DI/DM02VA STAGE-5	DI/DM02VA STAGE-5
	7.2	45.6	45.6	45.6	45.6
	7.3	2,200	2,200	2,200	2,200
	7.3.1	300 Nm / 1,200~1,400	300 Nm / 1,200~1,400	300 Nm / 1,200~1,400	300 Nm / 1,200~1,400
	7.4	4/2,392	4/2,392	4/2,392	4/2,392
	7.5	3.4	3.8	3.9	4.0
	7.10	12/110	12/110	12/110	12/110
Addition Data	10.1	156	156	156	156
	10.2	76.5	76.5	76.5	76.5
	10.4	58	58	58	58
	10.7	75	75	75	75



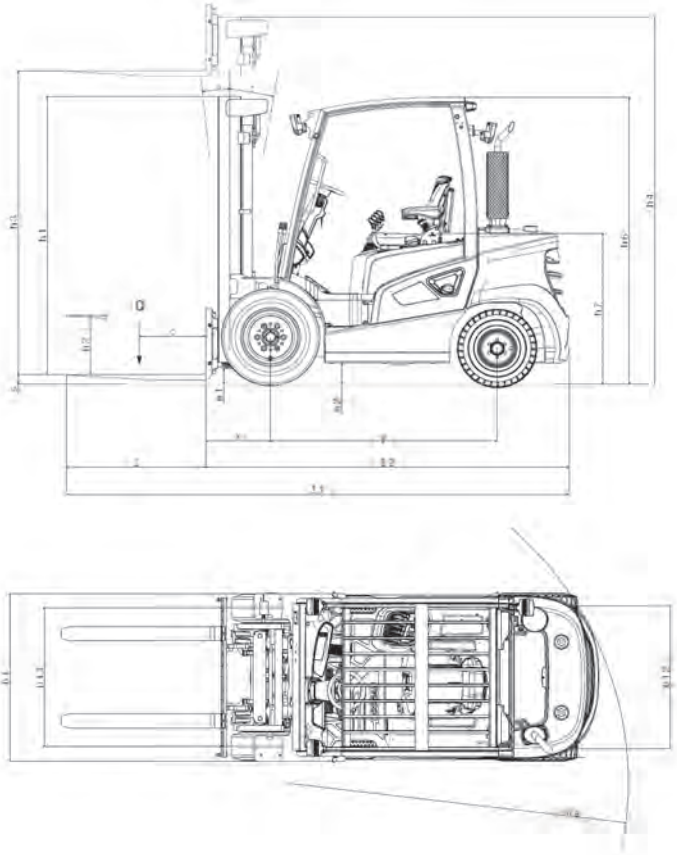
Specifications

Characteristics	1.1	Manufacturer			Doosan
	1.2	Model designation			D20S-9
	1.3	Drive: Diesel, Gasoline, LP			Diesel
	1.4	Operator type: Hand, Pedestrian, Standing, Seated, Order-picker			Seated
	1.5	Load Capacity	Q	lb (kg)	4,000 (2,000)
	1.6	Load Center	c	in (mm)	24 (500)
	1.8	Load Distance: Center of Driveaxle to fork	x	in (mm)	18.9 (480)
	1.9	Wheelbase	y	in (mm)	66.9 (1,700)
Weight	2.1	Service weight		lb (kg)	8,444 (3,830)
	2.2	Axle Loading, Laden Front/Rear		lb (kg)	10,972/1,881 (4,977/853)
	2.3	Axle Loading, Unladen Front/Rear		lb (kg)	40,23/4,420 (1,825/2,005)
Tyres	3.1	Tyres: pneumatic (P), superelastic (SE), cushion (C)			P
	3.2	Tyre size, Front			7.00x15-12
	3.3	Tyre size, Reat			6.50x10-10
	3.5	Wheels, number Front/Rear (x = driven wheels)			2/2
	3.6	Tread, Front	b_{11}	in (mm)	38.4 (975)
	3.7	Tread, Rear	b_{12}	in (mm)	39 (990)
Dimensions	4.1	Tilt of Mast/Fork carriage Forward/Backward	α/β	°	6/10
	4.2	Height, Mast lowered	h_1	in (mm)	86.2 (2,190)
	4.3	Free Lift	h_2	in (mm)	5.79 (147)
	4.4	Lift	h_3	in (mm)	127 (3,230)
	4.5	Height, Mast Extended	h_4	in (mm)	177 (4,490)
	4.7	Height of Overhead Guard(Cabin)	h_6	in (mm)	85.9 (2,183)
	4.8	Height of Seat	h_7	in (mm)	40.4 (1,026)
	4.19	Overall Length	l_1	in (mm)	142.7 (3,624)
	4.20	Length to Forkface	l_2	in (mm)	101.3 (2,574)
	4.21	Overall Width	b_1/b_2	in (mm)	46.1 (1,170)
	4.22	Fork Dimensions	s/e/l	in (mm)	1.57x3.94x41.3 (40x100x1,050)
	4.23	Fork carriage ISO 2328, class/type A,B			II
	4.24	Fork carriage width	b_3	in (mm)	43.4 (1,103)
	4.31	Ground Clearance, laden, below mast	m_1	in (mm)	4.53 (115)
	4.32	Ground Clearance, center of wheelbase	m_2	in (mm)	5.63 (143)
	4.34.1	Aisle withd for pallets 1,000 x 1,200 crossways	A_{st}	in (mm)	153.9 (3,910)
	4.34.2	Aisle width for pallets 800 x 1,200 lengthways	A_{st}	in (mm)	161.8 (4,110)
	4.35	Turning Radius	W_a	in (mm)	87.8 (2,230)
	4.36	Internal Turning Radius	b_{13}	in (mm)	25.2 (640)
Performance data	5.1	Travel Speed, Laden/Unladen		mph (km/h)	12.5/13 (20/21)
	5.2	Lift Speed, Laden/Unladen		fpm (m/s)	118.7/126.8 (0.61/0.65)
	5.3	Lowering Speed, Laden/Unladen		fpm (m/s)	99.5/87.8 (0.51/0.45)
	5.5	Drawbar pull, Laden/Unladen (@ 1.6km/h)		lb(N)	3,997/3,934 (17,780/17,500)
	5.6	Max. Drawbar pull, Laden/Unladen		lb(N)	4,465/4,361 (19,860/19,400)
	5.7	Gradeability, Laden/Unladen (@ 1.6km/h)		%	33.6/55.2
	5.8	Max. Gradeability, Laden/Unladen		%	38.1/63.5

	5.10	Service Brake			foot/hyd
Combustion Engine	7.1	Engine Manufacturer/type			DI/DM02P De-tier (T4F)
	7.2	Engine power according to DIN ISO1585		hp(N)	62 (45.6)
	7.3	Rated Speed		min^{-1}	2,200
	7.3.1	Torque at 1/min		ft•lbs(N•m)	203.5 ft•lbs (276 Nm /1,500)
	7.4	Number of Cylinders/Displacement		-/cc(-/cm^3)	4/2,392
	7.5	Fuel Consumption according to VDI Cycle		gal/h or lb/h (l/h or kg/h)	0.74 (2.8)
	7.10	Battery Voltage/normal capacity		V/Ah	12/80
Addition Data	10.1	Operating pressure for attachments		Psi (bar)	2,262.5 (156)
	10.2	Oil volume for attachments		gpm (l/min)	20.2 (76.5)
	10.4	Fuel Tank Capacity		gal(l)	15.3 (58)
	10.7	Sound level at the driver's ear according to EN 12 053		dB(A)	75

Characteristics	1.1	Doosan	Doosan	Doosan	Doosan
	1.2	D25S-9	D30S-9	D33S-9	D35C-9
	1.3	Diesel	Diesel	Diesel	Diesel
	1.4	Seated	Seated	Seated	Seated
	1.5	5,000 (2,500)	6,000 (3,000)	6,500 (3,250)	7,000 (3,500)
	1.6	24 (500)	24 (500)	24 (500)	24 (500)
	1.8	18.9 (480)	19.1 (485)	19.1 (485)	19.5 (495)
	1.9	66.9 (1,700)	66.9 (1,700)	66.9 (1,700)	66.9 (1,700)
Weight	2.1	8,885 (4,030)	9,987 (4,530)	10,174 (4,615)	10,406 (4,720)
	2.2	12,619/1,777 (5,724/806)	14370/2231 (6,518/1,012)	15,194/2,145 (6,892/973)	16,098/2,024 (7,302/918)
	2.3	3,924/4,960 (1,780/2,250)	3,924/6,063 (1,780/2,750)	3,880/6,294 (1,760/2,855)	3,869/6,537 (1,755/2,965)
Tyres	3.1	P	P	P	P
	3.2	7.00x15-12	28x9x15-12	28x9x15-12	250x15-18
	3.3	6.50x10-10	6.50x10-10	6.50x10-12	6.50x10-12
	3.5	2/2	2/2	2/2	2/2
	3.6	38.4 (975)	38.7 (982)	38.7 (982)	40.4 (1,026)
	3.7	39 (990)	39 (990)	39 (990)	39 (990)
Dimensions	4.1	6/10	6/10	6/10	6/10
	4.2	86.2 (2,190)	85.8 (2,180)	85.8 (2,180)	85.8 (2,180)
	4.3	5.79 (147)	5.98 (152)	5.98 (152)	5.98 (152)
	4.4	127 (3,230)	127 (3,230)	127 (3,230)	118 (3,000)
	4.5	177 (4,490)	177 (4,490)	177 (4,490)	168 (4,260)
	4.7	85.9 (2,183)	85.9 (2,183)	85.9 (2,183)	85.9 (2,183)
	4.8	40.4 (1,026)	40.4 (1,026)	40.4 (1,026)	40.4 (1,026)
	4.19	144.7 (3,674)	148.8 (3,779)	149.5 (3,798)	150.7 (3,828)
	4.20	103.3 (2,625)	107.5 (2,730)	108.2 (2,749)	109.4 (2,779)
	4.21	46.1 (1,170)	47.1 (1,197)	47.1 (1,197)	48.2 (1,255)
	4.22	1.57x3.94x41.3 (40x100x10,50)	1.77x4.92x41.3 (45x125x1,050)	1.77x4.92x41.3 (45x125x1,050)	1.77x4.92x41.3 (45x125x1,050)
	4.23	II	III	III	III
	4.24	43.4 (1,103)	43.9 (1,115)	43.9 (1115)	43.9 (1,115)
	4.31	4.53 (115)	4.13 (105)	4.13 (105)	4.13 (105)
	4.32	5.63 (143)	5.63 (143)	5.63 (143)	5.63 (143)
	4.34.1	155.5 (3,950)	159 (4,040)	159.6 (4,055)	160.8 (4,085)
	4.34.2	163.4 (4,150)	166.9 (4,240)	167.5 (4,255)	168.7 (4,285)
	4.35	89.4 (2,270)	92.7 (2,355)	93.3 (2,370)	94.1 (2,390)
	4.36	25.2 (640)	25.3 (641.5)	25.3 (641.5)	25.7 (652.5)
Performance data	5.1	12.5/13 (20/21)	11.7/12.5 (19/20)	11.7/12.5 (19/20)	12.5/13 (20/21)
	5.2	116.8/126.8 (0.60/0.65)	115.1/126.8 (0.59/0.65)	99.5/109.2 (0.51/0.56)	99.5/109.2 (0.51/0.56)
	5.3	99.5/87.8 (0.51/0.45)	99.5/87.8 (0.51/0.45)	99.5/87.8 (0.51/0.45)	99.5/87.8 (0.51/0.45)
	5.5	3,995/3,965 (17,770/17,640)	4,152/4,064 (18,470/18,080)	4,127/4,069 (18,360/18100)	3,907/3,837 (17,380/17,070)
	5.6	4,474/4,406 (19,900/19,600)	4,683/4,534 (20,830/20,170)	4.658/4.541 (20,720/20,200)	4,386/4,258 (19,510/18,940)
	5.7	28.7/49.3	25.7/44.1	24.1/42.2	22.3/40.4
	5.8	32.5/52.5	29.3/50.5	.27.4/48.1	25.2/45.7
	5.10	foot/hyd	foot/hyd	foot/hyd	foot/hyd

Combustion Engine	7.1	DI/DM02P De-tier (T4F)	DI/DM02P De-tier (T4F)	DI/DM02P De-tier (T4F)	DI/DM02P De-tier (T4F)
	7.2	62 (45.6)	62 (45.6)	62 (45.6)	62 (45.6)
	7.3	2,200	2,200	2,200	2,200
	7.3.1	203.5 ft•lbs (276 Nm /1,500)	203.5 ft•lbs (276 Nm /1,500)	203.5 ft•lbs (276 Nm /1,500)	203.5 ft•lbs (276 Nm /1,500)
	7.4	4/2,392	4/2,392	4/2,392	4/2,392
	7.5	0.90 (3.4)	1.00 (3.8)	1.03 (3.9)	1.05 (4.0)
	7.10	12/80	12/80	12/80	12/80
Addition Data	10.1	2,262.5 (156)	2,262.5 (156)	2262.5 (156)	2,262.5 (156)
	10.2	20.2 (76.5)	20.2 (76.5)	20.2 (76.5)	20.2 (76.5)
	10.4	15.3 (58)	15.3 (58)	15.3 (58)	15.3 (58)
	10.7	75	75	75	75

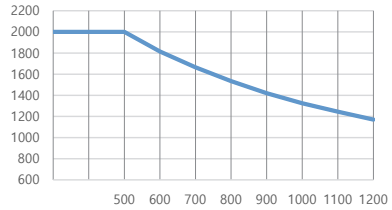
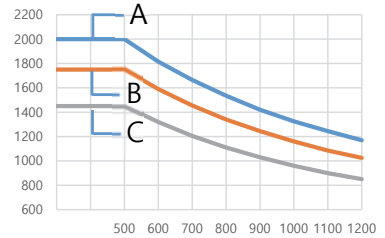
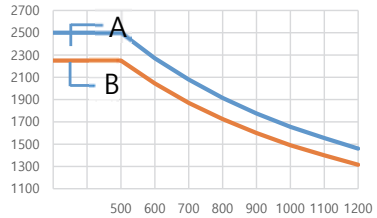
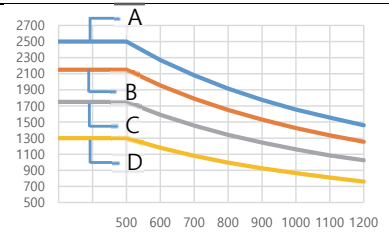
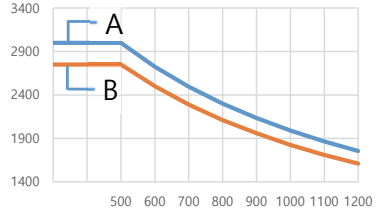
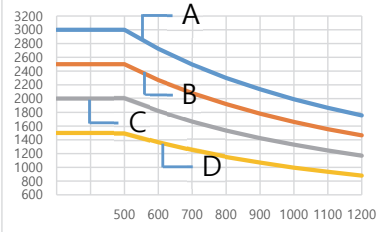


Noise and Vibration

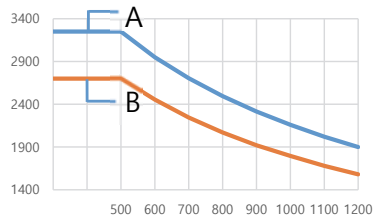
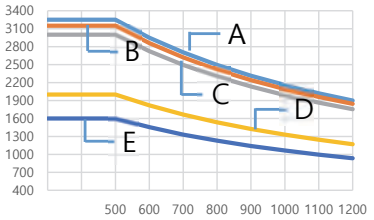
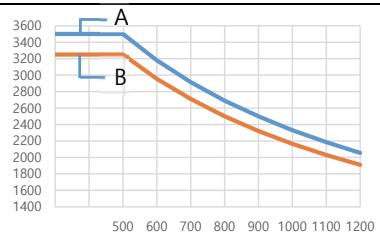
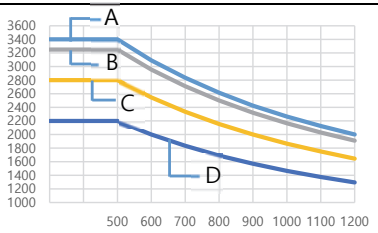
Model	Sound Pressure Level at Operator's ear (Leq.) according to EN12053 Guaranteed Sound	Power level (L_{WA}) By Noise Directive 2000/14/EC	Whole-body Vibration Level according to EN13059 (m/s^2)	
	dB(A)	dB(A)	Mean	Uncertainty
STAGE5 (DM02VA E/G) D20S-9, D25S-9, D30S-9, D33S-9, D35C-9 (W/O Cabin)	75	102	0.7	0.2

* NA: Not Applicable

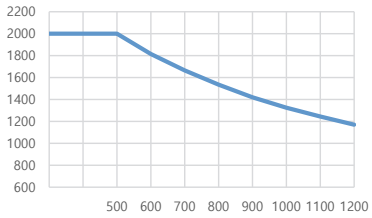
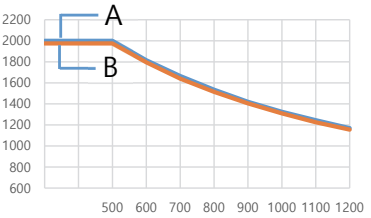
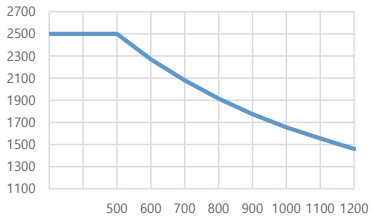
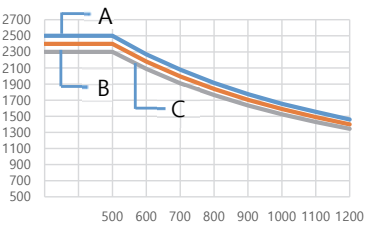
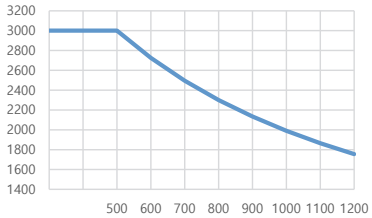
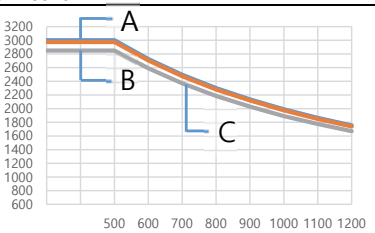
Capacity Chart (Without Sideshifter Pneumatic)

MODEL	SINGLE TIRE	
	STD, FFL	FFT
D20S-9	 2030 – 4960mm mast	 A. 2950 - 5110 B. 5560 C. 6010
D25S-9	 A. 2030 - 4350 B. 4960	 A. 2950 - 4805 B. 5110 C. 5560 D. 6010
D30S-9	 A. 2030 - 4350 B. 4960	 A. 2950 - 4805 B. 5110 C. 5560 D. 6010

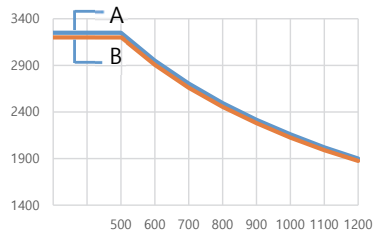
Capacity Chart (Without Sideshifter Pneumatic)

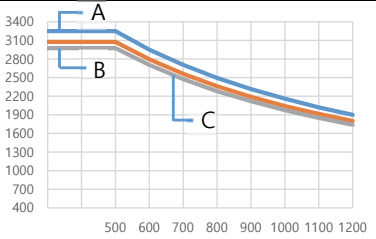
MODEL	SINGLE TIRE	
	STD, FFL	FFT
D33S-9	 A. 2030 - 4350 B. 4960	 A. 2950 - 4290 B. 4730 C. 4805 D. 5560 E. 6010
D35C-9	 A. 1800-4205 B. 4805	 A. 3555 - 4380 B. 4820 C. 5205 D. 5655

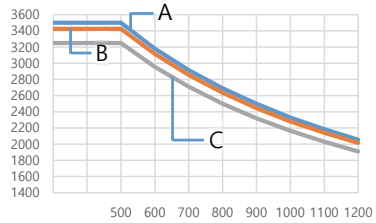
Capacity Chart (Without Sideshifter Pneumatic)

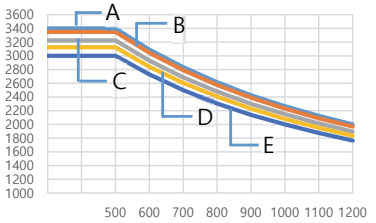
MODEL	DOUBLE TIRE	
	STD, FFL	FFT
D20S-9	 2030 - 4960	 A. 2950 - 5560 B. 6010
D25S-9	 2030 - 4960	 A. 2950 - 4730 B. 5560 C. 6010
D30S-9	 2030 - 4960	 A. 2950 - 4805 B. 5560 C. 6010

Capacity Chart (Without Sideshifter Pneumatic)

<table>
<tr><th rowspan="2">MODEL</th><th colspan="2">DOUBLE TIRE</th></tr>
<tr><th>STD, FFL</th><th>FFT</th></tr>
<tr><td>D33S-9</td><td> 

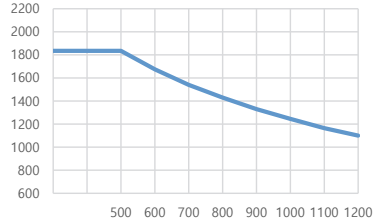
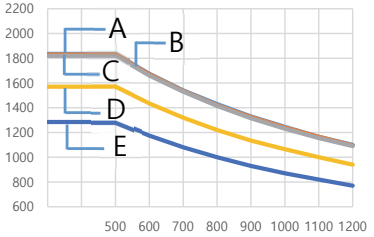
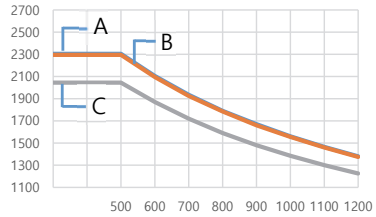
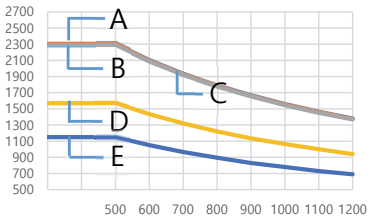
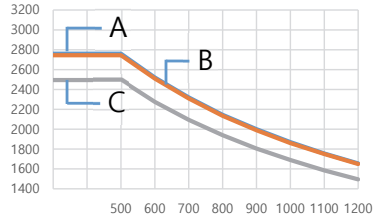
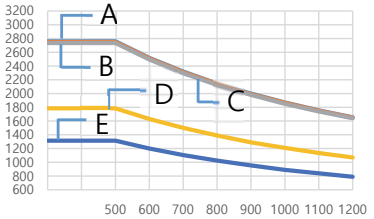
A. 2030 – 4350
B. 4960</td><td> 

A. 2950 - 4805
B. 5560
C. 6010</td></tr>
<tr><td>D35C-9</td><td> 

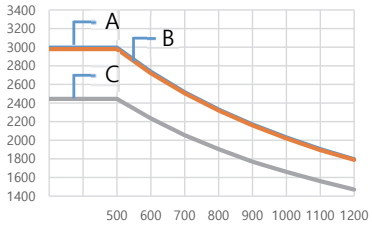
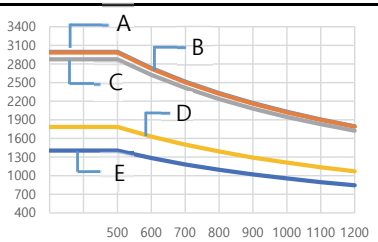
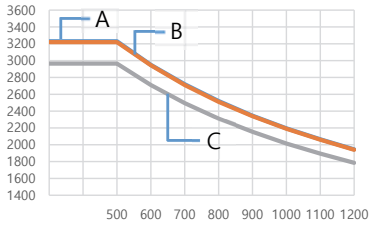
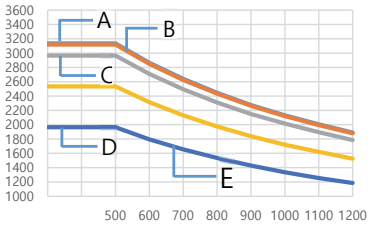
A. 1800 - 3805
B. 4205
C. 4805</td><td> 

A. 3555 - 3960
B. 4380
C. 4820
D. 5205
E. 5655</td></tr>
</table>

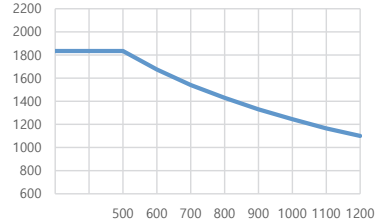
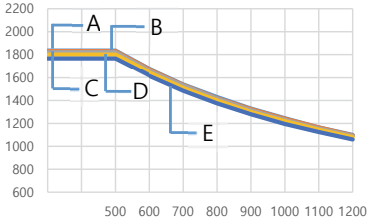
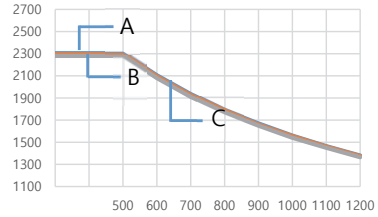
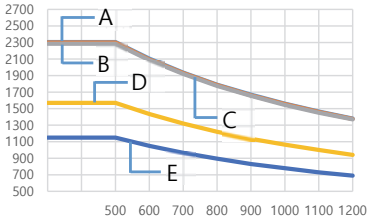
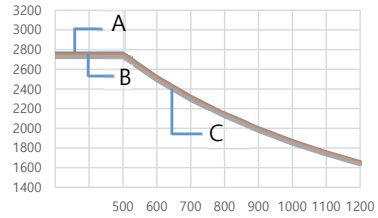
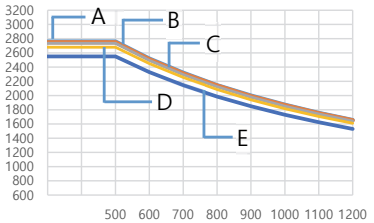
Capacity Chart (With Sideshifter Pneumatic)

MODEL	SINGLE TIRE	
	STD, FFL	FFT
D20S-9	 2030 - 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010
D25S-9	 A. 2030 - 3950 B. 4350 C. 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010
D30S-9	 A. 2030 - 3950 B. 4350 C. 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010

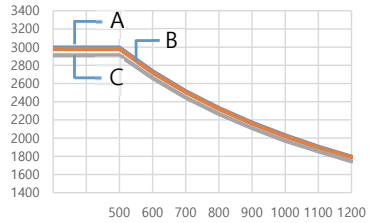
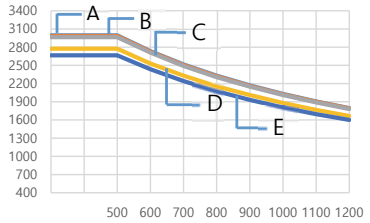
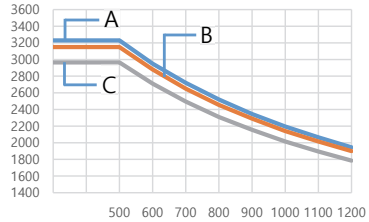
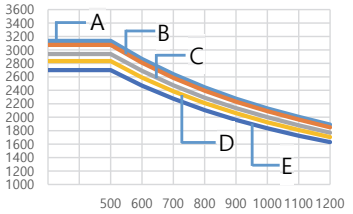
Capacity Chart (With Sideshifter Pneumatic)

MODEL	SINGLE TIRE	
	STD, FFL	FFT
D33S-9	 A. 2030 - 3950 B. 4350 C. 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010
D35C-9	 A. 1800 - 3805 B. 4205 C. 4805	 A. 3555 - 3960 B. 4380 C. 4820 D. 5205 E. 5655

Capacity Chart (With Sideshifter Pneumatic)

MODEL	DOUBLE TIRE	
	STD, FFL	FFT
D20S-9	 2030 - 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010
D25S-9	 A. 2030 - 3950 B. 4350 C. 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010
D30S-9	 A. 2030 - 3950 B. 4350 C. 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010

Capacity Chart (With Sideshifter Pneumatic)

MODEL	DOUBLE TIRE	
	STD, FFL	FFT
D33S-9	 A. 2030 - 3950 B. 4350 C. 4960	 A. 3900 B. 4290 C. 4730 D. 5560 E. 6010
D35C-9	 A. 1800 - 3805 B. 4205 C. 4805	 A. 3555 - 3960 B. 4380 C. 4820 D. 5205 E. 5655

Serial Number

Serial Number Locations

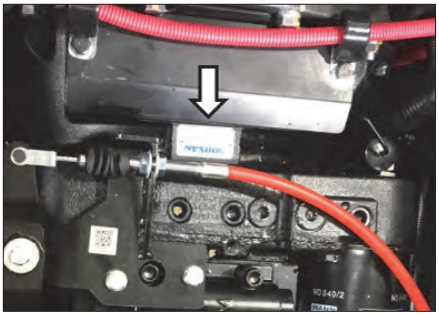
For quick reference, record your lift truck's serial numbers in the spaces provided below the photographs.

Lift Truck Serial Number

•_____

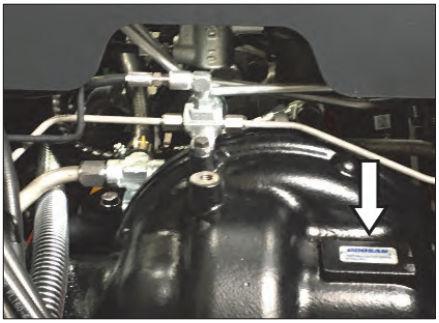
2.4 liter Diesel Engine (DM02VA, DM02P) Serial Number

•_____



Power Shift Transmission Serial Number

•_____



Drive Axle Serial Number

•_____

Side Shifter Serial Number (If Equipped)

•_____

Attachment Abbreviations (Includes Special Forks)

SC - Special Carriage-increased width, height or outreach

SSS - Shaft-type Sideshift Carriage

HSS - Hook-type Sideshift Carriage (ITA)

CW - Counterweight

SF - Special Forks

SWS - Swing Shift, Sideshift

RAM - Ram or Boom

DBCBH - Double Cube Block Handler

HFP - Hydraulic Fork Positioner

CR - Crane Arm or Crane Boom

TH - Tire Handler

CTH - Container Handler

LPP - Load Push-Pull Device

CC - Carton Clamp

RC - Roll Clamp

LS - Load Stabilizer

PWH - Pulp Wood Handler

SS-ST - Sideshift-Side Tilt Carriage

Operator's Warning and Identification Plate

Familiarize yourself with the OPERATOR'S WARNING PLATE and IDENTIFICATION, LIFT CAPACITY and ATTACHMENT PLATES. DO NOT exceed capacity as equipped load ratings.

Operator's Warning Plate

Located on the right side of the operator's seat.

If Convenience Package Equipped

Located on the overhead guard. (If Convenience Package Equipped).

Identification, Lift Capacity and Attachment Plate

Located on the cowl to the right side of the steering column.

Below are abbreviations that may appear on the IDENTIFICATION, LIFT CAPACITY and ATTACHMENT PLATES and their meanings.

Mast Abbreviations

STD - Standard Mast (single inner member, low free lift)

FF - Full Free Lift Mast (single inner member with high free lift duplex cylinder)

FFT - Triple Lift Mast (two inner members) with either low or full free lift characteristics.

QUAD - Quadruple (Quad) Mast(with three inner members)

NOTE: When only a mast-type is listed on the identification plate, a standard carriage and forks are used.

Operator's Station and Monitoring Systems

Instrument Panel

Your lift truck may not have the same indicator or warning lights as shown in the illustrations.
Due to the various options available, typical instrument panels are shown.

However, the symbols on the indicators and lights on your panel identify what those particular items are.
Also, the symbol for each of the items is identified and an explanation of their function and location is described on the following pages.

1. Diesel Engine Water in Fuel Filter Indicator Light
2. Alternator Indicator Light
3. Diesel Engine Start Preheat Indicator Light
4. Fuel Level Gauge
5. Engine Coolant Temperature Gauge
6. Transmission Oil Temperature Gauge
7. Engine Malfunction Indicator Light (MIL)
8. Seat Belt Warning Light (If Equipment)
9. Service Hour Meter
10. Parking Indicator Light
11. Front Floodlights
12. Transmission Neutral Position Light
13. Mast Interlock
14. Directional Turning Indicator Light
15. Brake oil level
16. ECT Warning Lamp
17. Engine Oil Pressure Warning Lamp
18. Fuel Warning Lamp
19. Speedometer
20. Odometer
21. Engine rpm Gauge
22. Vehicle Mode
23. T/M Gear Inform
24. After Treatment Indicator (After Treatment Only)
25. Regen Gauge (After Treatment Only)
26. Clock
27. Weight Scale Indicator (OPT)
28. Speed Limit Indicator
29. Air Cleaner Indicator
30. TM Option Indicator

1. Diesel Engine Water in Fuel Filter Indicator Light - Indicates when the engine is running, there is water in the fuel filter exceeds 100cc.

The light will come ON when the ignition switch is turned to the ON position. The light should go off after the engine is started. If the light turns on with the engine running, park the lift truck and stop the engine.

Drain some fuel (and any water) until clean fuel flows from the filter which approximately takes 5 to 6 seconds

2. Alternator Indicator Light - Indicates if the battery charging system is operational. The light will come on when the ignition switch is turned to the ON position.

The light should go off after the engine is started, indicating the alternator is producing sufficient voltage to charge the battery. If the light turns on with the engine running, check the alternator charging system for a malfunction.

3. Diesel Engine Start Preheat Indicator Light - The light will come ON when the key is turned to the ON position from the OFF position. This indicates that the glow plugs are preheating the pre-combustion chambers for easier starting.

The amount of time needed to preheat the pre-combustion chambers is approximately seven seconds, depending on the surrounding air temperature. When the light goes OFF the maximum pre-combustion chamber temperature has been reached and the key can be turned to the START position to start the engine.

4. Fuel Level Gauge - Shows current level of the fuel in the fuel tank. Replenish fuel when the Level Gauge indicates "E" during the forklift operation.

5. Engine Coolant Temperature Gauge - Indicates coolant temperature. Shows current temperature of the engine coolant. If the gauge pointer moves beyond the red band during the operation, the engine is overheated. Park the lift truck and stop the engine.

Check the cooling system for any defect. The pointer will be in the red band when the coolant temperature reaches approximately 110 °C on all engines.

6. Transmission Oil Temperature Gauge - Shows transmission oil temperature If the gauge pointer moves beyond the red band during operation, the engine is overheated. Park the lift truck and stop the engine.

Check the system for any defect. The pointer will be in the red band when the transmission oil temperature reaches approximately 125 °C.

7. Engine Malfunction Indicator Light (MIL) - Engine control system is equipped with built-in fault diagnostics. Detected system faults can be displayed by the Malfunction Indicator Lamp (MIL) as Diagnostic Fault Codes (DFC) or flash codes, and viewed in detail with the use of service tool software. When the ignition key is turned ON the MIL will perform a self-test, illuminate once and then go OFF. If a detected fault condition exists, the fault or faults will be stored in the memory of the engine control unit (ECM). Once a fault occurs the MIL will light up and remain ON. This signals the operator that a fault has been detected by the SCEM.

8. Seat Belt Warning Light (If Equipment) Indicates when the seat belt dose not fastened by operator.

The light will come on when the ignition switch is turned to the on position.

The light should go off after engine is started.

9. Service Hour Meter - Indicates the total number of hours the engine and the lift truck have operated. The hour meter will operate when the ignition switch is in the ON position, whether the engine is running or not. The hour meter is used to determine lubrication and maintenance intervals.

10. Parking Indicator Light - The light will come ON when the parking lever is applied.

11. Front Floodlights - Push down on the switch (14), to the first step, to turn the front floodlights on.

Front and Rear Floodlights – Push down on the switch (14), to the second step, to turn both the front and rear floodlights on. The floodlights are optional.

12. Transmission Neutral Position Light - Indicates the neutral position of transmission.

13. **Mast Interlock** – Alarm warning lights when operator leaves the seat without applying parking brake and then, operation of mast is automatically interrupted.

14. Directional Turning Indicator Light

15. Brake oil level – Brake oil level Lamp indicates when the brake oil level is low.

16. ECT Malfunction Warning Lamp (if installed) – electronic transmission control system has a built-in diagnosis system. If a failure occurs, the electronic transmission control system reports the operator of the failure code by the number of flashes with the malfunction warning lamp.

17. Engine Oil Pressure Warning Lamp – The warning lamp will light up if the engine oil is short or the pressure is low.

18. Fuel Warning Lamp – The warning lamp will light up to warn the operator to refuel.

19. Speedometer – Shows vehicle speed

20. Odometer – Shows vehicle run time

21. Engine rpm gauge – Shows engine rpm speed

22. Vehicle mode – Shows Vehicle mode (High, Standard, ECO)

23. T/M Gear inform – Shows T/M Gear state

24. After treatment indicator – Shows After treatment warning and inform.

When this waring lamp is on, refer to topic “operation section - after staring the engine - Electronic Controlled Diesel Engines.

1) SCR fault warning lamp: When the first lamp is on, check the SCR system.
2) SCR cleaning lamp: The SCR system shall be initialized on a regular basis to maintain the emission purification efficiency at an adequate level. This process is called SCR cleaning. When the second lamp is on, start the SCR cleaning process, during which the vehicle shall not be used. The lamp lights up with a message popping up 10 hours prior to the required timing of SCR cleaning. The cleaning process takes about 30 minutes, with this lamp flickering. Press the cleaning switch for about 3 seconds to start the cleaning process.
3) High-temperature exhaust lamp: During SCR cleaning the temperature of exhaust emissions exceeds 600°C. When this lamp light on, the operator shall warn other people around not to approach the vehicle or touch the exhaust system, particularly at the back of the vehicle. If there is any flammable substance such as gas or particles around the vehicle, move it to a safe place.
4) SCR cleaning inhibition lamp: One you press the inhibition switch, this lamp lights up and the SCR process is suspended. When in a place with flammable substances or dust, you shall press the inhibition switch to prevent any fire or explosion that can be caused by high temperature emissions.

25. Regen gauge – Shows DPF Soot or DeSox Level

26. Clock – Shows Time

27. Weight scale indicator (Optional) – Shows weight and over weight warning

28. Speed limit indicator – Shows limit speed

29. Air cleaner indicator – If it on, need to change the air filter

30. TM option indicator – When the TM option is on, it is on.

High-temperature Exhaust Lamp

During SCR cleaning, the temperature of the exhaust emissions exceeds 600 °C. When this lamp lights up, the operator should warn other people around not to approach the vehicle or touch the exhaust system, particularly at the back of the vehicle. If there is any flammable substance, such as gas or particles, near the vehicle, move it to a safe place.

Engine Check Lamp (Red)

This lamp lights up when the engine has a problem or needs to be checked.

To check the problem, press the MODE switch for 3 seconds. When the display shows the main menu, select Check. See page** for the detailed procedure.

Horn Switch - Push on the horn button to sound the horn.

Electrical Disconnect Switch (If Equipped)

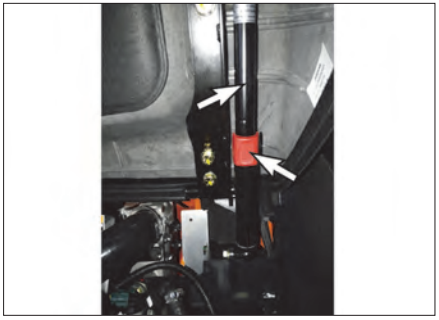
1. ON - Connects the battery for electrical power to all electrical circuits.

2. OFF - Disconnects the battery from all electrical circuits.

Engine Compartment

1. The engine compartment is accessible by pulling the latch.

NOTE: Unlock latch before pulling-if key equipped



2. The hood and seat assembly is held up by a support cylinder. Make certain the air cylinder is operating properly and securely hold the hood up before doing anything in the engine compartment. To close the hood, push the red button on the cylinder and then pull the hood down.

NOTE: Any attempt to lower the hood without pressing down the button is likely to damage either the gas spring or hood.

⚠ WARNING

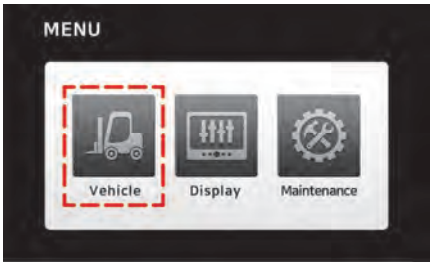
Since the exhaust tube is very hot, make sure to fold the seat before opening the hood.

Display Cluster

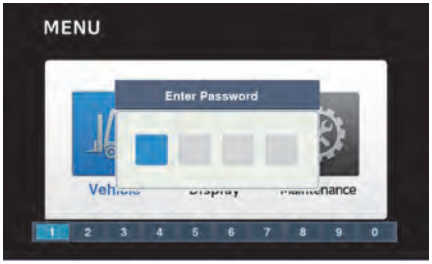
Display

1) SCR device warning display information.
2) Weight information on the weight scale (Option).
3) SCR cleaning warning display and guideline.
4) Urea residual quantity warning display and guideline.
5) Engine check warning lamp.
6) Speed limit setting speed (the lamp comes ON when it is set up).
7) Menu button.
8) UP button.
9) Down button.
10) Enter button.
11) Rear view camera operation button (manual).

Menu

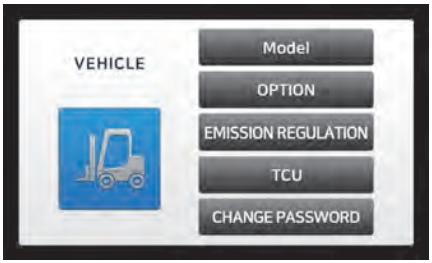


Menu - Vehicle



The password needs to be entered.
The initial password is 1111.

Menu - Vehicle - Model



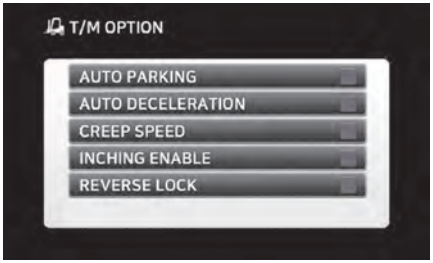
Consists of the Doosan model and the Crown model. Upon selecting either model, the corresponding brand logo will be displayed at the time of initial starting.

Menu - Vehicle - Option

Menu - Vehicle - Option - Multi Torque

ECO: Fuel economy operation mode.
STANDARD: Ordinary operation mode.
HIGH: Heavy duty operation mode.

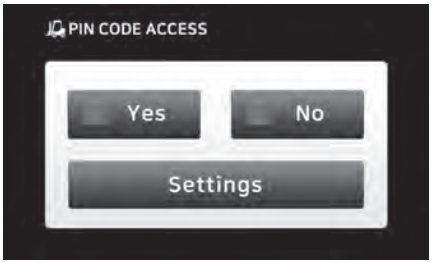
Menu - Vehicle - Option - T/M Option

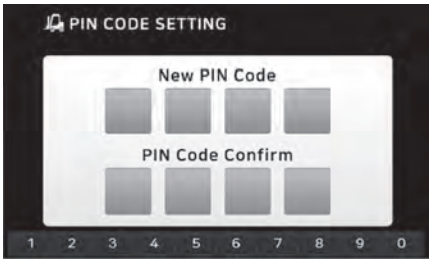


The electronic transmission option can be selected.

Auto parking: When the vehicle's speed is 0km/h, Parking turns ON.
Forward/backward switch control: As the transmission may be damaged in the case of forward/backward switching during a high-speed operation, a specific speed can be set so that forward/backward switching is only possible at the selected speed.

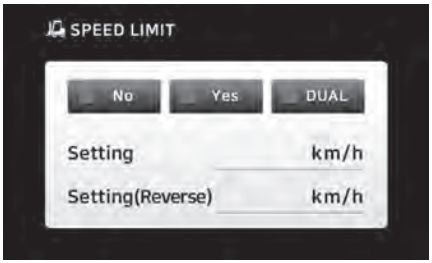
Menu - Vehicle - Option - Pin Code Access





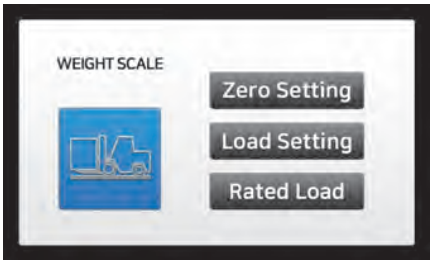
The anti-theft function allows vehicle start-up only after entering the password.

Menu - Vehicle - Option - Speed Limitation

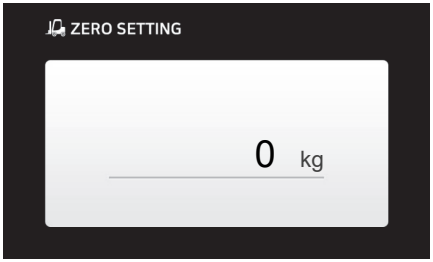


This function limits the maximum vehicle speed to the setting speed; and forward/backward speeds are identical in the case of regular setting, whereas forward/backward speeds differ in the case of dual setting.

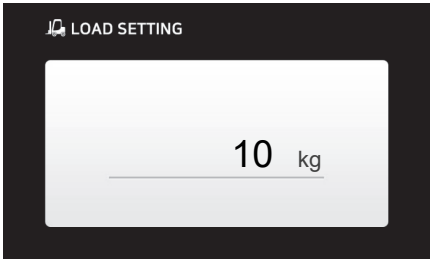
Menu - Vehicle - Option - Weight Scale



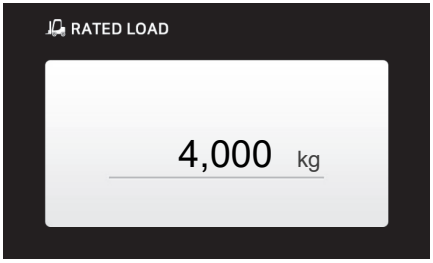
There are three sub-menus: (No load setting, load setting, rated load setting).



Zero setting under no-load condition.

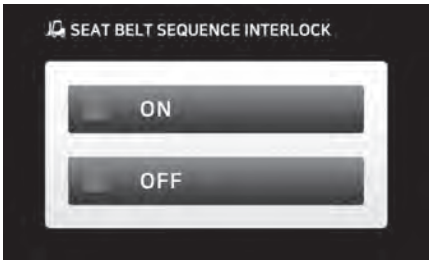


Enter the prepared load to set the corresponding load value.



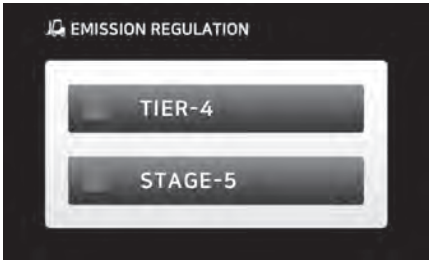
Rated load setting for warning against overload.

Menu - Vehicle - Option - Seat Belt Interlock



This safety function enables operation only when the seat is occupied and the safety belt is on.

Menu - Vehicle - Emission regulation

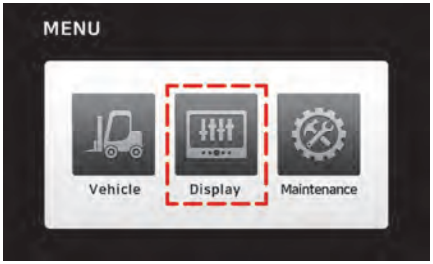


Tier-4, Stage-5 emission regulation setting.

Menu - Vehicle - Change Password

New password and setting by confirming

Menu



Menu - Display

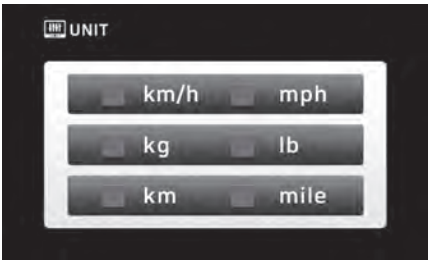
Menu - Display - Rear View camera (If the rear view camera is equipped)

Camera connection setting while reversing

Menu - Display - Language

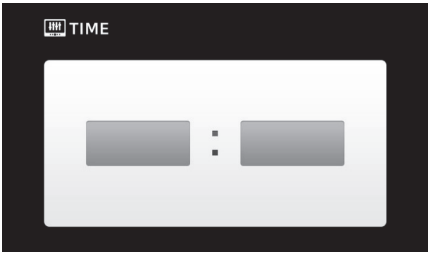
Setting for Korean, English, Chinese and Spanish

Menu - Display - Unit



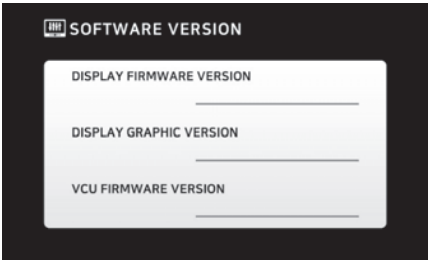
Setting for SI unit system and US unit system

Menu - Display - Time



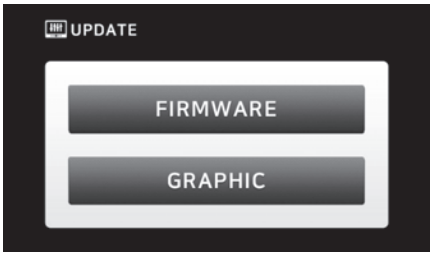
Current time setting

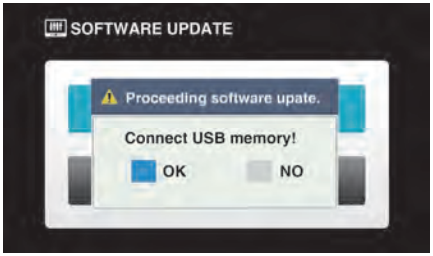
Menu - Display - Software Version



Instrument panel firmware, graphic version and VCU firmware version can be checked.

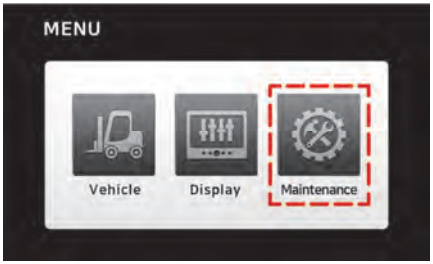
Menu - Display - Software Update



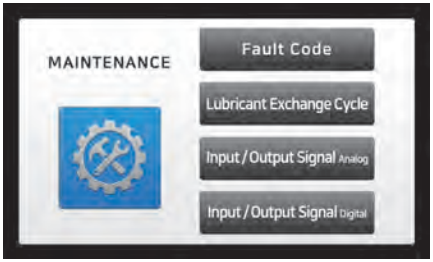


New firmware version can be updated through the USB memory.

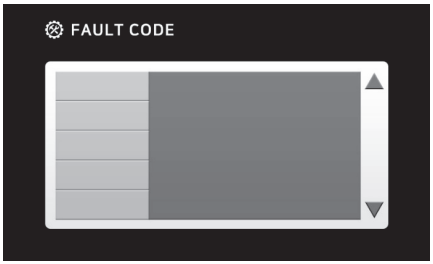
Menu



Menu - Maintenance

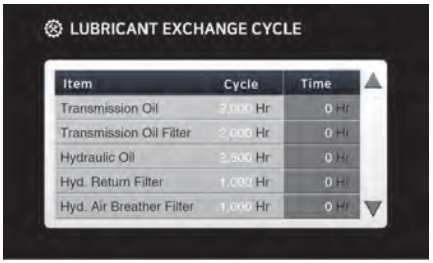


Menu - Maintenance - Fault Details



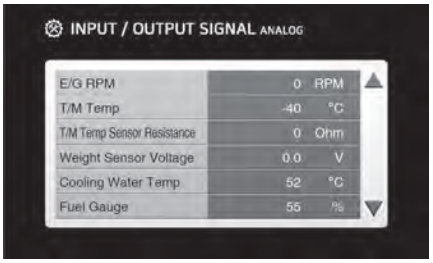
Details of faults that currently occur can be checked.

Menu - Maintenance - Consumable Item Management



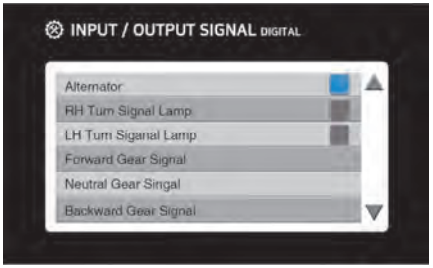
The replacement cycles and amount (in hours) of use of consumable items can be checked.

Menu - Maintenance - Input/Output Signal Analogue



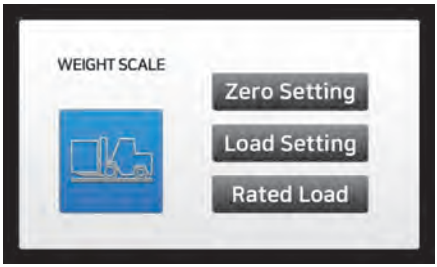
The vehicle analogue signal can be checked

Menu - Maintenance - Input/Output Signal Digital



The vehicle digital signal can be checked (Alternator, RH turn signal lamp, LH turn signal lamp, forward gear signal, neutral gear signal, Backward gear signal)

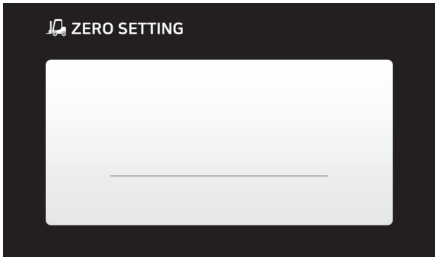
Weight Scale Mode (Optional - Hydraulic)

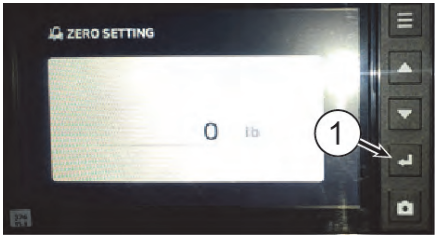


This option enables the operator to measure and limit the weight of the load using the LCD display. Use "WEIGHT SCALE" under the "VEHICLE" menu.

Zero Setting

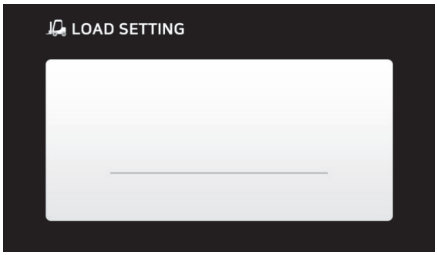
Raise the forks by 1 m as unloaded and press ENTER(1) to set the weight of the mast assembly to be zero.

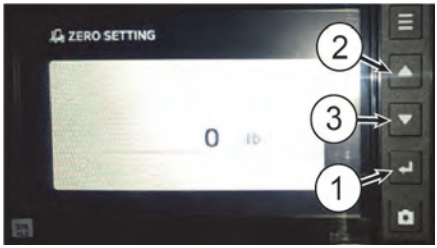




Load Setting

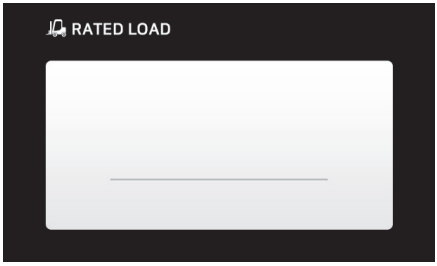
Prepare a reference load whose weight is accurately known and enter its weight into the display. Put the reference load on the forks and raise the forks. And then press ENTER(1) to complete the setting of a reference load value.
If the measured weight is different from the Load weight, press the button(2), (3) to change the weight. Since the weights of any loads will be measured based on this reference load value, it must be accurately set.





Rated Load Setting

Enter(1) the rated load capacity of the vehicle into the display and press ENTER(1) to complete the setting of the rated load value.
Press the button (2), (3) to set the rated capacity, then press Enter(1) to set it.
An overload warning will be given if any weight exceeding the rated load entered is measured.



Weight Scale Option (Load Cell Type)

With this weight scale option, the operator can measure and limit the load's weight using a display panel. Using the key (ENTER), you can start settings.

1. Entering the Calibration Mode

To perform initial settings for the load cell, enter the calibration mode as follows:

(ENTER) Press this key when "ST.CAL" is displayed to start calibration mode.

(ENTER) Press this key once again.

2. Specifying a Minimum Scale

You can select a minimum scale on which the load cell displays the weight from among 1 kg, 2 kg, 5 kg, 10 kg, 20 kg, and 50 kg (for example, 1235 kg is displayed with a 5 kg minimum scale and 1250 kg displayed with a 50 kg scale). The default value is "10 kg."

(F) Each time you press this key, the setting increases in the order of 01, 02, 05, 10, 20, and 50.

(ENTER) Press this key to save the minimum scale setting and proceed the subsequent step.

(SET) Press this key to move to the previous step.

3. Specifying a Maximum Measuring Scale

This step is to specify the rated capacity of the vehicle on which the load cell is installed.

Since the device does not weigh a load heavier than the set capacity (determines to be overloaded), **it is recommended to set the capacity to be 5% higher than the actual value taking into consideration the safety factor.**

(ZERO) Each time you press this key, the number (0 to 9) at the cursor position increases by 1.

(F) Each time you press this key, the cursor is moved to the left by one point.

(SET) Press this key to save the set value and proceed the subsequent step.

(SET) Press this key to move to the previous step.

4. Inputting a Reference Load

This step is to input the weight of a reference load needed for weight setting.
If the weight of the reference load is 3,000 kg, input "3000" and proceed the next step (reference load lift). The initial setting value should be set to 50% to 60% of the rated capacity (for a 7ton capacity model for example, use a 3.5 to 4ton load).

(ZERO) Each time you press this key, the number (0 to 9) at the cursor position increases by 1.

(F) Each time you press this key, the cursor is moved to the left by one point.

(SET) Press this key to save the set value and proceed the subsequent step.

(ZERO) Press this key to move to the previous step.

NOTE: After the initial setting, if the load weight is measured with an error, you must adjust this value.

NOTE: Example: If you have inputted 3,000 kg but the actual load weighs 2,900 kg, adjust the reference load value to 2,900 kg; if the load weighs 3,100 kg, adjust the value to 3,100 kg.

5. Zero Adjustment

This step is to set the weight condition of the vehicle's unloaded front end to zero. Keeping the mast unloaded, raise it approx. 300 mm from the ground just vertically.

Press this key to save the set value and proceed the subsequent step.

Press this key to move to the previous step.

6. Reference Load Lift

Put a reference load that weighs as much as the set value on the attachment (e.g. forks).
You should align the centers of gravity of the attachment and of the reference load.
Raise the mast approx. 300 mm from the ground vertically.
Once the vehicle's vibration ends after lifting the load, press the Enter key.

Press this key.

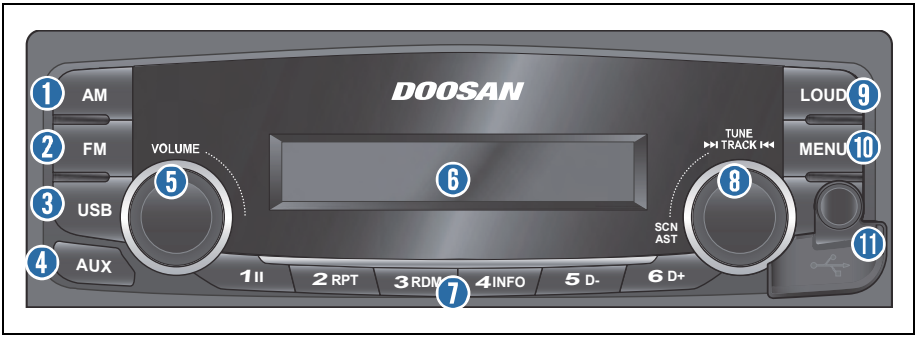
7. Finishing Calibration

Once you have done all the steps above, a certain figure appears along with a blinking message "C._End" on the display for a while, and then the weight scale mode resumes."

Initial settings for the load cell have been finished.
Use this device after fully lowering the load for the indicator to display 0 kg.

Audio System (AM/FM Tuner with USB/AUX Player)

Location of controls



1. **AM** button: Select AM Radio mode.
2. **FM** button: Select FM Radio mode.
3. **USB** button: Select USB player.
4. **AUX** button: Select AUX mode.
5. **POWER/MUTE** [🔇] button with VOLUME dial: Turn the power on or mute function on/off (press); turn the power off (press and hold); control the volume level (rotate).
6. Display window for Play/Reception/Menu state and information.
7. **PRESET** [1 II] - [6 D+] buttons

   Radio mode: Recall each stored station(press); store each station (press and hold)

   USB mode: Change the playback mode ([1 II]/[2 RPT]/[3 RDM] buttons); shows available information about the current track ([4INFO] button); move to folder down/up ([5 D-]/[6 D+] buttons).
8. **SCN/AST** button with | ◄◄ TUNE/TRACK ►► | dial

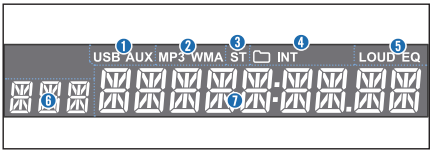
   Radio mode: Plays frequencies with superior reception for 5 seconds each (press); Saves frequencies with superior reception to Preset buttons (press and hold). select the reception frequency manually (rotate).

   USB mode: Scans the beginning parts (approx. 10 seconds per track) of tracks (press); moves to the previous/next track (rotate); rewind or fast-forward the track (rotate and hold).
9. **LOUD** button: Turn the Loudness mode on/off.
10. **MENU** button: Enter the sound setting mode (press); show/hide the clock or when power is off, enter the clock setting mode (press and hold).
11. **Input Terminal cover**: Open the cover to connect the external audio device or the USB device.

    - **AUX IN** jack: Connect the external audio device.

    - **USB port**: Connect the USB device.

Display window



1. USB/AUX indicators: When the External Device is connected, indicator is lights up.

2. MP3/WMA indicators: When the Audio Stream is detected, indicator is lights up.

3. Stereo [ST] indicator for FM stereo station: When a stereo Broadcast is received, indicator is lights up.

4. Playback mode indicators for USB mode

: Folder mode

INT : Intro playback

: Repeat playback

: Random playback

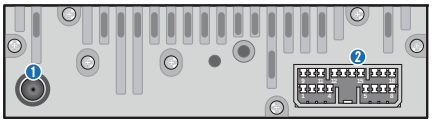
5. LOUD/EQ indicators for sound effect

LOUD: Loudness mode on

EQ: EQ mode on

6. Multi-function display area for showing the information

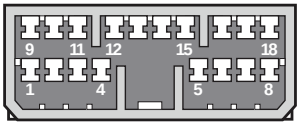
Rear view/Connectors



1. Antenna jack: To plug the FM antenna cable.

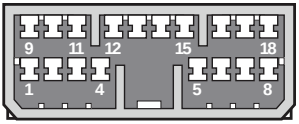
2. I/0 connector: To plug the 1/0 cable.

<ARA-5080WF: 18 Pin>



1. Front R (+)
2. Rear R (+)
3. Illumination (+)
4. ACC (+)
5. Battery (B+)
6. N.C
7. Rear L (+)
8. Front L (+)
9. Front R (-)
10. Rear R (-)
11. N.C / Illumination (-)
12. N.C
13. REM GND
14. GND
15. 5V Output
16. REM Data
17. Rear L (-)
18. Front L (-)

<ARA-5081WF: 18 Pin>



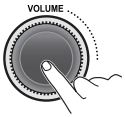
1. Tel Mute
2. Rear R (+)
3. Illumination (+)
4. ACC (+)
5. Battery (B+)
6. DMB GND
7. Rear L (+)
8. DMB L-CH
9. H/F GND
10. Rear R (-)
11. DMB Det
12. DMB Mute
13. REM GND
14. GND
15. 5V Output
16. REM Data
17. Rear L (-)
18. DMB R-CH

Getting started

Turning the unit on/off

1. Turn your car's ignition key to **ACC** or **IGN (ON)** position.

   Displays the current time.

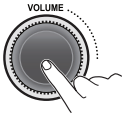


2. Press the **POWER** button to turn the power on.

   If the source is ready, playback also starts.

   To turn on the power directly

   By connecting an USB into the USB port or pressing the AM/FM or USB button (while the USB device is connected), you can also turn on the power and the unit then plays.



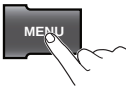
3. When power is on, press and hold the **POWER** button to turn power off.

Adjusting volume directly

1. Turn the **VOLUME** dial to control volume.

   Available volume range: 1 - 41.

Setting the sound

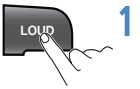


1. Press **MENU** button repeatedly to select the Sound setting mode as below;

   - **BAS** (Bass): sets the bass sound level. (-5 ~ +5)
   - **MID** (Middle): sets the middle sound level. (-5 ~ +5)
   - **TRE** (Treble): sets the treble sound level. (-5 ~ +5)
   - **FAD** (Fader: Option): sets the sound fade between the front and rear speakers. (F15 ~ R15)
   - **BAL** (Balance): sets the sound balance between the right and left speakers. (L 15 ~ R15)
   - **LOUD** (Loudness): turn Loudness mode on/off
   - **EQ** (Equalizer style): selects the one of the 7 EQ styles (EQ OFF, POP, ROCK, COUNTRY, VOICE, JAZZ, CLASSIC)
   - **BEEP** (Beep): turn Beep sound on/off
   - **SCROLL** (Scroll): turn Scroll mode on/off
   - **VOL** (Volume): sets the sound volume level. (VOL 0 ~ VOL 41)

2. Turn the **VOLUME** dial left/right to adjust the value of the level, balance or style.

Setting the Loudness mode

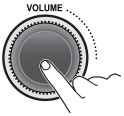


1. Press the **LOUD** button to turn loudness mode on/off.

Increases the level for low frequency.

To turn the loudness option off, press the **LOUD** button again.

Muting the sound quickly



1. Press the **MUTE** button to turn mute on. "MUTE" will flash on the display and mute the sound.

Press the **MUTE** button again or turn **VOLUME** dial to restore sound.

Radio

Setting the region of radio reception

1. When the power is turned on, press and hold the buttons more 3 seconds at the same time as below;

- U.S.A: Hold down 1 II and press 4 INFO + MENU more 3 seconds

  FM: 87.7 - 107.9 MHz (200 kHz step)

  AM: 530 - 1.7 10 kHz (10kHz step)

- South America : Hold down 2 RPT and press 5 D- + MENU more 3 seconds

  FM: 87.5 - 108.0 MHz (100 kHz step)

  AM: 530 - 1.7 10 kHz (10kHz step)

- Asia : Hold down 1 II and press 5 D- + MENU more 3 seconds

  FM: 87.5 - 108.0 MHz (100 kHz step)

  AM: 531 - 1,602 kHz (9 kHz step)

- Europe: Hold down 2 RPT and press 4 INFO + MENU seconds

  FM: 87.5 - 108.0 MHz (50 kHz step)

  AM: 522 - 1,629 kHz (9 kHz step)

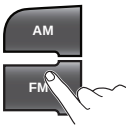
2. Please wait for more 5 seconds with no operation, the unit will save and apply yours setting.

If the region setting is not selected correctly to your country or region, the radio reception cannot be received. Retry the setting the region of radio reception correctly.

The region setting is required only for the first time

The region setting is return to the default setting when the power connector or battery is disconnected.

Tuning in a station



1. Press the **AM or FM** button to change the band in order of AM1. AM2. FM1 or FM2.

   You can select the FM 1. FM2. AM 1 or AM2 radio band.

   While the Auto 5tore stations are stored, you can select the AMA or FMA band by additional.

   The previously chosen broadcasting station will be received.

2. Press the **SCN** button or turn the ⏮ **TUNE** ⏭ dial left/right to select the station.

   Using TUNE: Briefly turn the dial, plays previous/next frequency.

   Using SEEK: Turn and hold the dial, automatically search for station with superior reception.

   Using SCAN: Press the button, starting from the current station, stations with superior reception are scanned for 5 seconds and the previous station is restored.

   During the seeking or scanning, if press or turn the dial left/right again, the selected station will begin playing.

During the FM reception, the Stereo [ST] indicator is on.

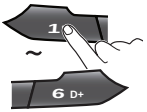
Radio

Saving radio stations manually

You can save up to 6 preset channels each for FM 1, FM2, FMA, AM 1, AM2, and AMA.

If change the stations while driving, use preset button to prevent accidents.

1. Press the **AM or FM** button repeatedly to select the band.

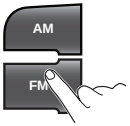


2. After selecting the frequency, press and hold the **PRESET** [1 ⏸] - [6 D+] button.

   The frequency is saved to the selected preset button.

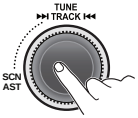
   A total of 24 frequencies with 6 preset frequencies each for FM1/FM2/AM1/AM2 modes can be saved.

Saving radio stations automatically



1. Press the **AM or FM** button repeatedly to select the band.

   The previously chosen broadcasting station will be received.

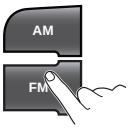


2. Press and hold the **AST** button to automatically save receivable frequencies to Preset button.

   "AST" is shown, and then stores stations in the order of their frequencies on the Preset buttons.

   Up to 6 stations can be stored in each of the AMA and FMA band

Listening to a preset station

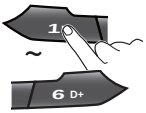


1. Press **AM or FM** button repeatedly to select the band.

You can select the FM 1. FM2. AM 1 or AM2 radio band.

While the Auto Store stations are stored, you can select the AMA or FMA band by additional.

The previously chosen broadcasting station will be received.



2. Press **Preset** [1 II] - [6 D+] button

From the 6 presets, select the frequency you want to listen to.

USB player

Before MP3 [WMA] USB playback

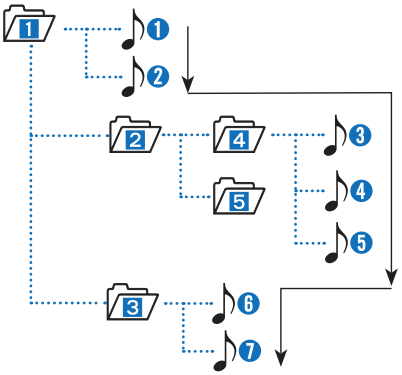
This unit cannot play the following files;

• MP3 files encoded with MP3i and MP3 PRO format.

- MP3 files encoded in an inappropriate format.

- MP3 files encoded with Layer 1/2.

Folder selection order/File playback order;



Playing a USB device

1. Open the cover, plug the USB device to the USB port.

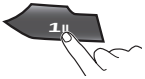
Once a USB is connected, USB will automatically start playing from the first file within the USB.

If a previously played USB is reconnected, then the file after the most recently played file is played.

If a different USB is connected or the file information within the USB was changed, then the USB will start playing from the first song within the USB.

2. When a USB device to be played is already connected, press the USB button to play **USB** device.

The previously selected file is played.



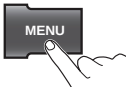
3. While playing, press the [1 II] button to pause the file.

Press the button again to play the current file.

4. Press the [4 INFO] button repeatedly to display information about the file being played.

The information displayed includes the file name, playing time, ID3 Tag or folder name information saved with the song.

If there is no information on the playing file, then the unit will display "**NO INFO**".



5. Press **MENU** button repeatedly to select the Scroll setting mode. Tum the **VOLUME** dial to changes the display method between Scroll On/Off.

- SCROLL ON: activate the scroll function
- SCROLL OFF: deactivate the scroll function

Controlling the playback

1. While playing, turn the ▶▶|TRACK|◀◀ dial left/right to moves to the previous or next track.

- Clockwise: move to the next file

  Counter-clockwise: move to the previous file

- You can skip files within the same folder.

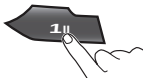
2. While the ▶▶|TRACK|◀◀ dial is being turned and held, the file will rewind or fast forward at high speed. Once released, the file will begin playing at normal speed.

- Clockwise: fast forward
- Counter-clockwise: fast rewind
- The search function works but search speed is not constant.
- While fast forwarding or rewinding, you can only hear intermittent sounds.

3. Press the [5 D-] or [6 D+] button to moves to the previous or next folder.

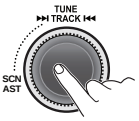
- [5 D-]: move to previous folder

  [6 D+]: move to next folder



- While folder moving, he folder name will be displayed briefly.

Change the playback mode



1. While playing, press the SCN button to begin the Intro scan playback.

- When pressed shortly, scans the beginning parts of device files. (approx. 10 seconds per file)
- INT : Successively plays the intro of the file in the USB device.
- INT: Successively plays the intro of the file in the current folder.
- Off : Cancels intro playback.

2. Press the [2 RPT] button to select the Repeat playback mode.

- : The current file plays repeatedly.
- : The current folder plays repeatedly.
- Off: Cancels repeat playback.

3. Press the [3 RDM] button to select the Random playback mode.

- : AII files of current folder play in random order
- : AII files of USB device play in random order
- Off: Cancels random playback.

About MP3/WMA

This unit can play MP3 (WMA) files with .mp3, .wma (lower case letters) or .MP3 and .WMA (capital letters) file name extensions.

This unit can display ID3 Tag (Version 1.0, 1.1, 2.2, 2.3 or 2.4) information for MP3 files. such as the album name and the artist.

This unit can recognize the Korean and English characters.

This unit can play MP3/WMA files meeting the conditions below;

- Bit rate: 8 kbps - 320 kbps / VBR for MP3
- Sampling frequency:

  48 kHz, 44.1 kHz, 32 kHz

  (for MPEG-1 Layer 2/3)

  24 kHz, 22.05 kHz, 16 kHz

  (for MPEG-2 Layer 2/3)

This unit can recognize total of 9,999 files, of 256 folders, and 7 stages of folder structure.

This product can play MP3 files using VBR. When playing an MP3 file of this VBR type, the remaining time displayed may be different from the real time.

Handling precautions for USB device

When using the external USB device, make sure to keep the device disconnected and connect only sometime after turning on the vehicle ignition. The USB device may be damaged if the USB device already connected when the ignition is turned on. (USB device is not an electronic automotive component).

Some USB devices may not operate properly because of compatibility issues. Check that the external device is supported by the device before stating use.

The device will only recognize USB devices formatted in FAT 16/32.

When formatting the external USB device, the device may not properly recognize a Byte/Sector selection other than 512 Bytes or 2,048 Bytes.

Avoid the contact of bodily parts and foreign substances with the USB connector.

Repeatedly connecting/disconnecting the USB in a short period of time may cause damage to the device.

When disconnecting the USB, an abnormal sound may occur occasionally.

Abruptly disconnecting the external USB device while the USB is operating may cause the device to be damaged or function abnormally. Make sure to disconnect the USB device only after the audio power is turned off or when the audio is operating in a different mode.

The amount of time required to recognize the external USB device may differ depending on the type, size, or file formats stored on the USB. Such differences in the required time are not indications of malfunction. Please wait the period of time required to recognize the device.

The device support only USB devices used to play music files.

Do not use the USB I/F to charge batteries or USB accessories which generate heat. Such acts may lead to deteriorated performance or damage to the device

The device may not recognize the USB device if separately purchased USB hubs and extension cables are being used.

In the case of high capacity USB devices, there are instances where the logical drives are partitioned for user convenience. In this case, it will only be possible to play the USB music in the top level drive. When using partitioned drives, save the songs you wish to play on the device only in the top-level logical drive. In addition, certain USB devices are configured with a separate drive used to install application programs and it may not be possible to play songs from such drives for the reasons as described above.

The device may not support normal operation when using formats such as HDD Type, CF, or SD Memory.

The device will not support files locked by DRM (Digital Rights Management).

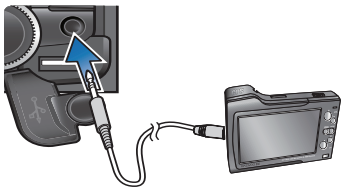
AUX player

Listening to auxiliary audio equipment

By connecting an optional portable audio device to the AUX input jack (stereo mini jack) on the unit and then simply selecting the source, you can listen on your car speakers.

1. Turn the **VOLUME** dial left to decrease the volume level.

The **AUX** volume can also be controlled separately through the connected device.



2. Turn the external audio equipment off Open the cover, connect the audio output of the external audio equipment to AUX input terminal on the unit.

3. Turn the external audio equipment on. Start playback of the external audio equipment at a moderate volume.

4. Press the **AUX** button to select the AUX function.

5. Set your usual listening volume by turn the **VOLUME** dial left/right on the unit.

Once the connector is disconnected, the previous mode will be restored.

AUX mode can be used only when an external audio player has been connected.

Listening to DMB sound (If Equipped)

1. By connecting the optional DMB receiver, you can listen the DMB source provided for the vehicle.

When the DMB receiver is turned power on, the current operation will be paused and the “AUX 1" will be displayed on the Display window.

The DMB's sound is output from the speakers in the unit.

2. While playing the DMB, press the AM, FM or USB button to change the function.

3. While playing the DMB, if turn the DMB receiver off, the unit will be returned to previous mode.

Calling via Handsfree (If Equipped)

1. By connecting the optional Handsfree equipment, you can use the Handsfree mode.

When make a call or receive. the bell will sound and the "PHONE“ will be displayed on the Display window.

2. The ringtone and talker's voice are output only from the front speakers.

3. When the call is ended, the mute will be canceled and the unit will be returned to the previous mode.

Seat Switch System

The lift truck is equipped with a SEAT SWITCH SYSTEM. In normal operation if the direction lever is placed in either forward or reverse, the lift truck will move at a speed proportional to the accelerator pedal's position. If the operator leavers the seat without setting the parking brake, within three seconds after leaving the seat, the SEAT SWITCH SYSTEM will automatically disengage the transmission. The directional lever, however, will remain in that forward or reverse location although internally the transmission will have shifted into neutral.

Before exiting the lift truck, the parking brake should always be applied.

⚠ WARNING

When leaving machine apply parking brake! Parking brake is not automatically applied.

NOTE: Some trucks may be equipped (ask your dealer if this applies to your truck) with an alarm that will sound if the parking brake is not applied when leaving the machine.

NOTICE

Prior to operating the lift truck, be sure to understand and check the SEAT SWITCH SYSTEM.

While in normal operation and on level ground, select a direction with the directional lever and with the park brake released. You will note that the truck will move slowly in the selected direction. If you lift your hips off of the seat, within three seconds, the SEAT SWITCH SYSTEM will disengage the transmission allowing the truck to coast but not automatically stop.

To restore the lift truck to normal operation, while sitting in the operator's seat depress the brake pedal to hold the lift truck, return the directional lever to the neutral position, and then reselect a direction of travel (either forward or reverse). The transmission will then re-engage.

If seat or seat switch replacement becomes necessary, be sure to use genuine lift truck parts. Lift trucks should never be operated without an operational SEAT SWITCH SYSTEM.

⚠ WARNING

When closing the engine hood, be careful not to pinch your hand.

Functional safety System

⚠ WARNING

These are the functions added for functional safety.

When using these functions, the vehicle is switched to neutral for safety purposes.

Therefore, attention is required when using them.

1. Seat belt sequence interlock

-. With this safety function, the vehicle will only be ready for travel when the driver has sat in the seat and put on the seatbelt in the correct sequence. However, in the case of initial starting, sitting can be recognized when the operator takes the seat and puts on the seatbelt, regardless of the sequence.
If the seatbelt is released or the driver leaves the seat while the vehicle is in motion, the vehicle will be switched to neutral.

2. Mast neutral detection

-. When starting the vehicle or when the operator returns to his seat or puts on his seatbelt after it has been released, the work machinery can only be used when it is in the neutral position.

3. The forced neutral lamp turns on

- When the operator leaves his seat or releases his seatbelt when the vehicle is driven or when it remains stopped, the neutral indicator light is turned on, and it will stop blinking if the operator returns to his seat in 0.2 ~ 2 seconds.
However, a buzzer will sound after two seconds with the gear in neutral, and the parking brake will operate when the vehicle's speed is 0 km/h.
- When returning to the operator's seat according to the seat belt sequence, forward/reverse are possible only after the FNR lever and accelerator pedal have been changed to neutral.

4. Accel drive

-. Vehicle forward/reverse are possible only by pressing the accelerator pedal after operating FNR lever for vehicle forward/reverse.

NOTE: After engaging the direction lever, caution is required as the vehicle is driven when push the accelerator in situations such as the use of the mast lever while the vehicle is stationary.

- Exceptions -

-. If the vehicle speed exists, vehicle forward/reverse is possible only by operating the FNR lever.

-. When driving on a slope with inclination equal to or higher than the set angle, the vehicle can be driven with the FNR lever and without the accelerator signal. However, the vehicle may be pushed back on a slope whose inclination is less than the set angle if the Accel pedal is not pressed. Depending on whether the vehicle is loaded or not, the inclination of the slope can be changed.

-. Even if the vehicle has the same specification, the amount of pushback may differ due to the tire specification (i.e. then amount of tire compression) or tire wear after shipment from the factory.

-. If the vehicle is stopped while driving, it must be stopped for 2 seconds to change to neutral.

5. Forward/reverse is not possible if there is a problem with the FNR solenoid.

6. The work machinery cannot be used when there is a problem with the solenoid related to the mast.

7. The accelerator pedal needs to be checked when engine check, mast interlock, forced neutral lamp are turned on.

8. When the neutral lamp is blinking or the engine check, mast interlock or neutral indicator lamp is turned on, it indicates abnormal engine output power, which needs to be checked.

When the engine exceeds 2800 rpm, the vehicle will be switched to the neutral state and the corresponding warning will be activated.

9. Auto-parking
Parking operates automatically if the gear remains in neutral for 1.5 seconds while the vehicle is stopped. When operating the accelerator pedal after FNR gear was inputted, parking is released and the vehicle moves. However, while driving on a slope, parking is released only by the FNR gear input and the vehicle moves.

10. The buzzer sounds for one second and rests for two seconds, which is deemed to be one cycle, and the cycle is repeated. If this happens, it is necessary to check the Gyro Sensor and the connection of the harness around it.
Please note that the Accel Drive function is executed on a slope if the Gyro Sensor malfunctions.

FS VCU Classification of Warning buzzer

Seat empty warning : 0.5sec ON - 0.5sec OFF

Brake oil level warning : 0.5sec ON - 0.5sec OFF

Engine stop : 1ec ON – 1sec OFF

WIF warning : 2sec ON – 2sec OFF

Mast front angle warning : 2sec ON – 1sec OFF

DPF soot warning : 2sec ON – 2sec OFF

After treatment(DPF) fault : 10sec ON-290sec OFF

GSS warning : Continuous

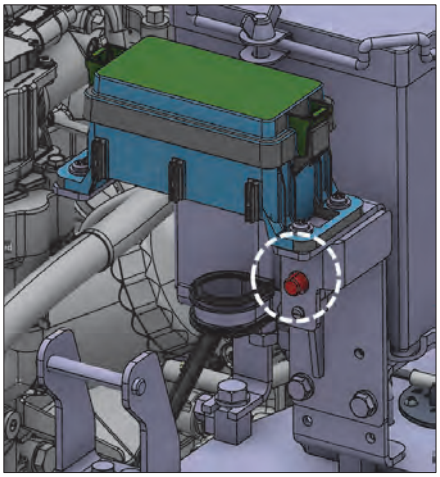
Performance Level

The table below shows the Performance Level based on ISO 13849-1/2:2015 regarding the PLr(Required Performance Level) of EN 1175:2020. The SRP/CS (Safety-related parts of control systems) consists of the parts in Category B, 1, 2, 3, and 4, while the control action to achieve a safe state under Clause 4.5 of EN 1175:2020 belongs to the control systems of Category 2. However, there may be Clauses that are irrelevant to the composition of this vehicle because the composition of the SRP/CS shown in the table below differs for each vehicle/model.

Clause	PLr for Counterbalance truck	PL calculation results	PLr for Reach truck	PL calculation results
4.3.7	b	b	b	b
4.4.2.1	b	b	b	b
4.4.2.2	b	b	b	b
4.5.2	c	c	c	c
4.5.3	b	b	b	b
4.5.5	a	a	a	a
4.5.6.2	c	c	c	c
4.5.6.3	b	b	b	b
4.5.7	c	c	c	c
4.5.8	c	c	c	c
4.5.9.1a	c	c	c	c
4.5.9.1b	b	b	b	b
4.5.9.1c	b	b	b	b
4.5.9.1d	a	a	a	a
4.5.9.2	a	a	a	a
4.5.9.3	a	a	a	a
4.5.10a	c	c	c	c
4.5.10b	c	c		
4.5.10c			c	c
4.5.10d	c	c		
4.5.10g	c	c	c	c
4.5.10h	c	c		
4.5.10i	c	c		
4.6.2	c	c	c	c
4.6.3	b	b	b	b
4.6.4a	c	c	c	c
4.6.4b	a	a	a	a
4.6.5	c	c	c	c
4.6.6	c	c	c	c
4.7.2.2a	d	d	d	d

4.7.2.2b	**c**	**c**	**c**	**c**
4.7.2.3	**c**	**c**	**c**	**c**
4.7.2.4	**a**	**a**	**a**	**a**
4.7.2.5	**c**	**c**	**c**	**c**
4.7.3	**a**	**a**	**a**	**a**
4.9.1.2.1	**c**	**c**	**c**	**c**
4.9.1.2.2	**b**	**b**	**b**	**b**
4.9.2.3a	**c**	**c**		
4.9.2.3b	**b**	**b**		
4.9.2.5	**b**	**b**	**b**	**b**
4.9.2.6	**a**	**a**	**a**	**a**
5.3.4	**b**	**b**	**b**	**b**

Circuit Breaker



Circuit Breaker -Protects the main electrical circuits. To reset the circuit breaker, push the button in. Located in the engine compartment.

Seat

NOTE: Seat arrangements may vary.
Basic operation will be similar.

Seat adjustment should be checked at the beginning of each shift and when operators change.

Lock the seat into position before operating, to prevent an unexpected seat change.

Adjust seat to allow full brake pedal travel with operator's back against seat back.

NOTE: The seat can only be correctly adjusted with the operator fully seated.

Lift Truck Controls

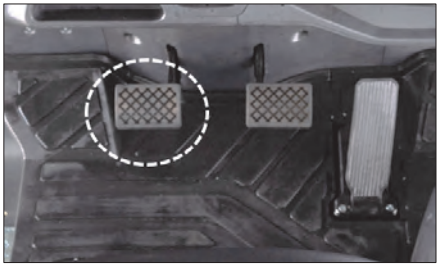
Direction Control Lever

1. **Forward** - Push the lever forward for FORWARD direction travel.

2. Neutral - Move the lever to center position for NEUTRAL.

3. Reverse - Pull the lever back for REVERSE direction travel.

Transmission Inching Control Pedal

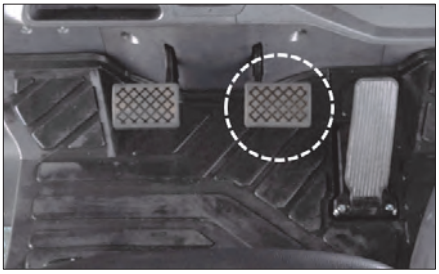


Inching Control Pedal - Pushing down on the inching pedal, modulates the hydraulic pressure to the clutch packs, permitting disc slippage.

Further pushing on the pedal completely relieves clutch pack pressure and applies the service brakes to stop and hold the lift truck.

NOTE: The purpose of the inching control pedal is to provide precise inching control at slow travel speed, with high engine rpm. This is used for fast hydraulic lift during load approach, pickup or positioning.

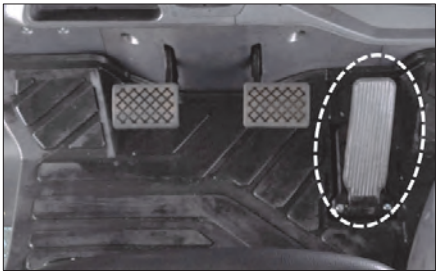
Service Brake Pedal



Push DOWN on the brake pedal to slow or stop the lift truck.

RELEASE the brake pedal to allow the lift truck to move.

Accelerator Pedal



Push DOWN on the pedal to increase engine rpm (speed).

RELEASE the pedal to decrease engine rpm (speed).

Electronic Parking Brake

Push the front side of the parking brake switch to engage the brake.

Push the rear side of the parking brake switch to release the brake.

Lift Control

NOTE: To prevent a sudden change of position of the load, operate all lift, tilt and attachment controls smoothly.

1. Lower Position - Push the lever FORWARD smoothly to lower the load.

2. Hold Position - When the lever is released it will return to the HOLD or center position. Lifting or lowering action will stop.

3. Lift Position - Pull the lever BACK smoothly to lift the load.

Tilt Control

1. Mast Tilt Forward - Push the lever FORWARD smoothly to tilt the mast forward.

2. Mast Hold - When the lever is released it will return to the HOLD or center position. Tilting action will stop.

3. Mast Tilt Back - Pull the lever BACK smoothly to tilt the mast backward.

Sideshift Attachment (If Equipped)

1. Sideshift Left - Push the lever FORWARD to shift the carriage to the left.

2. Sideshift Hold - When the lever is released it will return to the HOLD or center position. Sideshifting action will stop.

3. Sideshift Right - Pull the lever BACK to shift the carriage to the right.

Refueling

Gasoline or Diesel Engine Equipped

⚠ WARNING

Explosive fumes may be present during refueling.

Do not smoke in refueling areas.

Lift truck should be refueled only at designated safe locations. Safe outdoor locations are preferable to those indoors.

Stop the engine and get off the lift truck during refueling.

NOTICE

Do not allow the lift truck to become low on fuel or completely run out of fuel. Sediment or other impurities in the fuel tank could be drawn into the fuel system. This could result in difficult starting or damage to components.

Fill the fuel tank at the end of each day of operation to drive out moisture laden air and to prevent condensation.

In the cold weather, the moisture condensation can cause rust in the fuel system and hard starting due to its freezing

Do not fill the tank to the top. Fuel expands when it gets warm and may overflow.

Park the lift truck only at a designated safe location. Place the transmission in NEUTRAL. Lower the forks to the ground. Engage the parking brake. Stop the engine.

Open the filter cap.

Fill the fuel tank slowly. Close the filter cap. If spillage occurs, wipe off excess fuel and was down area with water.

NOTE: Drain water and sediment from fuel tank as required by prevailing conditions. Also, drain water and sediment from the main fuel storage tank weekly and before the tank is refilled. This will help prevent water or sediment being pumped from the storage tank into the lift truck fuel tank.

Before Starting the Engine

Walk - Around Inspection

Make a thorough walk - around inspection before mounting the lift truck or starting the engine. Look for such items as loose bolts, debris buildup, oil or coolant leaks. Check condition of tires, mast, carriage, forks or attachments. Have repairs made as needed and all debris removed.

Inspect the operator's compartment for loose items and cleanliness.

Inspect the instrument panel for broken or damaged indicator lights or gauges.

Test the horn and other safety devices for proper operation.

Inspect the mast and lift chains for wear, broken links, pins and loose rollers.

Inspect the carriage, forks or attachments for wear, damage and loose or missing bolts.

Inspect the tires and wheels for cuts, gouges, foreign objects, inflation pressure and loose or missing bolts.

Inspect the overhead guard for damage and loose or missing mounting bolts.

Inspect the hydraulic system for leaks, worn hoses or damaged lines.

Look for transmission and drive axle leaks on the truck and on the ground.

Inspect common parts and drive axle, mast etc. for grounded, loosen or missing mounting bolts.

Inspect the engine compartment for oil, coolant and fuel leaks.

Measure the engine crankcase oil level with the dip stick. Maintain the oil level between the MAX. and MIN., (or FULL and ADD) notches on the dip stick.

Observe the engine coolant level in the coolant recovery bottle. With the engine cold, maintain the level to the COLD mark. If the recovery bottle is empty, also fill the radiator at the top tank.

Observe the fuel level gauge after starting the truck. Add fuel if necessary.

⚠ WARNING

Personal injury may occur from accidents caused by improper seat adjustment. Always adjust the operator's seat before starting the lift truck engine.

Seat adjustment must be done at the beginning of each shift and when operators change.

To position the seat, PUSH the lever away from the seat track and move the seat forward or backward to a comfortable position.

Starting the Engine

Prestart Conditions

NOTE: The engine will not start unless the transmission directional control lever is in the NEUTRAL position.

1. Engage the parking brake, if not already engaged. Place the transmission directional control lever in the NEUTRAL position.

2. Lift trucks equipped with electrical disconnect switches; the engine will not start unless the disconnect switch is in the ON (closed) position.

NOTICE

When you restart the engine after turning off it, wait 4 to 5 seconds and restart it to protect the starter.

Diesel Engine

Starting Diesel Engine at Cold

1. Turn ignition the key to the ON position. The start pre heat light will come ON. The preheat light will stay ON maximum 20 seconds, depending on the ambient air temperature.

NOTICE

Do not crank more than 10 seconds continuously

If engine coolant is cold, engine low idle speed could be higher than normal condition. (Electronic engine)

2. After the preheat light goes OFF, turn the ignition key to the START position.

3. Release the ignition key after engine starting and check the engine condition.

4. If the engine stalls or does not start, turn the ignition key to the OFF position, then repeat steps 1 thru 3.

Starting a Warm Diesel Engine (Mechanical Engine)

Turn the key to the ON position and then to START position, without waiting for the preheat light to go OFF. At the same time press the accelerator.

Release the key when the engine starts and release the accelerator pedal to a low idle position.

Starting From a 12 Volt External Source

⚠ WARNING

Sparks occurring near the battery could cause vapors to explode.

Always connect the external power source ground cable to a point away from and below the battery, and well clear of fuel system components.

NOTICE

Do not reverse battery cables. It can cause damage to the alternator.
Always connect the external power source cables in parallel with the lift truck battery cables: POSITIVE (+) to POSITIVE (+) and NEGATIVE (-) to NEGATIVE (-).
Attach ground cable last, remove first. All lift trucks equipped with DOOSAN built internal combustion engines are NEGATIVE (-) ground.

After Starting the Engine

Observe all indicator lights and gauges frequently during operation, to make sure all systems are working properly. The entire indicator lights will come ON with the ignition switch in the ON position before the engine is started.

Diesel and LPG/GAS (12V)

The engine oil pressure indicator light (17), will not come ON with the engine running, unless there is low or no oil pressure. Stop the engine immediately, if the light comes ON.

The alternator indicator light (2), should not come ON during normal operation. The alternator is not charging if the light comes ON with the engine running.

The diesel engine water in fuel filter indicator light (1), will not come ON with the engine running, unless water in fuel filter exceeds 100cc. Stop the engine immediately and drain the water if the light comes ON.

Observe the fuel level gauge (4) for fuel level in the tank.

The engine coolant temperature gauge pointer (5) will be in the green band with the engine running, unless the coolant temperature is excessive.

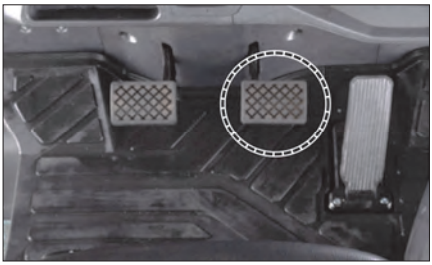
The transmission oil temperature gauge pointer (6) will be in the green band with the engine running, unless the oil temperature is excessive.

Observe the hour meter (9) to make sure it is operating properly.

Lift Truck Operation

Power Shift Transmission/Drive axle

1. Start the engine. See topic “Starting the Engine”.



2. Push down on the service brake pedal to hold the lift truck until ready to move it.
3. Release the parking brake.

NOTE: The parking brake must be released before the directional control can be used.

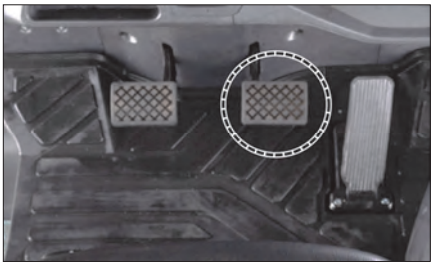
4. Select the direction of travel by pushing the directional lever FORWARD for forward direction or by pulling the lever BACK for reverse direction.

⚠ WARNING

A lift truck with the engine running but without an operator can move slowly (creep) if the transmission is engaged.

This could result in personal injury.

Always place the transmission control lever in the NEUTRAL (center) position and apply the parking brake before dismounting the lift truck.



5. Release the service brake.
6. Push down on the accelerator pedal to obtain the desired travel speed. Release the pedal to decrease travel speed.

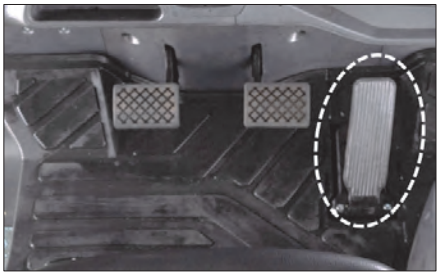
⚠ WARNING

Sudden reversal of a loaded lift truck traveling forward can cause the load to fall or the lift truck to tip over.

Stop the loaded lift truck completely, before shifting to reverse.

Failure to comply could result in personal injury.

NOTE: Where conditions permit, directional changes can be made under full power at speeds up to 6 km/h (3.73 mph). A speed of 6 km/h (3.73 mph) is a fast walk. Directional shift changes at speeds above 6 km/h (3.73 mph) are considered abusive. Bring the lift truck to a complete stop where load stability or other factors prevent safe operation under full power shifts.

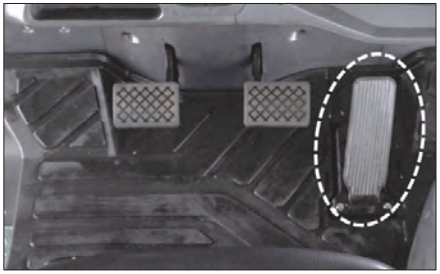


To change the lift truck direction of travel, release the accelerator pedal.

Push down on the service brake pedal to reduce the lift truck speed as necessary.

Move the directional lever to the desired direction of travel. Slowly push down on the accelerator pedal as the lift truck changes direction.

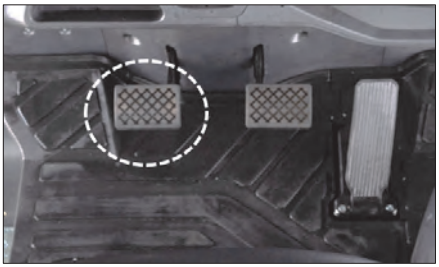
When the direction change is completed, continue to push down on the accelerator pedal to obtain the desired travel speed.



To stop the lift truck when traveling in either direction, release the accelerator pedal.

Push down on the service brake pedal and bring the lift truck to a smooth stop.

Inching



NOTE: The purpose of the inching pedal is to provide precise lift truck inching control at very slow travel speed and high engine rpm. This is used for fast hydraulic lift, during load approach, pick up or load positioning.

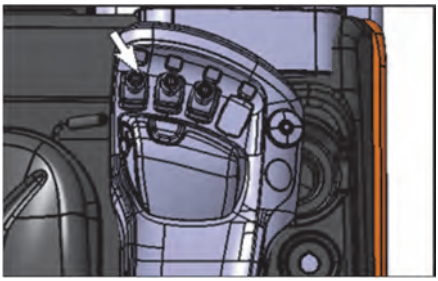
1. To inch (creep) in either direction, slowly push down on the inching pedal. This will start to apply the service brakes and allow the transmission clutch discs to slip.
2. Vary the position of the inching pedal and the accelerator pedal to control the inching speed and distance.
3. Pushing down further on the inching pedal will disengage the transmission completely and apply the service brakes fully to stop and hold the lift truck. This will provide full engine power for fast hydraulic lift.
4. Avoid overuse of the inching pedal as this may cause the automatic transmission oil to overheat or the clutch to slip. Do not use as a footrest or for long periods of time.
5. If user operates continuously pushing work or both brake pedal and accelerator pedal were depressed at the same time, it may cause the automatic transmission oil to overheat or the clutch to slip.

⚠ WARNING

Do not use inching pedal instead of brake pedal. It will give wearing to transmission clutch disc.

Finger Tip (Option)

Lift Control knob



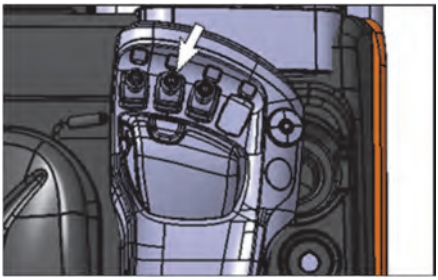
Lower - Push **the** knob forward smoothly to lower the lift forks.

Hold - Release the lift knob. The knob will return to the center(hold) position and the forks will remain in the position they are in.

Raise - Pull the knob back smoothly to raise the lift forks.

NOTE: To prevent a sudden change of position of the load, operate all lift, tilt and attachment knobs smoothly.

Tilt Control knob



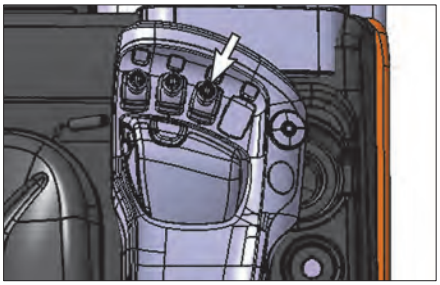
Tilt Forward - Push the knob forward smoothly to tilt the lift forks forward.

Hold - Release the tilt knob. The knob will return to the center(hold) position and the forks will remain in the position they are in.

Tilt Back - Pull the knob back smoothly to tilt the lift forks back.

NOTE: To prevent a sudden change of position of the load, operate all lift, tilt and attachment knobs smoothly.

Sideshift Attachment Control



The side shift attachment controller is at the front-right side of the driver, and the side shift control lever is at the right as shown in the figure.

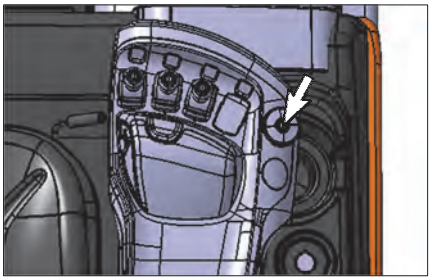
1. Side Shift Left – open the knob softly forward to move the carriage to the left.

2. Side Shift Stop – release the side shift knob. The knob will return to HOLD position and the side shifting operation will stop.

3. Side Shift Right – pull the knob softly forward reverse to move the carriage to the right.

NOTE: To prevent sudden position shift of the load, operate the lift, tilting and side shift controller smoothly.

Emergency Switch

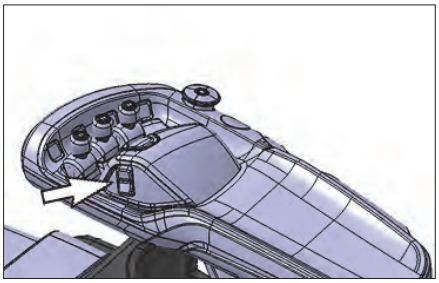


OFF - Push the emergency switch button to disconnect the electrical circuits. (It must be done after the key switch is turned off)

ON - Pull the emergency switch button to connect the electrical circuit.

When the vehicle is in forward or reverse, turning on the emergency switch disables the forward/reverse switch. To have it enabled, turn the emergency switch off and **set the forward/reverse switch in neutra**l before driving the vehicle.

Directional Control Switch



Forward - push the forward/reverse switch forward to drive the truck forward.

Neutral - if the forward/reverse switch is at the neutral position, the truck does not travel.

The forward/reverse switch must be at the neutral position when the driver is off from the driver's seat or the key switch is OFF. The forklift truck does not move until the accelerator pedal is released and the directional control forward/reverse switch is returned to neutral position.

NOTE: operation wait mode: - this mode is effective in the following condition While the driver is not driving, the seat switch is closed and the key switch is ON, and the directional control forward/reverse switch is at neutral for 5 s or longer

The circuit breaker opens, and the power steering motor is shut down to save energy. The lift truck maintains the mode until the driver operates the directional control switch and step on the acceleration pedal or operated the control valve lever.

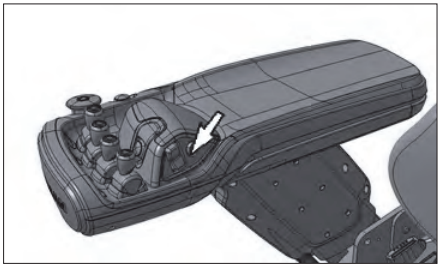
Reverse - pull the forward/reverse switch towards the driver to drive the lift truck reverse.

NOTE: The directional control forward/reverse switch may be used for electrical braking (plugging). To stop or low down the lift truck during travel, operate the directional control switch to the opposite direction of the travel. When the lift truck has slowed down sufficiently or stopped, accelerate the lift truck in the opposite direction.

If the driver stands up from the driver's seat while the forklift truck is in operation, the seat switch will be activated, and the drive motor will be turned off after 3 s. In this case, release the accelerator pedal and close the seat switch, return the forward/reverse switch to neutral and then shift it to desired position in the respective direction. Then, step on the acceleration pedal.

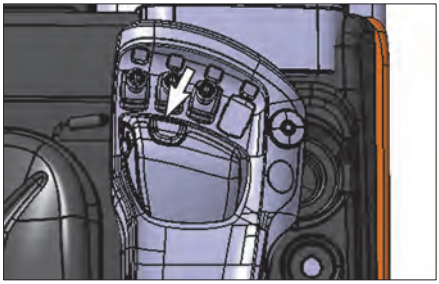
When the parking brake switch is on, the forward/reverse switch is disabled. To have it enabled, turn the parking brake switch off and **set the forward/reverse switch in neutral**.

Horn Button



Located in the right side of the directional control switch.
Push in on the horn button to sound the horn.

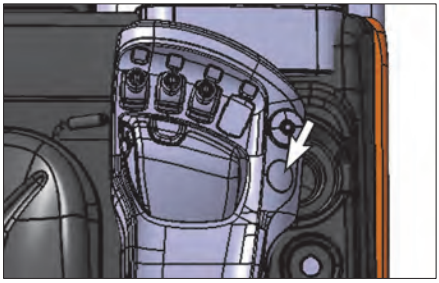
Auto Tilt Control



The auto tilt controller is at the rear side of the tilt knob. Press the auto tilt switch to turn on the switch lamp and push the tile knob forward. The mast will stop at 90 degrees angle.

NOTE: To prevent sudden position shift of the load, operate the lift, tilting and side shift controller smoothly.

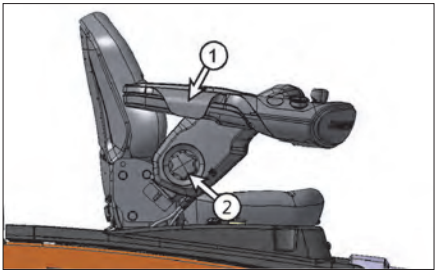
Auto Clamp Control (If provided)



The auto clamp controller is at the rear side of the emergency switch. Pressing the auto clamp switch enables operation of the AUX2 knob. If not AUX2 operation signal is provided for 10 s after the trigger, the AUX2 will be locked. To reset the AUX2, press the auto clamp switch again. In addition, if no AUX2 operation signal is provided after key switch ON, the AUX2 will be locked up.

NOTE: To prevent sudden position shift of the load, operate the lift, tilting and side shift controller smoothly.

Adjustment of Armrest

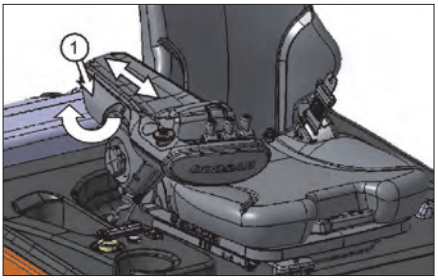


Using the two adjustment device, adjust the positions of the arm rests to a comfortable position.

knob #1 - forward, backward adjustment

knob #2 - upward, downward adjustment

Forward and Backward Adjustment

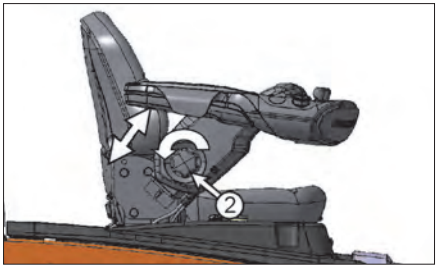


1. Turn No. 1 lever upwards.

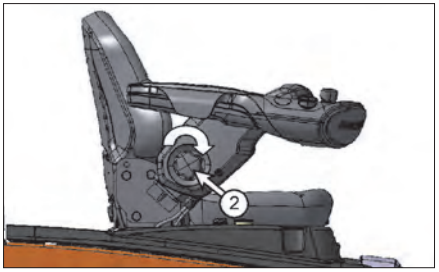
2. Adjust the position of the arm rest.

3. Release the No. 1 lever to fix the arm rest.

Up and Down Adjustment

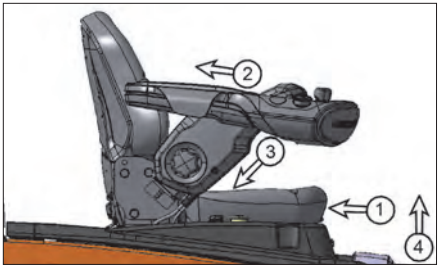


Turn No. 2 knob leftwards (CCW) to adjust the arm rest position up/down.



Turn No. 2 knob to the right (CW) to fix the arm rest.

Hood Opening



1. Slide the seat to the backward-most position.

2. Slide the armrest to the backward-most position.

3. Slide the armrest to the downward-most position.

4. Open the hood.

DM02VA, DM02P Diesel Engine

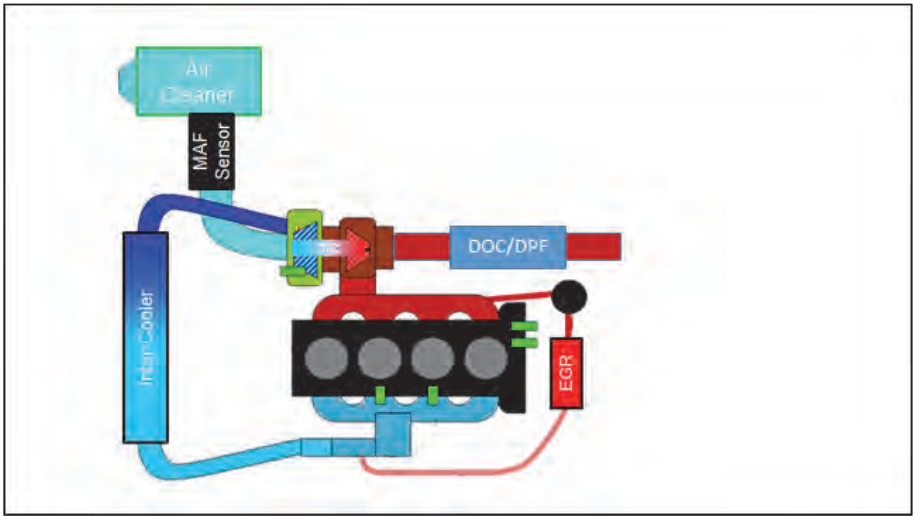
Introduction

The DM02VA, DM02P engine which is a high-power engine in compliance with the Stage5 and TIER4 Engine Emissions Standard is provided with various systems. The DM02VA, DM02P engine is equipped with a turbo-charger intercooler system that compresses and cools air and feed it to the intake manifold. Here, AMF sensor and temperature/pressure sensors detect the air condition and transmit the data to the ECU which controls fuel injection rate according to the engine load, speed and air quantity. Fuel is supplied to a high pressure pump through a fuel filter. The fuel compressed in the high pressure pump is transferred to common rail and injected by injectors in controlled order. Surplus fuel after injection returns to the fuel tank via a return hose. The exhaust gas recirculation (EGR) system controls the quantity of recirculating air according to the engine speed and load in order to comply with applicable exhaust gas emission standards.
The DOC (Diesel Oxidation Catalyst) uses a chemical process to reduce hydrocarbons (HC) and carbon monoxide (CO). DPF (Diesel Particulate Filter) as after-treatment is the process by which the oxides of nitrogen (NOx) contained in diesel exhaust are reduced to nitrogen (N2) and water (H2O).

The figure below shows the positions of the electronic control system and sensors.

NOTICE

It is normal to hear a slight operating sound after Key Switch On/Off.
This is the ECU checking the actuator before/after engine running.



TMS(Lin-Q) (Option)

Safety Precautions

This information is intended to protect the safety and property of the user.

Before using the TMS (LIN-Q) terminal, make sure to read the user manual carefully and familiarize yourself with the contents.

Operating Environment

- The TMS (LIN-Q) terminal has an operating voltage of DC 9 V – 34 V.
- Make sure to use it within the specified temperature range.

Installation and Wiring

- The installation and wiring procedures require professional expertise. Consult a professional technician for assistance with installing the product. Improper installation or wiring may cause a fire and/or malfunction.
- Perform the installation and wiring in a place free of moisture. Installing the product in a place with the risk of water or rain splashing on it or with significant amounts of dust or dirt may cause malfunctions and accidents.
- Use the specified cables and parts.
- When installing the product on the ceiling of the machine or in places with severe vibrations, take care to ensure that it does not fall and make sure that it is secured properly.
- Do not block any vents or heat sinks. Doing so may cause a fire.

Precautions for Using the Product

- Avoid operating the terminal while the vehicle is running; otherwise, an accident may occur. Stop the machine in a safe place before operating the terminal.
- Do not disassemble or modify the terminal without permission. Unauthorized disassembly and modification may cause a malfunction and void the warranty for after-sales service.

Basic TMS

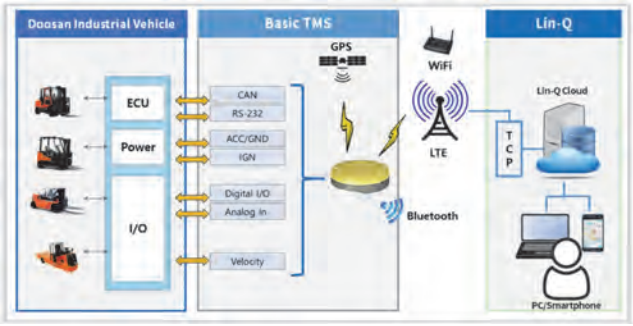
Lift Control knob

The TMS (LIN-Q) terminal is mounted on the forklift to monitor the driving and operating state of the vehicle.

To register and use the product, visit the Lin-Q website or contact an administrator.

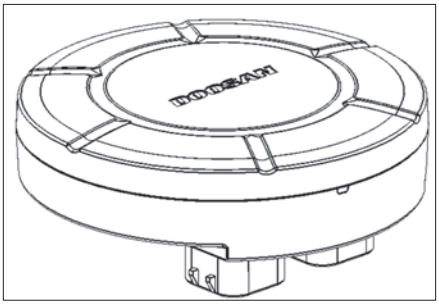
System Schematic Drawing

The terminal uses LTE, Wi-Fi communications (providing each terminal) and is an IoT terminal which can be used anywhere in the world.



Product Configuration and Functions

The TMS (LIN-Q) terminal is configured and connected as shown in the figure below. A separate harness cable assembly is required to connect it to the vehicle.



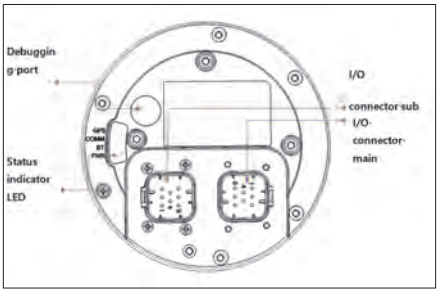
- LTE communications (Cat 4, 150M DL/ 50M UL), globally supported modem
- CAN data (J1939) collection
- Data collection from various vehicle sensors
- Periodic transmission of collected data
- Transmission of irregular event data
- Operating restriction by syncing with NFC
- Impact detection
- Remote update function
- Various I/O ports
  - ➢ 2 digital inputs
  - ➢ 3 digital in/outputs
  - ➢ 1 analog input
  - ➢ CAN
  - ➢ UART 2 ports

Product Specifications

Item	DTM-02L	
Size	ø117.7 (D) x 31 (H) [mm] [Unit: mm]	
Weight	204 grams	
Operating temp.	-30°C to +70°C (-22°F to +158°F)	
Storage temp.	-40°C to +85°C (-40°F to +185°F)	
Vibrations	Random 5 – 20 Hz 0.05 g2/Hz, 20 – 150 Hz: -3 dB/oct. (1.7g rms), 3-axis, 30 minutes for each axis.	
Thermal shock	-40°C (1H)/+85°C (1H), 1 cycle - total 24 cycles, 48H, non-operating	
Humidity	+70°C /95%/48 hours, operating	
Communication	LTE	LTE data modem (LTE Cat4, worldwide)
	BT	nRF52810, Bluetooth 5.0
GPS	Chipset	Gen8C-Lite
	TTFF	Cold start: 35 sec./Hot start: 2.5 sec.
IP class	IP66	
Operating voltage	+9 V DC to +34 V DC	
Current consumption	Sleep mode: 20 uAh or less (IGN OFF) /Standby mode: 100 mAh or less	
I/O ports	2 X 8 pin waterproof connectors	
Antenna	LTE	Internal
	BT	Internal
	GPS	Internal
SIM	ESIM	
LED	4 LEDs (POWER, BT, COMM, GPS)	

Names and Functions of Parts

Terminal Body



Name	Feature	Remarks
I/O connector main	A connector for connecting to the vehicle	8 pins, black
I/O connector sub	A connector for connecting to the vehicle	8 pins, natural
Status indicator LED	Four LEDs indicating the current status of the terminal	
Debuggin g port	Debugging port for developers	

There are two types of connectors: A (black) and B (natural). The pin map is shown in the table below.

- CONNECTOR Main (776276-1, Black)

No.	Name	Type	Description
1	FUEL_ ADC	Input	Signal Input Analog (with ADC)
2	CAN Low	Input /Outp ut	CAN Low Signal
3	IGN+	Input	IGN+ Signal Input (Logic)
4	BRK	Input	Brake Signal Input (Logic)
5	GND1	Pow er	Digital Ground
6	SPD	Input	Speed Signal Input (Logic)
7	CAN High	Input /Outp ut	CAN High Signal
8	BAT+	Pow er	Car Battery +

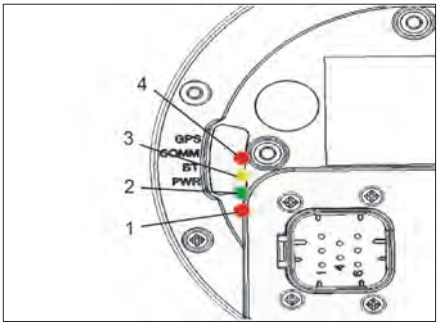
- CONNECTOR Sub (776276-2, Natural)

No.	Name	Type	Description
1	ACC_ TXD	Outp ut	RS232C Level TXD Signal (Acc_Sensor)
2	GPI01	Input /Outp ut	Digital Signal Input1/Output1 (Logic)
3	NFC_ TXD	Outp ut	RS232C Level TXD Signal (NFC Reader)
4	GPI02	Input /Outp ut	Digital Signal Input2/Output2 (Logic)
5	GND2	Pow er	Digital Ground
6	ACC_ RXD	Input	RS232C Level RXD Signal (Acc_Sensor)
7	GPI03	Input /Outp ut	Digital Signal Input3/Output3 (Logic)
8	NFC_ RXD	Input	RS232C Level RXD Signal (NFC Reader)

Status Indicator LED

DTM-02L indicates the status of the terminal with LEDs.

There are four LEDs which indicate the status of the terminal with colors as shown in the table below.



No.	Display Info	Color	Status	Detailed Status	Description
1	POWER	Red	Power status	Off	Power off
				On	Power on
2	BT	Green	BT communication status	Off	BT disconnected
				On	BT connected
				Blinking	BT data transmission in progress
3	COMM	Yellow	Communication status	Off	LTE disconnected
				On	LTE connected
				Blinking	LTE data transmission
4	GPS	Red	GPS connection status	Off	GPS disconnected
				On	GPS connected

Using the Product

A. User Registration

You must perform user registration in order to use the product.

To register a user, visit the dealer from which the product was purchased or go to https://lin-q.doosan-iv.com.

For more details, refer to the Lin-Q user manual.

B. Activating LTE Mode

The product comes with an ESIM (chip setting SIM card) installed and activated.

Electronic Controlled Diesel Engines (DI DM02VA, DM02P)

No.	SPN	Description
1	0	Timeout Error Of CAN
2	27	EGR Valve
3	29	Accel Pedal
4	51	Throttle Valve
5	91	Accel Pedal
6	97	Water In Fuel
8	100	Engine Oil Pressure Sensor
9	102	Intake Manifold Pressure Sensor
10	105	Intake Manifold Temperature Sensor
11	108	Atmospheric Pressure Sensor
12	110	Coolant Temperature Sensor
13	132	Intake Manifold Pressure Sensor
14	157	Pressure Relief Valve (PRV)
15	171	Environment Temperature Sensor
16	172	Inlet Air Temperature Sensor
17	173	Doc Exothermal Efficiency Fault
18	174	Fuel Temperature Sensor
20	177	Transmission Oil Temperature High
21	190	Engine Over Speed Detection
22	444	Battery Voltage High
23	626	Starter Switch Stuck
24	636	Crank Signal Disturbed
25	637	Cam Signal Drift
26	639	CAN Communication Error
27	651	Injector High Low Side Short Circuit Fault
28	652	Injector Code (IQA) Program Missing Fault
29	653	Injector High Low Side Short Circuit Fault
30	654	Injector Code (IQA) Program Missing Fault
31	676	Glowplug Relay Driver Open Circuit Fault
32	729	Glowplug Relay
33	970	Engine Shut Off Request Through CAN
34	975	PWM FAN Output Open Circuit
36	1076	Rail Pressure Too Low For Injection
38	1207	ECU Temperature Sensor Low Fault
39	1382	Fuel Filter Pressure Sensor
40	1485	ECU Main Relay

No.	SPN	Description
42	1612	Injector
43	1639	Fan Speed too High Fault
44	1761	DEF Tank Level Sensor
45	1867	ECU Over Temperature For SCR Monitoring
46	2789	Turbine Inlet Temperature
47	2791	EGR H-Bridge Driver
48	3031	DEF Tank Temperature Sensor
49	3216	Upstream Nox Sensor
50	3217	Upstream Nox Sensor
51	3219	Upstream Nox Sensor
52	3224	Upstream Nox Sensor
53	3226	Downstream Nox Sensor
54	3227	Downstream Nox Sensor
55	3229	Downstream Nox Sensor
56	3234	Downstream Nox Sensor
57	3236	EGR Rate Slow Response Positive Error
58	3242	DPF (SCRF) Inlet Temperature Sensor
59	3251	DPF Differential Pressure Sensor
60	3360	DEF Pressure Line Heater Error
61	3361	DEF Dosing Valve Actuator
62	3363	DEF Tank Heating Coolant Valve
63	3509	ECU Sensor Supply 1
64	3510	ECU Sensor Supply
65	3511	ECU Sensor Supply 3
66	3516	DEF Quality Failure (Tampering)
67	3517	DEF Tank Level is Empty
68	3520	Def Quality Sensor
69	3532	DEF Level Sensor
70	3532	DEF Level Sensor
71	3695	DPF Regeneration Inhibit Switch
72	3696	DPF Regeneration Switch
74	3715	DPF Regeneration Failure
75	3720	DPF Ash Loading High
76	4082	Fuel Metering Unit
77	4335	DEF Underpressure Error
78	4344	DEF Backflow Line
79	4354	DEF Pressure Line Heater
80	4355	DEF Backflow Line Heater
81	4356	DEF Suction Line Heater
82	4364	SCR Efficiency too Low Fault

No.	SPN	Description
83	4365	DEF Temperature Sensor
84	4374	DEF Supply Pump Motor
85	4781	DPF Soot Mass too High Status (> 120%)
88	5313	Rail Pressure Sensor
89	5419	Throttle Valve
90	5435	DEF Pressure Check Error
91	5436	DEF Reverting Valve
92	5491	DEF Pressure Line Heater
93	5571	Common Rail Pressure Relief Valve
94	5629	DPF Differential Pressure
95	5706	DEF Supply Module Heater
96	5965	DPF System Main relay
98	6385	Timeout Error of CAN
99	6875	DEF Supply Pump Pressure Sensor
102	7069	DEF Backflow Line Heater Relay
103	7069	DEF Backflow Line Heater
104	7107	DEF Supply Module Temperature
105	7416	DEF Supply Module Heater
106	7538	DEF Supply Module Temperature
107	7540	DEF Suction Line Heater
108	7748	Starter Relay
109	7749	Starter Relay
110	8614	Injection Cut off Demand for Shut off Coordinator
111	55296	ECU EEPROM Read Error
112	55552	ECU EEPROM Write Error
113	57344	Timeout Error of CAN
114	61441	Timeout Error of CAN
115	61454	Timeout Error of CAN
116	61455	Timeout Error of CAN
117	64923	Timeout Error of CAN
118	65110	Timeout Error of CAN
119	65164	Timeout Error of CAN
120	65265	Timeout Error of CAN
121	65272	Timeout Error of CAN
122	65320	Timeout Error of CAN
123	65400	Timeout Error of CAN
124	65401	Timeout Error of CAN
125	65402	Timeout Error of CAN
126	104332	Upstream NOx sensor
127	104385	Downstream NOx sensor

No.	SPN	Description
128	520601	ECU
129	520618	ECU
130	520641	ECU
131	520642	ECU
132	520643	ECU
133	520696	ECU
134	520697	ECU
135	520698	ECU
136	520699	ECU
137	520700	ECU
138	520701	ECU
139	520702	ECU
140	520703	ECU
141	520704	ECU
142	520705	ECU
143	520706	ECU
144	520707	ECU
145	520707	ECU
146	520723	SCR Inducement Fault Level1 (EGR Block)
147	520724	SCR Inducement Fault Level2 (EGR Block)
148	520725	SCR Inducement Fault Level3 Final inducement (EGR Block)
149	520726	SCR Inducement Fault Warning (EGR Block)
150	520727	SCR Inducement Fault Level1 (Dosing Interrupt)
151	520728	SCR Inducement Fault Level2 (Dosing Interrupt)
152	520729	SCR Inducement Fault Level3 Final inducement (Dosing Interrupt)
153	520730	SCR Inducement Fault Warning (Dosing Interrupt)
154	520736	SCR Inducement Fault Level1 (Group4 – DEF Quality)
155	520737	SCR Inducement Fault Level2 (Group4 – DEF Quality)
156	520738	SCR Inducement Fault Level3 Final inducement (Group4 – DEF Quality)
157	520739	SCR Inducement Fault Warning (Group4 – DEF Quality)
158	520740	SCR Inducement Fault Level1 (Group5 – Tampering)
159	520741	SCR Inducement Fault Level2 (Group5 – Tampering)
160	520742	SCR Inducement Fault Level3 Final inducement (Group5 – Tampering)
161	520743	SCR Inducement Fault Warning (Group5 – Tampering)
162	520790	SCR inducement Repeat offense Level1
163	520791	SCR Inducement Repeat offense Level2
164	520792	SCR Inducement Repeat offense Level3 Final inducement
165	520797	MoF (Monitoring of Function) Engine speed error

Information - correlation between Symbol and message (Display)

As shown in the table below, for your information, we provide correlation between Engine fault warning strategy and LCD display.

Warning Stage	Warning Strategy				LCD Display	
	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit	Method	Message on the Display
						
Normal	Off	Off	0%	NA	NA	NA
Level 1	On	On	Reduced	Reduced	Continuous	**ENGINE MALFUNCTION CALL DOOSAN SERVICE AGENT** Engine Power Reduced!
Level 2	Blinking	On	Limp Home	Limp Home	Continuous	**ENGINE MALFUNCTION CALL DOOSAN SERVICE AGENT** Engine is in Limp Home Mode
Level 3	Blinking	On	Engine Stop	Engine Stop	Continuous	**FATAL ENGINE ERROR CALL DOOSAN SERVICE AGENT** Engine Stop Now

NCD (NOx Control Diagnosis) Inducement (Diesel Stage5 below 55kW only)

There are several interruption level points at which the Emission System indicator and engine check lamps light up or blink and the display shows a message to warn that the NOx is not being reduced due to a fault on the engine EGR valve. The lower the point, the more the system limits the engine power and speed. As shown in the table below, for your information, we provide correlation of NCD (NOx Control Diagnosis) Inducement strategy and LCD display.

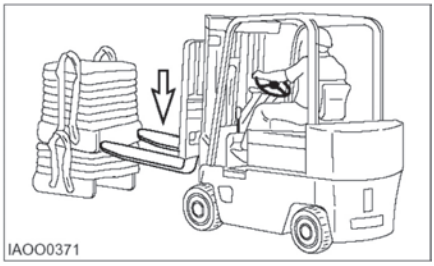
Impeded EGR and Tampering

Inducement Stage	Condition	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	Emission System Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	NA	≥ 95% of counter value for severe induce ment (100hrs)	Green ON	Off	Off	Off	0%	NA
Level1	Impeded EGR detected		Green ON	On	Off	Off	0%	NA
Level2	36~100hrs		Green ON	On	On	At starting & Every 20min	25%	NA
Level3	over 100hrs		Green ON	Blinking	Blinking	Every 10min	50%	60% (about 1500rpm)

Inducement Stage	Condition	Repeat Offence (within 40hrs)	LCD Display	
			Method	Message on the Display
				
Normal	NA	≥ 95% of counter value for severe inducement (100hrs)	NA	NA
Level1	Impeded EGR detected		At starting & Every 20min	**DPF/SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT** Engine Power will be Reduced
Level2	36~100hrs		Every 10min	**DPF/SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT** Engine Power is Reduced By 25%
Level3	over 100hrs		Continuous	**DPF/SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT** Engine Power is Reduced By 50%

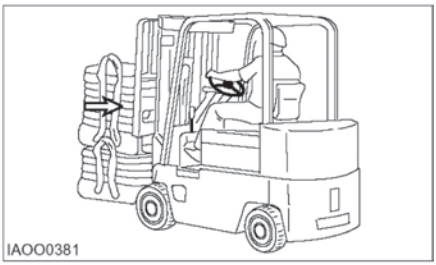
Operating Techniques

Inching into Loads



Typical Example

1. Move the lift truck slowly FORWARD into position and engage the load. The lift truck should be square with load, forks spaced evenly between pallet stringers and as far apart as load permits.

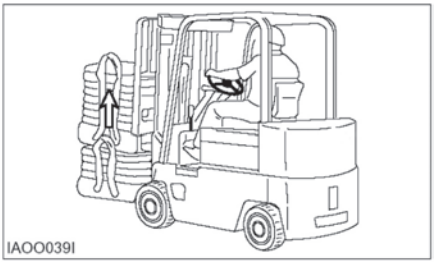


Typical Example

2. Move the lift truck FORWARD until the load touches the carriage.

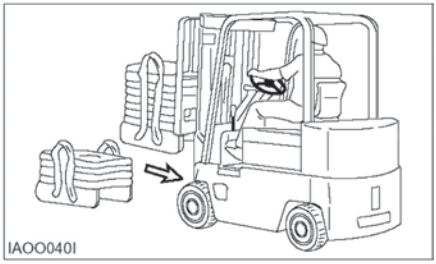
Lifting the Load

1. Lift the load carefully and tilt the mast back a short distance.



Typical Example

2. Tilt the mast further back to cradle the load.



Typical Example

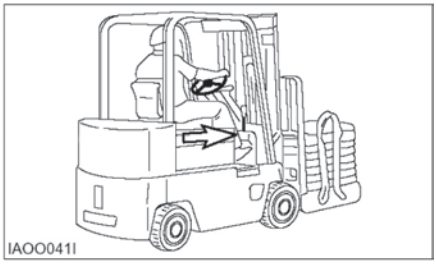
3. Operate the lift truck in reverse until the load is clear of the other material.
4. Lower the cradled load to the travel position.

NOTE: Lift and tilt speeds are controlled by engine rpm.

Traveling With the Load

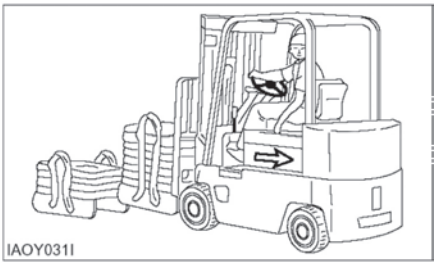
NOTICE

Travel with the load as low as possible, while still maintaining ground clearance.



Typical Example

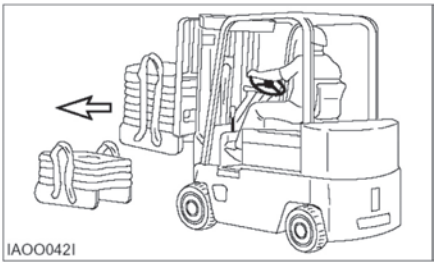
1. Travel with the load uphill on upgrades and downgrades.



Typical Example

2. For better vision, travel in reverse with bulky loads.

Unloading



Typical Example

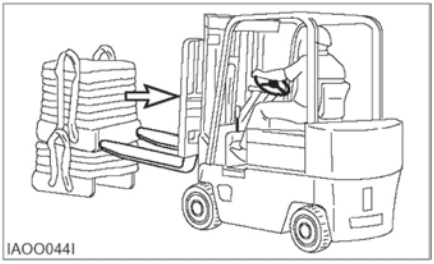
1. Move the lift truck into the unloading position.

Typical Example

2. Tilt the mast FORWARD only when directly over the unloading area.

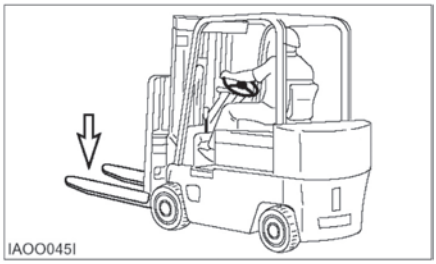
⚠ WARNING

Do not tilt the mast forward with the load unless directly over the unloading area, even if the power is off.



Typical Example

3. Deposit the load and BACK away carefully to disengage the forks.



Typical Example

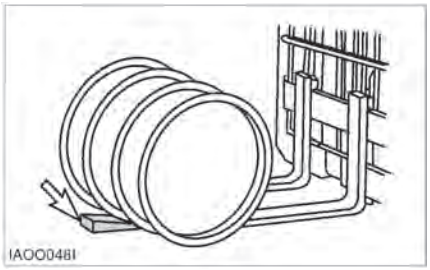
4. Lower the carriage and forks to the travel position or to the park position.

Turning

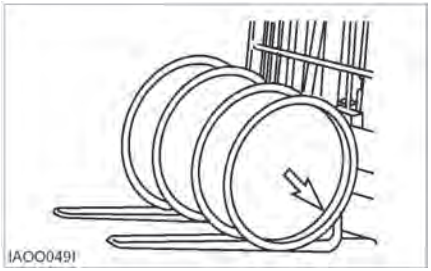
1. When turning sharp corners, keep close to the inside corner. Begin the turn when the inside drive wheel meets the corner.

2. In narrow aisles, keep away from the stockpile when turning into the aisle. Allow for counter weight swing.

Lifting Drums or Round Objects



1. Block drums or round objects. Tilt the mast FORWARD and slide the fork tips along the floor to get under the load.



2. Before lifting, tilt the mast BACK slightly until the load is cradled on the forks.

Operating in hot weather

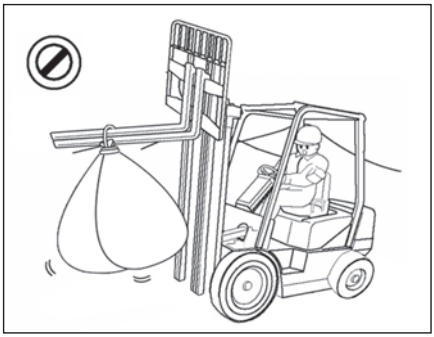
Keep the following points in mind when you operate the lift truck in hot weather.

1. Check the radiator. Clogging can cause overheating. Clean them out regularly with a blast of compressed air, also, check for leakage of water.

2. Check the fan belt tension and adjust to proper tension.

3. Even if the engine overheats and the coolant boils over, let the engine idle for a while with opening engine hood until temperature falls before shutting off the engine.

Safety instructions for attachments when transporting suspended load



⚠ WARNING

Swinging/Wide loads and a reduced residual capacity can result in accidents

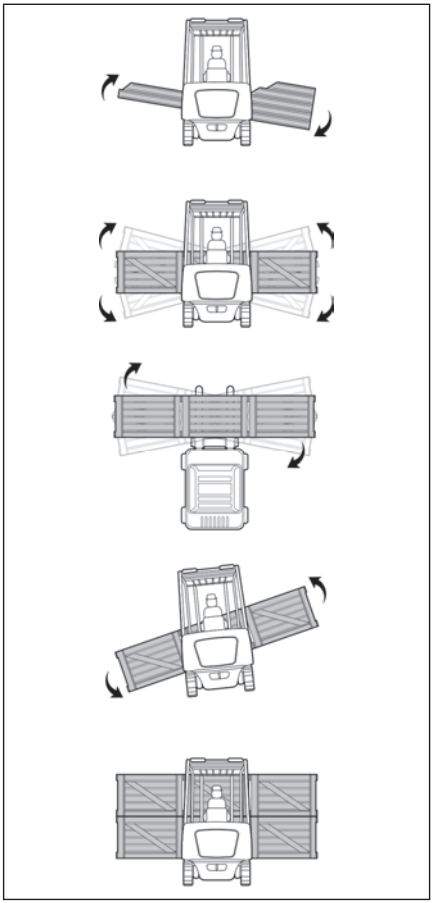
Adapt the travel speed to the load, less than walking pace.

Secure swinging loads for example with lifting slings.

Reduce the residual capacity and have it certified by an expert.

Failure to follow the operation precautions may cause early damage to parts.

Safety instructions for attachments when transporting wide loads



Load lateral center of gravity
Where it is necessary to lift a wide load where the lateral load center of gravity is unknown.
Do a test lift first to determine lateral center of gravity and potential movement with the load during transport. Exercise extra caution when handling off-center loads that cannot be centered.

Load Stability
Be careful when stopping or changing direction suddenly, lifting or lowering suddenly as wide loads could become unstable.

Load Swing
Be careful whilst travelling or turning, the load ends will swing wide. Make sure you have adequate clearance, and watch out for people in the area.

Load Shift
Be careful when turning, turn slowly to prevent load from shifting.

Visibility
When carrying a bulky load which blocks or restricts forward visibility the truck shall be driven with the load trailing and if necessary, under the direction of a person who has visibility in the direction of travel, unless safe work practices allow otherwise.

Parking the Lift Truck

NOTE: Park the lift truck level with the fork lowered and the mast tilted forward until the fork touches the floor. Block the drive wheels when parking on an incline.

1. Park in an authorized area only. Do not block traffic. If LP equipped, do not park near elevator shafts or any other area where LP could collect in a pocket (low area), causing a potentially dangerous condition.

2. Place the transmission controls in NEUTRAL.

3. Engage the parking brake.

4. Tilt the mast forward and lower the fork to the ground.

⚠ WARNING

Blocking the wheels will prevent unexpected lift truck movement, which could cause personal injury.

5. Turn the key in the ignition switch to the OFF position and remove the key.

6. Turn the disconnect switch to OFF (if equipped). **Do operate the disconnecting switch after 30 seconds from start key-off.**

Otherwise Engine Control Unit (ECU) can be damaged.

7. Actuate each loading lever several times to remove the residual pressure in the respective cylinders and hoses.

Parking Brake Alarm

⚠ WARNING

When leaving machine apply parking brake! Parking brake is not automatically applied. Alarm will sound if parking brake is not applied.

Lift Fork Adjustment

⚠ WARNING

When adjusting the fork spread, be careful not to pinch your hand between forks and the carriage slot.

Hook-on type Fork

1. Move up the hook pin to the free position.
2. Raise the hook pin in each fork to side the fork on the carriage bar.
3. Adjust the forks in the position most appropriate for the load and as wide as possible for load stability.
4. When adjusting the forks, make sure that the weight of the load is centered on the truck.
5. After adjustment, set the fork locks to keep the forks in place.

⚠ WARNING

Make sure the forks are locked before carrying a load.

If the fork/locking pin is not fully engaged, the fork could become unintentionally disengaged.

Storage Information

Before Storage

Before storing your lift truck, clean and inspect as the following procedures.

- **Wipe away grease, oil, etc. adhering to the body of the truck with waste cloth, and use water, if needed.**
- **While cleaning the truck, check general condition of the truck. Especially check the truck body for dents or damage and tires for wear or nails or stones in the tread.**
- **Fill the fuel tank with fuel specified.**
- **Check for leakage of hydraulic oil, engine oil, fuel, or coolant, etc.**
- **Apply grease, where needed.**
- **Check for looseness of nuts and bolts, especially hub nuts.**
- **Check mast rollers to see that they rotate smoothly.**
- **Prime the oil into the lift cylinders by actuating the lift lever all the way several times.**
- **Drain off coolant completely in cold weather, if antifreeze is not used.**

Long Time Storage

Perform the following service and checks in addition to the “Parking the lift truck” services.

- **Taking the rainy season into consideration, park the machine at a higher and hard ground.**
- **Avoid parking on soft grounds such as an asphalt ground in summer.**
- **Dismount the battery from the machine. Even though the machine is parked indoors, if the place is hot or humid, the battery should be kept in a dry, cool place. Charge the battery once a month.**
- **Apply antirust to the exposed parts which tend to rust.**
- **Cover components such as the breather and air cleaner which may be caught with humidity.**
- **The machine should be operated at least once a week. Fill the cooling system, if cooling water is discharged, and mount the battery. Start the engine and warm up thoroughly. Move the machine a little forwards and backwards. Operate the hydraulic controls several times.**

To Operate the Lift Truck after a Long Time Storage

- **Remove covers and antirust from each of the components and exposed parts.**
- **Drain the engine crankcase, transmission (clutch type machine), differential and final reduction gear, clean the inside of them and add new oil.**
- **Drain off foreign matter and water from the hydraulic oil tank and fuel tank.**
- **Remove the head cover from the engine cylinder. Oil valves and rocker shaft and check each valve for proper operation.**
- **Add cooling water to the specified level.**
- **Charge the battery and mount it on the machine. Connect the cables.**
- **Perform pre - operational checks carefully. (refer to “Before Starting the Engine”)**
- **Warm up the machine.**

Transportation Hints

Lift Truck Shipping

Check travel route for overpass clearances. Make sure there is adequate clearance if the lift truck being transported is equipped with a high mast, overhead guard or cab.

To prevent the lift truck from slipping while loading, or shifting in transit, remove ice, snow or other slippery material from the loading dock and the truck bed before loading.

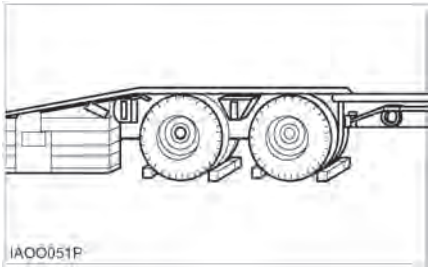
NOTICE

Obey all state and local laws governing the height, weight, width and length of a load.

Observe all regulations governing wide loads.

NOTICE

Remove ice, snow or other slippery material from the shipping vehicle and the loading dock.



Always block the trailer or the rail car wheels before loading the lift truck.

Position the lift truck on the truck bed or the rail car.

Apply the parking brake and place the transmission control in NEUTRAL.

Tilt the mast forward and lower forks to the floor.

Turn the ignition switch to the OFF position and remove the key. If LP equipped, shut off the LP fuel tank.

Block the wheels and secure the lift truck with tiedowns.

Machine Lifting and Tiedown Information

NOTICE

Improper lifting or tiedowns can allow load to shift and cause injury and/or damage.

1. Weight and instructions given herein apply to lift trucks as manufactured by DOOSAN.
2. Use proper rated cables and slings for lifting. Position the crane for level lift truck lift.
3. Spreader bar widths should be sufficient to prevent contact with the lift truck.
4. Use the tiedown locations provided for lift truck tiedown.

Check the state and local laws governing weight, width and length of a load.

Contact your DOOSAN Lift Truck dealer for shipping instructions for your lift truck.

Lifting a Forklift using a Crane

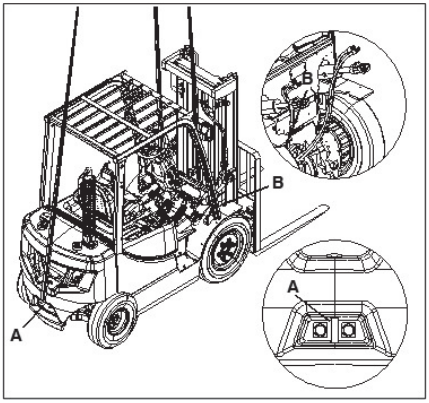
⚠ WARNING

1. **If lifting rope breaks, serious injury/damage may occur.**
2. **The lifting wire rope and stay must be long enough to avoid contact with the forklift. Short rope/stay can damage the vehicle. If it's too long, it may cause interference.**

   If sling and LP tank contact happens during refloatation operation, you should get rid of tank of vehicle with LP tank first, and then proceed.

   Cover the rope/chain with rubber or cloth to prevent damage to the vehicle, as necessary.
3. **Rope/chain and other lifting tools must have sufficient strength, and free of any defect or wear.**
4. **Avoid impact load to the lifting devices/tools.**

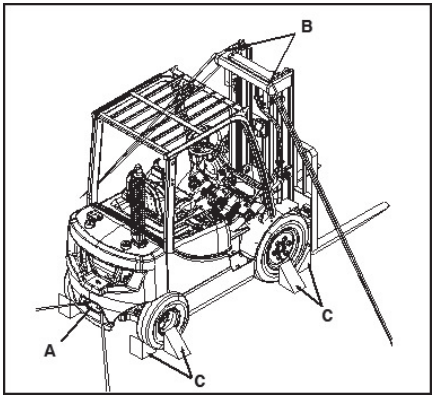
1. Check the weight, length, width and height of the vehicle before lifting.
2. Park the crane at an appropriate position.
3. Connect the rope/chain to the points A and B of the figure below.
4. If the wire rope/chain contacts the vehicle, insert a rubber plate between the rope/chain and the vehicle to protect the vehicle.

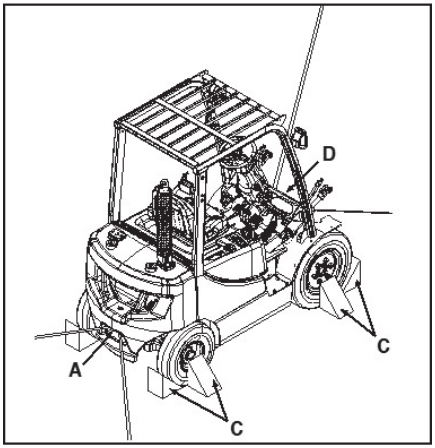


5. Lift up the vehicle slowly.

How to Fix Forklift to a Carrier

1. The rope/chain must have sufficient length for fixing.
2. Park the vehicle on a level ground.
3. Set the mast vertically. Lower the fork or attachment to the lowest position.
4. Set all the operating devices to Neutral Position. Turn OFF the start switch.
5. Apply the parking brake. Stop the tires with blocks (C).
6. Connect towing hooks to the mast top B (if without mast, front drive axle fix frame or front fender bottom fixing hole D) and rear tow pin A, as shown in the figure below.





Towing Information

⚠ WARNING

Personal injury or death could result when towing a disabled lift truck incorrectly.

Block the lift truck wheels to prevent movement before releasing the brakes. The lift truck can roll free if it is not blocked.

Follow the recommendations below, to properly perform the towing procedure.

These towing instructions are for moving a disabled lift truck a short distance, at low speed, no faster than 2 km/h (1.2 mph), to a convenient location for repair. These instructions are for emergencies only. Always haul the lift truck if long distance moving is required.

Shield must be provided on the towing lift truck to protect the operator if the tow line or bar should break.

Do not allow riders on the lift truck being towed unless the operator can control the steering and/or braking.

Before towing, make sure the tow line or bar is in good condition and has enough strength for the towing situation involved. Use a towing line or bar with a strength of at least 1.5 times the gross weight of the towing lift truck for a disabled lift truck stuck in the mud or when towing on a grade.

Keep the tow line angle to a minimum. Do not exceed a 30°angle from the straight ahead position. Connect the tow line as low as possible on the lift truck that is being towed.

Quick lift truck movement could overload the tow line or bar and cause it to break. Gradual and smooth lift truck movement will work better.

Normally, the towing lift truck should be as large as the disabled lift truck. Satisfy yourself that the towing lift truck has enough brake capacity, weight and power, to control both lift trucks for the grade and the distance involved.

To provide sufficient control and braking when moving a disabled lift truck downhill, a larger towing lift truck or additional lift trucks connected to the rear could be required. This will prevent uncontrolled rolling.

The different situation requirements cannot be given, as minimal towing lift truck capacity is required on smooth level surfaces to maximum on inclines or poor surface conditions.

Consult your DOOSAN Lift Tuck dealer for towing a disabled lift truck.

1. Release the parking brake. (EPB Switch).

See the next page for how to release Electronic Parking Brake.

NOTICE

Release the parking brake to prevent excessive wear and damage to the parking brake system.

2. Check that the service brake pedal is released.
3. When the key is turned off, the parking brake operates automatically.
4. Direction control lever is in neutral.
5. Fasten the tow bar to the lift truck.
6. Remove the wheel blocks. Tow the lift truck slowly. Do not tow any faster than 2 km/h (1.2 mph).

⚠ WARNING

Be sure all necessary repairs and adjustments have been made before a lift truck that has been towed to a service area is put back into operation.

How to Release the Electronic Parking Brake

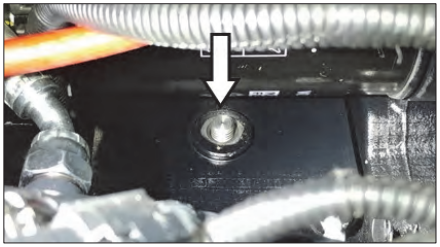
NOTICE

In the case of the electronic parking brake, it always stays engaged when the ignition is off, regardless of where the parking switch is positioned.

Before towing the vehicle, therefore, you have to release the parking brake by force to prevent excessive wear and damage on the park brake components or tyres.

How to Release by Force

1. Secure the wheels with blocks.
2. Fasten M12 x 1.75 nut to the parking brake spool under the transmission oil filter.



3. By using a spanner, fully tighten the NUT by rotating it clockwise until the parking brake spool does no longer rise.
4. Connect a tow bar to the forklift.
5. Take out the supporting blocks and tow the forklift slowly. Keep the towing speed no higher than 2 km/h.
   (If the wheels remain secured, repeat step 3.)

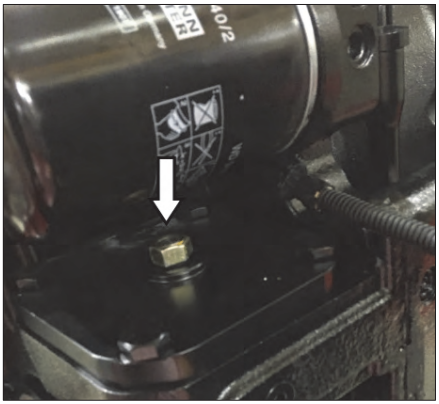
⚠ WARNING

Be sure all necessary repairs and adjustments have been made before a lift truck that has been towed to a service area is put back into operation.

NOTE: On the completion of towing the forklift, you must return the emergency-release spool to its original position; otherwise, both the service and parking brakes do not work.

How to Return the Electronic Parking Brake

1. Secure the wheels with blocks.
2. By using a spanner, fully remove the nut installed on the parking brake spool under the transmission oil filter.



3. After starting up the forklift, take out its supporting blocks and check that the parking brake works normally and the parking brake secures the forklift when on a slope.

Inspection, Maintenance and Repair of Lift Truck Forks

The following section gives practical guidelines for inspection, maintenance and repair of lift truck forks. It also provides general information on the design and application of forks and the common cause of fork failures.

Lift truck forks can be dangerously weakened by improper repair or modification. They can also be damaged by the cumulative effects of age, abrasion, corrosion, overloading and misuse.

A fork failure during use can cause damage to the equipment and the load. A fork failure can also cause serious injury.

A good fork inspection and maintenance program along with the proper application can be very effective in preventing sudden failures on the job.

Repairs and modifications should be done only by the fork manufacturer or a qualified technician who knows the material used and the required welding and heat treatment process.

Users should evaluate the economics of returning the forks to the manufacturer for repairs or purchasing new forks. This will vary depending on many factors including the size and type of fork.

Forks should be properly sized to the weight and length of the loads, and to the size of the machine on which they are used. The general practice is to use a fork size such that the combined rated capacity of the number of forks used is equal to or greater than the “Standard (or rated) Capacity” of the lift truck.

The individual load rating, in most cases, will be stamped on the fork in a readily visible area. This is generally on the top or side of the fork shank.

• A fork rated at 1500 pounds at 24inch load center will be stamped 1500x24.

• A fork rated at 2000 kg at 600 mm load center will be stamped 2000x600.

The manufacturer identification and year and date of manufacture are also usually shown.

Some countries have standards or regulations which apply specifically to the inspection and repair of forks.

Users may also refer to the International Organization for Standardization-ISO Technical Report 5057- Inspection and Repair of Fork Arms and ISO Standard 2330 - Fork Arms - Technical Characteristics and Testing.

While there are no specific standards or regulations in the United States, users should be familiar with the requirements for inspection and maintenance of lift trucks as provided by the 29 Code Federal Register 1910.178 Powered Industrial Truck, and ANSI/ASME Safety Standard(s) B56.1 as applicable to the type of machine(s) in use.

Environment Protection

When servicing this lift truck, use an authorized servicing area and an approved container to collect coolant, oil, fuel, grease, electrolyte and any other potential environmental pollutant before any lines, fittings or related items are disconnected or removed. After servicing, dispose of those materials in an authorized place and container. When cleaning the lift truck, be sure to use an authorized area.

Causes of Fork Failure

Improper Modification or Repair

Fork failure can occur as a result of a field modification involving welding, flame cutting or other similar processes which affect the heat treatment and reduces the strength of the fork.

In most cases, specific processes and techniques are also required to achieve proper welding of the particular alloy steels involved. Critical areas most likely to be affected by improper processing are the heel section, the mounting components and the fork tip.

Bent or Twisted Forks

Forks can be bent out of shape by extreme overloading, glancing blows against walls or other solid objects or using the fork tip as a pry bar.

Bent or twisted forks are much more likely to break and cause damage or injury. They should be removed from service immediately.

Fatigue

Parts which are subjected to repeated or fluctuating loads can fail after a large number of loading cycles even though the maximum stress was below the static strength of the part.

The first sign of a fatigue failure is usually a crack which starts in an area of high stress concentration. This is usually in the heel section or on the fork mounting.

As the crack progresses under repetitive load cycling, the load bearing cross section of the remaining metal is decreased in size until it becomes insufficient to support the load and complete failure occurs.

Fatigue failure is the most common mode of fork failure. It is also one which can be anticipated and prevented by recognizing the conditions which lead up to the failure and by removing the fork service prior to failing.

Repetitive Overloading

Repetitive cycling of loads which exceeds the fatigue strength of the material can lead to fatigue failure. The overload could be caused by loads in excess of the rated fork capacity and by use of the forks tips as pry bars. Also, by handling loads in a manner which causes the fork tips to spread and the forks to twist laterally about their mountings.

Wear

Forks are constantly subjected to abrasion as they slide on floors and loads. The thickness of the fork blade is gradually reduced to the point where it may not be capable of handling the load for which it was designed.

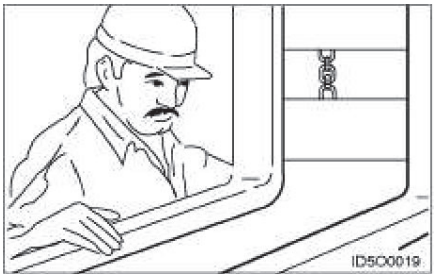
Stress Risers

Scratches, nicks and corrosion are points of high stress concentration where cracks can develop. These cracks can progress under repetitive loading in a typical mode of fatigue failure.

Overloading

Extreme overloading can cause permanent bending or immediate failure of the forks. Using forks of less capacity than the load or lift truck when lifting loads and using forks in a manner for which they were not designed are some common causes of overloading.

Fork Inspection



Establish a daily and 12month inspection routine by keeping a record for the forks on each lift truck.

Initial information should include the machine serial number on each the forks are used, the fork manufacturer, type, original section size, original length and capacity. Also list any special characteristics specified in the fork design.

Record the date and results of each inspection, making sure the following information is included.

- **Actual wear conditions, such as percent of original blade thickness remaining.**
- **Any damage, failure or deformation which might impair the use of the truck.**
- **Note any repairs or maintenance.**

An ongoing record of this information will help in identifying proper inspection intervals for each operation, in identifying and solving problem areas and in anticipating time for replacement of the forks.

First Installation

1. Inspect forks to ensure they are the correct size for the truck on which they will be used. Make sure they are the correct length and type for the loads to be handled.

If the forks have been previously used, perform the “12 Month Inspection”.

If the forks are rusted, see “Maintenance and Repair”.

2. Make sure fork blades are level to each other within acceptable tolerances. See “Forks, Step 4,” in the “2000 Service Hours or Yearly” in “Maintenance Intervals”
3. Make sure positioning lock is in place and working Lock forks in position before using truck. See “Forks, Step 7”, in the “2000 Service Hours or Yearly” in “Maintenance Intervals”.

Daily Inspection

1. Visually inspect forks for cracks, especially in the heel section, around the mounting brackets, and all weld areas. Inspect for broken or jagged fork tips, bent or twisted blades and shanks.
2. Make sure positioning lock is in place and working. Lock the forks in position before using the truck. See “2000 Service Hours or Yearly” in “Maintenance Intervals”.
3. Remove all defective forks from service.

12 Months Inspection

Forks should be inspected, at a minimum, every 12 months. If the truck is being used in a multi-shift or heavy duty operation, they should be checked every six months. See “Forks” in the “2000 Service Hours or Yearly” in “Maintenance Intervals.”

Maintenance and Repair

1. Repair forks only in accordance with the manufacturer’s recommendations.

Most repairs or modifications should be done only by the original manufacturer of the forks or an expert knowledgeable of the materials, design, welding and heat treatment process.

2. The following repairs or modifications SHOULD NOT be attempted.

- Flame cutting holes or cutouts in fork blades.
- Welding on brackets or new mounting hangers.
- Repairing cracks or other damage by welding.
- Bending or resetting.

3. The following repairs MAY be performed.

- Forks may be sanded or lightly ground, to remove rust, corrosion or minor defects from the surfaces.
- Heel sections may be ground with a carbon stone to remove minor surface cracks or defects. Polish the inside radius of the heel section to increase the fatigue life of the fork. Always grind or polish in the direction of the blade and shank length.
- Repair or replace the positioning locks on hook type forks.
- Repair or replace most fork retention devices used with other fork types.

4. A fork should be load tested before being returned to service on completion of repairs authorized and done in accordance with the manufacturer’s recommendations.

Most manufacturers and standards require the repaired fork to be tested with a load 2.5 times the specified capacity and at the load center marked on the fork arm.

With the fork restrained in the same manner as its mounting on the lift truck, apply the test load twice, gradually and without shock. Maintain the test for 30 seconds each time.

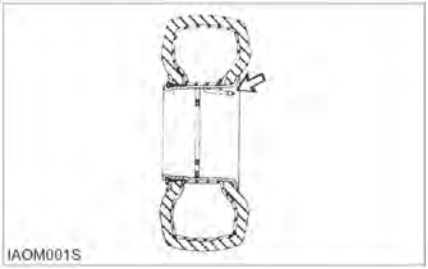
Check the fork arm before and after the second application of the test load. It shall not show any permanent deformation.

Consult the fork manufacturer for further information as may be applicable to the specific fork involved.

Testing is not required for repairs to the positioning lock or the markings.

Tire Inflation Information

Tire Inflation



⚠ WARNING

Personal injury or death could result when tires are inflated incorrectly.

Use a self - attaching inflation chuck and stand behind the tread when inflating a tire.

Proper inflation equipment and training in using the equipment are necessary to avoid over-inflation. A tire blowout or rim failure can result from improper or misused equipment.

NOTICE

Set the tire inflation equipment regulator at no more than 140 kPa (20 psi) over the recommended tire pressure.

Tire Shipping Pressure

The tire inflation pressures shown in the following chart are cold inflation shipping pressures.

Size	Ply Rating or Strength Index	Shipping Pressure	
		kPa	psi
6.5X10	10	790	115
6.5X10	12	885	130
7.0X15	12	825	120
28X9-15	12	825	120
250X15	18	885	130

[1] Standard tire, ply rating and inflation pressures.

The operating inflation pressure is based on the weight of a ready - to - work machine without attachments, at rated payload, and in average operating conditions. Pressures for each application may vary and should always be obtained from your tire supplier.

NOTE: Fill tires to the recommended pressures listed ± 35 kPa (5 psi). Tires can be filled with nitrogen.

Tire Inflation Pressures Adjustment

Tire inflation in a warm shop area, 18° to 21°C (65° to 70°F), will be underinflated if the machine works in freezing temperatures. Low pressure shortens the life of a tire.

Torque Specifications

Metric Hardware

Most of the nuts, bolts, studs, and threaded holes in your lift truck are metric. In this manual we provide specifications in both metric and U.S. customary measurement. Always replace metric hardware with metric hardware. See the parts books for proper replacement.

NOTE: For proper fit, use only metric tools on metric hardware. Non-metric tools might slip and cause injury.

Torque for Standard Hose Clamps - Worm Drive

NOTICE

The chart below gives the torques for initial installation of hose clamps on new hose and for reassembly or retightening of hose clamps on existing hose.

Clamp Width	Initial Installation Torque On New Hose	
	N·m[1]	lb·in
16 mm (.625 in)	7.5 ± 0.5	65 ± 5
13.5 mm (.531 in)	4.5 ± 0.5	40 ± 5
8 mm (.312 in)	0.9 ± 0.2	8 ± 2
Clamp Width	**Reassembly or Retightening Torque On Existing Hose**	
	N·m[1]	**lb·in**
16 mm (.625 in)	4.5 ± 0.5	40 ± 5
13.5 mm (.531 in)	3.0 ± 0.5	25 ± 5
8 mm (.312 in)	0.7 ± 0.2	6 ± 2

[1]1 Newton meter (N·m) is approximately the same as 0.1 kg·m.

Torque for Standard Bolts, Nuts, and Taperlock Studs

NOTICE

The two charts below give general torques for bolts, nuts, and taperlock studs of SAE Grade 5 or better quality.

Torques for Bolts and Nuts with Standard Threads

Thread Size Inch	Standard Nut and Bolt Torque	
	N·m	lb·ft
1/4	12 ± 4	9 ± 3
5/16	25 ± 7	18 ± 5
3/8	45 ± 7	33 ± 5
7/16	70 ± 15	50 ± 11
1/2	100 ± 15	75 ± 11
9/16	150 ± 20	110 ± 15
5/8	200 ± 25	150 ± 18
3/4	360 ± 50	270 ± 37
7/8	570 ± 80	420 ± 60
1	875 ± 100	640 ± 75
1 1/8	1100 ± 150	820 ± 110
1 1/4	1350 ± 175	1000 ± 130
1 3/8	1600 ± 200	1180 ± 150
1 1/2	2000 ± 275	1480 ± 200

[1]1 Newton meter (N·m) is approximately the same as 0.1 kg ·m.

Torques for Taperlock Studs

Thread Size Inch	Standard Taperlock Stud Torque	
	N·m[1]	lb·ft
1/4	8 ± 3	6 ± 2
5/16	17 ± 5	13 ± 4
3/8	35 ± 5	26 ± 4
7/16	45 ± 10	33 ± 7
1/2	65 ± 10	48 ± 7
5/8	110 ± 20	80 ± 15
3/4	170 ± 30	125 ± 22
7/8	260 ± 40	190 ± 30
1	400 ± 60	300 ± 45
1/8	500 ± 700	370 ± 50
1/4	650 ± 80	480 ± 60
3/8	750 ± 90	550 ± 65
1/2	870 ± 100	640 ± 75

[1]1 Newton meter (N·m) is approximately the same as 0.1 kg·m.

Torque for Metric Fasteners

NOTICE

Be very careful never to mix metric with U.S. customary (standard) fasteners. Mismatched or incorrect fasteners will cause lift truck damage or malfunction and may even result in personal injury.

Original fasteners removed from the lift truck should be checked for any damages and kept for reassembly whenever possible. If new fasteners are needed, they must be of the same size and grade as the ones that are being replaced.

The material strength identification is usually shown on the bolt head by numbers (8.8, 10.9, etc.). This chart gives standard torques for bolts and nuts with Grade 8.8.

For mounting torques of main parts, Please refer to Service manual for detail.

NOTE: Metric hardware must be replaced with metric hardware. Check parts book.

Thread Size Metric	Standard Torque	
	N·m[1]	lb·ft
M6	12 ± 4	9 ± 3
M8	25 ± 7	18 ± 5
M10	55 ± 10	41 ± 7
M12	95 ± 15	70 ± 11
M14	150 ± 20	110 ± 15
M16	220 ± 30	160 ± 22
M20	450 ± 70	330 ± 50
M24	775 ± 100	570 ± 75
M30	1600 ± 200	1180 ± 150
M36	2700 ± 400	2000 ± 300

[1]1 Newton meter (1 N·m) is approximately the same as 0.1 kg·m.

[2]ISO - International Standards organization.

Cooling System Specifications

Coolant Information

NOTE: The following information is generic and valid for lift trucks.

Engine operating temperatures have increased to improve engine efficiency. This means proper cooling system maintenance is especially important. Overheating, overcooling, pitting, cavitation erosion, cracked heads, piston seizures, and plugged radiators are classic cooling system failures. In fact, coolant is as important as the quality of fuel and lubricating oil.

NOTICE

DOOSAN recommends that the coolant mixture contain 50% commercially available automotive antifreeze, and 50% water.

The coolant mix with concentration of antifreeze smaller than 30% does not provide sufficient corrosion protection. Concentrations over 60% adversely affect freeze protection and heat transfer rates.

Never add coolant to an overheated engine, engine damage can result. Allow the engine to cool first.

If the machine is to be stored in, or shipped to, an area with freezing temperatures, the cooling system must be protected to the lowest expected outside (ambient) temperature.

The engine cooling system is normally protected to -28°C (-20°F) with antifreeze, when shipped from the factory unless special requirements are defined.

Check the specific gravity of the coolant solution frequently in cold weather to ensure adequate protection.

Clean the cooling system if it is contaminated, the engine overheats or foaming is observed in the radiator.

Old coolant should be drained, the system cleaned and new coolant added every 2000 service hours or yearly.

Refer to topic, “Cooling System - Clean, Change” in Every 2000 Service Hours or Yearly section.

Filling at over 20 liters (5 U.S. gallons) per minute can cause air pockets in the cooling system.

After draining and refilling the cooling system, operate the engine with the radiator cap removed until the coolant reaches normal operating temperature and the coolant level stabilizes. Add coolant as necessary to fill the system to the proper level.

Never operate without a thermostat in the cooling system. Cooling system problems can arise without a thermostat.

Coolant Water

Hard water, or water with high levels of calcium and magnesium ions, encourages the formation of insoluble chemical compounds by combining with cooling system additives such as silicates and phosphates.

The tendency of silicates and phosphates to precipitate out-of-solution increases with increasing water hardness. Hard water or water with high levels of calcium and magnesium ions encourages the formation of insoluble chemicals, especially after a number of heating and cooling cycles.

DOOSAN prefers the use of distilled water or deionized water to reduce the potential and severity of chemical insolubility.

Acceptable Water	
Water Content	**Limits (PPM)**
Chlorides (Cl)	50 maximum
Sulfates (SO_4)	50 maximum
Total hardness	80mg/l
Total solids	250 maximum
PH	6.0 to 8.0

ppm = parts per million

Using water that meets the minimum acceptable water requirement may not prevent drop-out of these chemical compounds totally, but should minimize the rate to acceptable levels.

Antifreeze

NOTICE

DOOSAN recommends using automotive antifreeze suitable for gasoline engines having aluminum alloy parts. Antifreeze of poor quality will cause corrosion of the cooling system, and thus always use automotive antifreeze prepared by a reliable maker, and never use it mixed with antifreeze of different brand.

DOOSAN recommends that the coolant mix contain 50% commercially available automotive antifreeze, or equivalent and acceptable water to maintain and adequate water pump cavitation temperature for efficient water pump performance.

Premix coolant solution to provide protection to the lowest expected outside (ambient) temperature. Pure undiluted antifreeze will freeze at -23℃ (-10℉).

Use a greater concentration (above 50%) of commercially available automotive antifreeze only as needed for anticipated outside (ambient) temperatures. Do not exceed the recommendations, provided with the commercially available automotive antifreezes, regarding the coolant mixture of antifreeze to water.

Make proper antifreeze additions.

Adding pure antifreeze as a makeup solution for cooling system top-up is an unacceptable practice. It increases the concentration of antifreeze in the cooling system which increases the concentration of dissolved solids and undissolved chemical inhibitors in the cooling system. Add antifreeze mixed with water to the same freeze protection as your cooling system.

Use the chart below to assist in determining the concentration of antifreeze to use.

Antifreeze Concentrations	
Protection Temperature	**Concentrations**
Protection to -15°C (5°F)	30% antifreeze and 70% water
Protection to -23°C (-10°F)	40% antifreeze and 60% water
Protection to -37°C (-34°F)	50% antifreeze and 50% water
Protection to -51°C (-60°F)	60% antifreeze and 40% water

Fuel Specifications

General Fuel Information

Use only fuel as recommended in this section.

NOTICE

Fill the fuel tank at the end of each day of operation to drive out moisture laden air and to prevent condensation. Maintain a constant level near the top of the day tank to avoid drawing moisture into the tank as the level decreases.

Do not fill the tank to the top. Fuel expands as it gets warm and can overflow.

Do not fill the fuel filters with fuel before installing them. Contaminated fuel will cause accelerated wear to the fuel system parts.

Drain the water and sediment from main fuel storage tank before it is refilled. This will help prevent water and/or sediment from being pumped from the fuel storage tank into the engine fuel tank.

Diesel Fuel Specifications

Diesel fuel should comply with the following specifications. The table lists several worldwide specifications for diesel fuels.

Diesel Fuel Specification	Location
ASTM D975 No.1D/2D	USA
EN590:96	EU
IS0 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No. 2	Japan
KSM-2610	Korea
GB252	China

Additional Technical Fuel Requirements

- **The fuel cetane number should be equal to 45 or higher.**
- **The sulfur content must not exceed 0.5% by volume. Less than 0.05% is preferred.**
- **For electronically controlled engines, for example 4TNV98-ZSDF, it is mandatory to use fuel that does not contain 0.1 % or more sulfur content.**
- **In general, using a high sulfur fuel may possible result in corrosion inside the cylinder.**
- **Especially in U.S.A. and Canada, Low Sulfur (300-500mglkg sulfur content) or Ultra Low Sulfur fuel should be used.**
- **Bio-Diesel fuels. See Bio-Diesel Fuels on next page.**
- **NEVER mix kerosene, used engine oil, or residual fuels with the diesel fuel.**
- **The water and sediment in the fuel should not exceed 0.05% by volume.**
- **Keep the fuel tank and fuel-handling equipment clean at all times.**
- **Poor quality fuel can reduce engine performance and / or cause engine damage.**
- **Fuel additives are not recommended. Some fuel additives may cause poor engine performance.**
- **Consult your Doosan representative for more information.**
- **The ash content must not exceed 0.01% by volume.**
- **The carbon residue content must not exceed 0.35% by volume. Less than 0.1 % is preferred.**
- **The total aromatics content should not exceed 35% by volume. Less than 30% is preferred.**
- **The PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.**
- **The metal content of Na, Mg, Si, and Al should be equal to or lower than 1 mass ppm.**
- **Lubricity: The wear mark of WS1.4 should be Max. 0.01 8 in (460 pm) at HFRR test.**

Bio-Diesel Fuels

In Europe and in the United States, as well as some other countries, non-mineral oil based fuel resources such as RME (Rapeseed Methyl Ester) and SOME (Soybean Methyl Ester), collectively known as FAME (Fatty Acid Methyl Esters), are being used as extenders for mineral oil derived diesel fuels.

Doosan approves the use of bio-diesel fuels that do not exceed a blend of 7% (by volume) of FAME with 93% (by volume) of approved mineral oil derived diesel fuel. Such bio-diesel fuels are known in the marketplace as B7 diesel fuels.

These B7 diesel fuels must meet certain requirements.

1. The bio-fuels must meet the minimum specifications for the country in which they are used.

- **In Europe, bio-diesel fuels must comply with the European Standard EN14214.**
- **In the United States, bio-diesel fuels must comply with the American Standard ASTM D-6751.**

2. Bio-fuels should be purchased only from recognized and authorized diesel fuel suppliers.

Precautions and concerns regarding the use of bio- fuels:

1. Free methanol in FAME may result in corrosion of aluminum and zinc FIE components.
2. Free water in FAME may result in plugging of fuel filters and increased bacterial growth.
3. High viscosity at low temperatures may result in fuel delivery problems, injection pump seizures, and poor injection nozzle spray atomization.
4. FAME may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.
5. Even bio-diesel fuels that comply with a suitable standard as delivered, will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and / or fuel storage containers, may be necessary.
6. The use of bio-diesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or biodiesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine.

HVO (Hydro treated Vegetable Oil)

HVO is a synthetic diesel which is manufactured through the hydrogenation of plants and animal fats.

To the user, HVO is reminiscent of diesel in accordance with EN590, apart from HVO having a somewhat lower density.

Doosan approves the use of up to 100% HVO for engines in accordance with the EU standard EN15940.

GTL (Gas To Liquids)

GTL is a synthetic fuel that is often refined from natural gas.

To the user, GTL is reminiscent of diesel in accordance with EN590, apart from GTL having a somewhat lower density and less odour.

Doosan approves the use of up to 100% GTL for engines in accordance with the EU standard EN15940.

Lubricant Information

Lubricant Information

Certain abbreviations follow Society of Automotive Engineers (SAE) J754 nomenclature and some classifications follow SAE J183 abbreviations.

The MIL specifications are U.S.A. Military Specifications.

The recommended oil viscosities can be found in the Lubricant Viscosities chart in this publication.

Grease is classified by the National Lubricating Grease Institute (NLGI) based on ASTM D217-68 Worked Penetration characteristics which are given a defined consistency number.

Engine Oil (DEO and EO)

The following oil specifications provide guidelines for the selection of commercial products:

• Gasoline/LP Engine: API SJ or higher

NOTE: Engine Oil Service hours can be extended to 500 hours by using Doosan supplied specific oil. Please consult Doosan dealer about it.

• Diesel Engine:

API CJ-4 for 500 hrs service interval

API CK-4 for 1000 hours service interval

NOTICE

Failure to follow the oil recommendations can cause shortened engine lift due to carbon deposits or excessive wear. Especially for DM02VA, DM02P engine, API CJ/CK-4 engine oil should be used, because of EGR, DOC and DPF performance.

Consult the EMA Lubricating Oils Data Book for a listing of oil brands.

NOTE: The percentage of sulfur in the fuel will affect the engine oil recommendations.

NOTE: For fuel sulfur effects, the Infrared Analysis or the ASTM D2896 procedure can be used to evaluate the residual neutralization properties of engine oil. The sulfur products formation depends on the fuel sulfur content, oil formulation, crankcase blow-by, engine operating conditions and ambient temperature.

Hydraulic Oil (HYDO)

The following commercial classifications can be used in the hydraulic system.

• **ISO 6743/4**	**HM**
• **AFNOR NFE 48-603**	**HM**
• **DIN 51524 TEIL 2**	**H-LP**
• **HAGGLUNDS DENISON**	**HFO-HF2**
• **CINCINNATI**	**P68,69,70**

Viscosity: ISO VG32

Industrial premium hydraulic oils that have passed the Vickers vane pump test (35VQ25).

These oils should have antiwear, antifoam, antirust and antioxidation additives for heavy duty use as stated by the oil supplier. ISO viscosity grade of 32 would normally be selected.

NOTICE

Make-up oil added to the hydraulic tanks must mix with the oil already in the systems. Use only petroleum products unless the systems are equipped for use with special products. If the hydraulic oil becomes cloudy, water or air is entering the system. Water or air in the system will cause pump failure. Drain the fluid, retighten all hydraulic suction line clamps, purge and refill the system. Consult your DOOSAN Lift Truck dealer for purging instructions.

Transmission & Drive Axle Oil

NOTE: Do not use Gear Oil in the final drives or differentials. Gear Oil can cause seal material to fail and possibly leak oil.

Failure to follow the recommendation will cause shortened life due to excessive gear wear.

NOTE: Failure to follow this recommendation can cause shortened transmission life due to material incompatibility, inadequate frictional requirements for disk materials and/or excessive gear wear.

The API CD/TO-2 specification or MIL-L-2104D, Eor F oils could be used.

NOTE: Multi-grade oils are not blended by DOOSAN for use in transmissions.

Multi-grade oils which use high molecular weight polymers as viscosity index improvers lose their viscosity effectiveness by permanent and temporary shear of the viscosity index improver and therefore, are not recommended for transmission and drive train compartments.

Lubricating Grease (MPGM)

Use Multipurpose Molybdenum Grease (MPGM) for all lubrication points. If MPGM grease cannot be used, multipurpose type grease which contains 3% to 5% molybdenum disulfide can be used.

NLGI No.2 grade is suitable for most temperatures. Use NLGI No.1 or No.0 grade for extremely low temperature.

NOTICE

This oil is formulated for transmissions and drive trains only, and should not be used in engines.

Shortened engine life will result.

Brake Fluid

Oil Cooled Disc Brake Only

Use heavy duty hydraulic brake fluid certified by oil supplier to meet the latest version of following classifications.

• ISO 6743/4	**HM**
• AFNOR NFE 48-603	**HM**
• DIN 51524 TEIL 2	**H-LP**
• HAGGLUNDS DENISON	**HFO-HF2**
• CINCINNATI	**P68,69,70**

Viscosity: ISO VG32

Brake reservoir oils that have passed the Vickers vane pump test (35VQ25). These oils should have antiwear, antifoam, antirust and antioxidation additives for heavy duty use as stated by the oil supplier. ISO viscosity grade of 32 would normally be selected.

The following products are authorized for use.

Supplier	Product Name
TOTAL	AZOLLAZS
SHELL	TELLUS
MOBIL	DTE20S'
CALTEX	RANDO HD
ESS	NOTO H
CASTROL	HYSPIN AWS

Lubricant Viscosities and Refill Capacities

Lubricant Viscosities

LUBRICANT VISCOSITIES FOR AMBIENT (OUTSIDE) TEMPERATURES					
Compartment or System	**Oil Viscosities**	**°C**		**°F**	
		Min	**Max**	**Min**	**Max**
Engine Crankcase (Diesel) API CJ/CK-4,	SAE 5W30	-30	+30	-22	86
	SAE10W30	-20	+30	-4	86
	SAE5W40	-30	+40	-22	104
	SAE10W40	-20	+40	-4	104
	SAE15W40	-15	+40	5	104
	SAE15W50	-15	+50	5	122
	SAE20W50	-10	+50	14	122
Power Shift Transmission & Drive Axle Housing API CD/TO-2	SAE 10W	-20	+22	-4	+72
	SAE 30	+10	+50	+50	+122
Hydraulic and Power Steering System ISO 6743/4 HM	ISO VG 22	-30	+20	-22	+68
	ISO VG 32	-20	+30	-4	+86
	ISO VG 46	-10	+40	+14	+104
	ISO VG 68	0	+50	+32	+122
Brake Reservoir (Only for OCDB) ISO 6743/4HM	ISO VG32	-20	+30	-4	+86

The SAE grade number indicates the viscosity of oil. A proper SAE grade number should be selected according to ambient temperature.

Refill Capacities

REFILL CAPACITIES - (APPROXIMATE)		
Compartment or System	**Liters**	**U.S Gal.**
Engine Crankcase w/Filter DM02VA, DM02P Diesel	8.6	2.27
Fuel Tank	58	15.32
Powershift Transmission & Drive Axle	19.0	5
Hydraulic & Power Steering System	34	8.98
Brake Reservoir (Only for OCDB)	0.6	0.16

Maintenance Intervals

NOTICE

Never exceed the Maintenance Intervals specified in the manual. Defects and/or damage to the important functional components may be resulted in.

NOTICE

All maintenance and repair, except Every 10 Service Hours or Daily, on the lift truck must be performed by qualified and authorized personnel only.

NOTICE

Careless disposal of waste oil can harm the environment and can be dangerous to persons. Always dispose of waste oil to authorized personnel only.

When Required

Air Intake System - Check, Clean 137
Fuel Tank Filter Cap and Screen (If Equipped) - Clean 139
Seat, Hood Latch & Support Cylinder - Check, Lubricate 139
Fuses, Bulbs, Circuit Breaker & Relay - Change, Reset 140
Battery Terminal - Clean, Inspect 142
Priming the Fuel System (D20/25/30/33S-9, D35C-9 DM02VA, DM02P Diesel Engine Only) 142
Water Separator (D20/25/30/33S-9, D35C-9 DM02VA, DM02P Engine Only) - Check, Drain . 143
Tires and Wheels - Inspect, Check 143
Carriage Roller Extrusion – Adjust 144
DPF Regeneration (Stage5 Only) 144

Every 10 Service Hours or Daily

Inspect Engine for Fluid Leaks 148
Engine Oil Level - Check 148
Drive Axle Oil Level - Check 148
Coolant Level – Check 149
Inspect Foot Pedal Operation 150
Inspect Engine for Exhaust Leaks 150
Walk - Around Inspection - Inspect 151
Mast Channels – Lubricate 152
Brake Oil Level - Check 152
Parking Brake - Inspect 152
Hydraulic Oil Level – Check 153

First 50 - 100 Service Hours or a Week

Engine Oil & Filter (DM02VA/P Engine Only) - Change 154
Drive Axle Oil, Transmission Oil, Oil Filter & Strainer - Check, Clean, Change 156
Parking Brake - Test, Adjust 157

Every 500 Service Hours or 3 Months

Air Intake System – Change 159
Engine Oil & Filter (DM02VA/P with CJ-4 Grade Only) – Change 159
Belts - Check, Adjust (Only for Air-con Compressor) 160
Mast Hinge Pin – Lubricate 161
Tilt Cylinders - Check, Adjust, Lubricate 161
Mast Pivot Eyes - Lubricate 161
Crosshead Rollers - Inspect 162
Mast, Carriage, Lift Chains & Attachments - Inspect, Lubricate 162
Overhead Guard – Inspect 163
Steering Mechanism - Check, Lubricate 163
Steer Suspension – Inspect 163
Parking Brake - Test, Adjust 163
Inching & Braking Control Shaft - Lubricate 164
Horn and Lights (If Equipped) - Check 164
Fuel Filter (DM02VA/P Engine with Main Filter only) - Change 164
Wheel Bolts & Nuts – Inspect 165
Filter in the Air Compressor (optional) - Check, Replacement 166

Every 1000 Service Hours or 6 Months

Hydraulic Return Filter, Breather & Strainer - Check, Change 167
Lift Chains - Test, Check, Adjust 168
Universal Joint – Inspect 170
Drive axle – Inspect 170
Engine Oil Filter – Change (DM02VA/P Engine) 170
Engine Oil – Change (DM02VA/P Engine with CK-4 Grade Only) 170
Fuel Filter (DM02VA/P Engine with Pre/Main Filter only) - Change 170

Every 2000 Service Hours or Yearly

Drive Axle Oil, Transmission Oil, Oil Filter & Strainer - Clean, Change 171
Engine Valve Lash (Diesel Engine Only) – Check,

Adjust 171
Steer Wheel Bearings - Reassemble 171
Cooling System – Clean, Change 172
Forks – Inspect 173

Every 2500 Service Hours or 15 Months

Hydraulic Oil - Check, Clean, Change 175
Inspect Battery System 175

Every 5000 Service Hours or 30 Months

DPF Maintenance (DM02VA Stage5 Engine Only) - Ash Cleaning 176

Environment Protection

Environment Protection 177

Quick Reference to Maintenance Schedule				First	Every					
ITEMS	SERVICES	PAGE	When Required	50 - 100 Service Hours or a Week	10 Service Hours or Daily	500 Service Hours or 3 Months	1000 Service Hours or 6 Months	2000 Service Hours or Yearly	2500 Service Hours or 15	5000 Service Hours or 30
Air Intake System	Check, Clean	138	O							
Air Intake System	Change	160				O				
Battery Terminal	Clean, Inspect	143	O							
Belts (Only for Air-con Compressor)	Check, Adjust	161				O				
Brake Oil Level	Check	153			O					
Carriage Roller Extrusion	Adjust	145	O							
Check the pivot eye pins for loose retainer bolts and wear. Mast Pivot Eyes	Lubricate	162				O				
Coolant Level	Check	150			O					
Cooling System	Clean, Change	172						O		
Crosshead Rollers	Inspect	163				O				
DPF Maintenance (DM02VA Stage5 Engine Only)	Ash Cleaning	176								O
DPF Regeneration (Stage5 Only)		145	O							
Drive axle	Inspect	170					O			
Drive Axle Oil Level	Check	149			O					
Drive Axle Oil, Transmission Oil, Oil Filter & Strainer	Check, Clean, Change	157		O						
Drive Axle Oil, Transmission Oil, Oil Filter & Strainer	Clean, Change	171						O		
Engine Oil & Filter (DM02VA/P Engine Only)	Change	170		O						
Engine Oil & Filter (DM02VA/P with CJ-4 Grade Only)	Change	155				O				
Engine Oil (DM02VA/P Engine with CK-4 Grade Only)	Change	160					O			
Engine Oil Filter (DM02VA/P Engine)	Change	170					O			
Engine Oil Level	Check	149			O					
Engine Valve Lash (Diesel Engine Only)	Check, Adjust	171						O		
Forks	Inspect	173						O		
Fuel Filter (DM02VA/P Engine with Main Filter only)	Change	165				O				
Fuel Filter (DM02VA/P Engine with Pre/Main Filter only)	Change	170					O			
Fuel Tank Filter Cap and Screen (If Equipped)	Clean	140	O							
Fuses, Bulbs, Circuit Breaker & Relay	Change, Reset	141	O							
Filter in the Air Compressor (optional)	Check, Replacement	166				O				
Horn and Lights (If Equipped)	Check	165				O				
Hydraulic Oil	Check, Clean, Change	175							O	
Hydraulic Oil Level	Check	154			O					
Hydraulic Return Filter, Breather & Strainer	Check, Change	167					O			
Inching & Braking Control Shaft	Lubricate	165				O				
Inspect Battery System		175							O	
Inspect Engine for Exhaust Leaks		151			O					
Inspect Engine for Fluid Leaks		149			O					
Inspect Foot Pedal Operation		151			O					
Lift Chains	Test, Check, Adjust	168					O			

Quick Reference to Maintenance Schedule				First	Every					
ITEMS	SERVICES	PAGE	When Required	50 - 100 Service Hours or a Week	10 Service Hours or Daily	500 Service Hours or 3 Months	1000 Service Hours or 6 Months	2000 Service Hours or Yearly	2500 Service Hours or 15	5000 Service Hours or 30
Mast Channels	Lubricate	153			O					
Mast Hinge Pin	Lubricate	162				O				
Mast, Carriage, Lift Chains & Attachments	Inspect, Lubricate	163				O				
Overhead Guard	Inspect	164				O				
Parking Brake	Test, Adjust	158,164		O		O				
Parking Brake	Inspect	153			O					
Priming the Fuel System (D20/25/30/33S-9, D35C-9 DM02VA, DM02P Diesel Engine Only)		143	O							
Seat, Hood Latch & Support Cylinder	Check, Lubricate	140	O							
Steer Suspension	Inspect	164				O				
Steer Wheel Bearings	Reassemble	171						O		
Steering Mechanism	Check, Lubricate	164				O				
Tilt Cylinders	Check, Adjust, Lubricate	162				O				
Tires and Wheels	Inspect, Check	144	O							
Universal Joint	Inspect	170					O			
Walk - Around Inspection	Inspect	152			O					
Water Separator (D20/25/30/33S-9, D35C-9 DM02VA, DM02P Engine Only)	Check, Drain	144	O							
Wheel Bolts & Nuts	Inspect	166				O				

When Required

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

When required indicates no set schedule for review or replacement. This should be done based on operational conditions and operational environment. The Air filtration system should be kept as clean as possible and checked as often as the operational conditions demand. The harsher the application the more frequently the air filter should be checked. In some applications daily inspection may be required.

Air Intake System - Check, Clean

Precleaner (If Equipped)

NOTICE

Never service precleaner with the engine running.

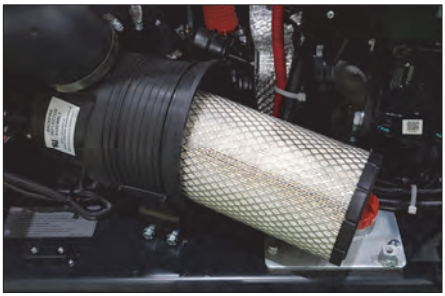
1. Check the precleaner bowl for dirt build-up.
2. If the dirt is up to the line, remove the precleaner bowl and empty it. Periodically wash the cover and bowl in water.

Servicing Filter Element

NOTICE

Never service filter with the engine running.

1. Service the air cleaner when the red target in the service indicator stays locked in the visible position with the engine stopped.
2. To service the air cleaner, raise the hood and seat assembly. Make certain the support cylinder securely holds the hood open. Loosen the cover latches and remove the cover.



3. Rotate the element slightly to separate it from its base and remove it from the air cleaner housing.
4. Clean and inspect the element or replace with a new element. See topic, “Cleaning Primary Filter

Element".

5. Clean the inside of air cleaner housing and the cover. Inspect all connections between the air cleaner and carburetor. Check intake hose for cracks, damage necessary to prevent leakage.

NOTICE

Do not allow dirty air to enter the intake hose when cleaning the inside of the air cleaner housing.

6. Check the air cleaner housing for loose latches.
7. Reset the air cleaner service indicator.
8. Install the air filter element.
9. Install the cover and tighten the cover latches.
10. Start the engine and observe the position of the indicator. If the indicator shows RED after the installation of the primary element, install another clean or a new element or, replace the secondary element. See topic, "Air Intake System-Change" in "Every 500 Service Hours or 3 months section
11. Stop the engine and close the hood and seat assembly.

Cleaning Primary Filter Elements

⚠ WARNING

Pressure air can cause personal injury.

When using pressure air for cleaning, wear a protective face shield, protective clothing and protective shoes.

The maximum air pressure must be below 205 kPa (30 psi) for cleaning purposes.

NOTICE

Do not clean the elements by bumping or tapping them.

Inspect filter elements after cleaning. Do not use a filter with damaged pleats, gaskets or seals.

When cleaning with pressure air, use 205 kPa (30 psi) maximum pressure to prevent filter element damage.

When cleaning with pressure water, use 280 kPa (40 psi) maximum pressure to prevent filter element damage.

Have spare elements on hand to use while cleaning used elements.

The primary element should be replaced after 3 months service. In case of harsh application having lots of dirt, please clean and replace the primary element more often.

Air-205 kPa (30 psi) Maximum Pressure

Direct air on the inside and outside of the element along the length of the pleats. Check the element for any tears, rips or damage

Water-280kPa (40 psi) Maximum Pressure

Direct water on the inside and outside of the element along the length of the pleats. Air dry it thoroughly and then examine it.

Detergent

1. Wash the element in warm water and mild household detergent.
2. Rinse the element with clean water.
3. See instructions in preceding topic for cleaning with water.
4. Air dry it thoroughly, and then examine it.

Checking Element

Insert a light inside the clean dry element and examine it. Discard the element if tears, rips or damage are found.

Wrap and store good elements in a clean, dry place.

Fuel Tank Filter Cap and Screen (If Equipped) - Clean

Park the lift truck with the forks lowered, parking brake applied, transmission in neutral and the engine stopped.

1. Remove the filter cap assembly. Clean in clean, nonflammable solvent.
2. Dry cap assembly.
3. Install filter cap assembly.

⚠ WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

4. Drain moisture and sediment from fuel tank as required by prevailing conditions.

Seat, Hood Latch & Support Cylinder - Check, Lubricate

Check the operation of the seat adjuster rod. Make sure that the seat slides freely on its track.

Lightly oil the seat slider tracks if necessary.

Push the lever down to raise the hood and seat assembly. Make certain the support cylinder will hold the hood open.

Note: Unlock latch before pulling it - if key equipped

Lightly oil the hood latch mechanism and the rod for the hood support cylinder.

Fuses, Bulbs, Circuit Breaker & Relay - Change, Reset

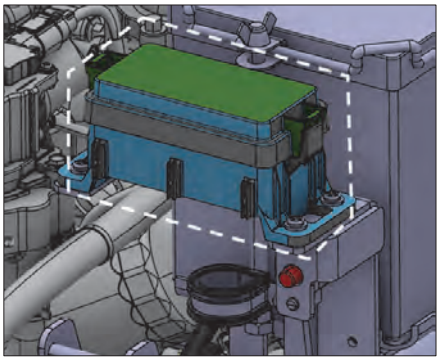
Fuses

NOTE: If a fuse filament separates, use only the same type and size fuses for replacement.

NOTE: If the filament in a new fuse separates, have the circuits and instruments checked.

NOTICE

Always replace fuses with ones of the correct ampere rating.

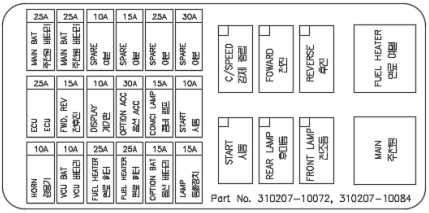


Typical Example

Check the fuses. Use a flashlight, if necessary.

Fuses are identified as follows:

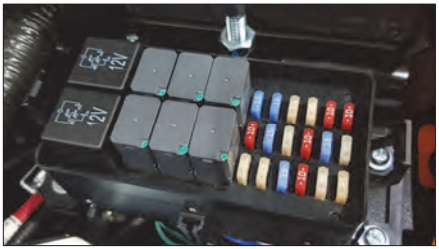
1.Horn - 10 amps.
2.Head/Rear Lamp - 15 amps.
3.Fwd./Rev. Solenoid, lamp Relay & Back-up Lamp/alarm - 10 amps.
4.Instrument Panel & Fuel Shutoff - 15 amps.
5.Turn Signal Lamp, Stop/Strobe Lamp & C.S.D.
6.Start Relay - 5 amp.



Check the fuses. Use a flashlight, if necessary.

Remove the front cover from the fuse box located under the cowl.

Fuse - Protects an electrical circuit from an overload. Opens (filament separates) if an overload occurs.



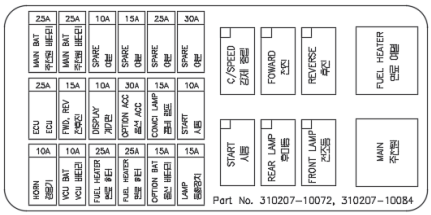
Check the fuses. Use a flashlight, if necessary.

Fuses are identified as follows:

1. BAT - 25A : Main power (BAT)
2. BAT - 25A : Main power (BAT)
3. Spare - 10A
4. Spare - 15A
5. Spare - 25A
6. Spare - 30A
7. Main - 25A : ECU Main power
8. IGN - 15A : FWD, REV power
9. IGN - 10A : Display cluster
10. ACC - 30A : Option ACC power
11. ACC - 15A : Combi lamp
12. ST - 10A : Start power

13. BAT - 10A : Horn
14. BAT – 10A : VCU Power
15. BAT – 25A : Fuel heater
16. BAT – 25A : Fuel heater
17. BAT – 15A : Option BAT power
18. BAT – 15A : Lamp

Relays are identified as follows:
1. FWD
2. C/SPEED
3. LP FUEL
4. LAMP
5. REV
6. NEUTRAL
7. FUEL PUMP
8. STARTER
9. MAIN
10. ETC



Check the fuses. Use a flashlight, if necessary.

Remove the cover from the fuse box located under the air filter

Fuse - Protects an electrical circuit from an overload. Opens (filament separates) if an overload occurs.

Relay – Electrically operated switch.

Bulbs

Bulbs are identified as follows:

1. Bulb-head lamp halogen (12V-35W)

*2. Bulb-back up (12V-10W)

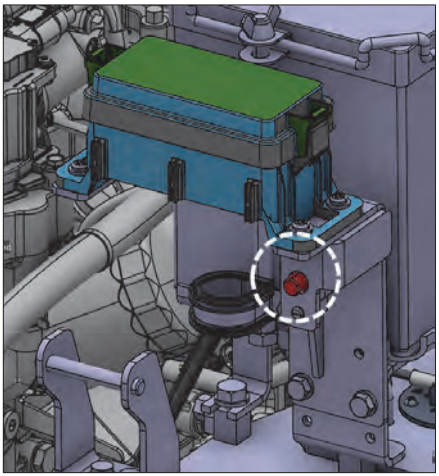
*3. Bulb-turn signal (12V-23W)

*4. Bulb-stop & tail (12V-23/8W)

*Optional lamp or light

Circuit Breaker

Raise the hood and seat assembly. Make sure the support cylinder securely holds the hood open.



The main circuit breaker is located on the rear of the support for the hydraulic controls.

NOTE: To reset circuit breakers push in on the button. The button should stay in if the breaker is reset. If the button will not stay in, or comes out shortly after reset, have the circuits checked.

Battery Terminal - Clean, Inspect

⚠ WARNING

Batteries give off flammable fumes that can explode.

Do not smoke when observing the battery electrolyte levels.

Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.

Always wear protective glasses when working with batteries.

1. Clean the top of the battery and terminals.
2. Check terminals for corrosion. Coat terminals with heavy grease.

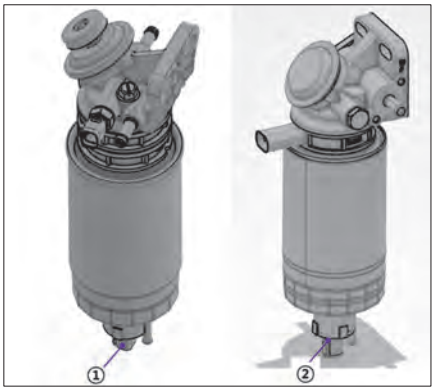
Priming the Fuel System (D20/25/30/33S-9, D35C-9 DM02VA, DM02P Diesel Engine Only)

In any one of the following cases, the fuel system requires priming.

1. Before starting up the engine for the first (priming completed at factory), exhaust all fuel and refuel the fuel tank.
2. After replacing fuel filter or other part of the fuel system, drained water from oil-water separator, or after any maintenance work with the fuel system, perform priming as described below:
3. Place an approved container under the air bleed port.
4. Loosen the plug of air bleed port (Figure, 1).
5. Press the pump (Figure, 3) with your hand until the oil comes out. In this operation, all the fuel hoses must be connected. (Figure, 2)
6. Retighten the hand pump.
7. Wipe out spilled fuel and dispose of properly.
8. Never try to crank the engine with the starting motor to feed the fuel system with fuel. Otherwise, the starting motor can be overheated and the coil, pinion, and/or ring gear can be damaged.

Water Separator (D20/25/30/33S-9, D35C-9 DM02VA, DM02P Engine Only) - Check, Drain

1. If the engine check lamp indicates any fault related to water separator, remove the water in the separator immediately, regardless of regular maintenance schedule. (SPN 97)
2. Lower part of the fuel filter is the water separator, in which a sensor is installed to monitor water and contaminants and transmit warning signal to the indicator to notify the operator of the water accumulated in the separator.
3. Drain the water in the water separator as follows.
4 Place an approved container under the water separator for collecting the water and contaminants.
5. Open the drain cock on the bottom of the water separator of the fuel filter. Drain the water in the water separator. (Figure, 1 for Main Filter Only, 2 for Pre Filter Option)
6. Close the drain cock by hand.
7. Having completed above procedures, check that the fuel system is filled with fuel. Filling fuel system with fuel



⚠ WARNING

Prior to any service or maintenance activity, Test Fuel System for Leaks.

Tires and Wheels - Inspect, Check

⚠ WARNING

Servicing and changing tires and rims can be dangerous and should be done only by trained personnel using proper tools and procedures.
If correct procedures are not followed while servicing tires and rims, the assemblies could burst with explosive force and cause serious physical injury or death.
Follow carefully the specific information provided by your tire servicing man or dealer.

Check Inflation and Damage

Inspect tires for wear, cuts, gouges and foreign objects. Look for bent rims and correct seating of locking ring.

Check tires for proper inflation. See “Tire Inflation Pressures”.

To inflate tires always use a clip-on chuck with a minimum 60 cm (24 inches) length of hose to an in-line valve and gauge.

Always stand behind the tread of the tire. NOT in front of the rim.

Do not re-inflate a tire that has been run while flat or underinflated, without first checking to make sure the locking ring on the rim is not damaged and is in the correct position.

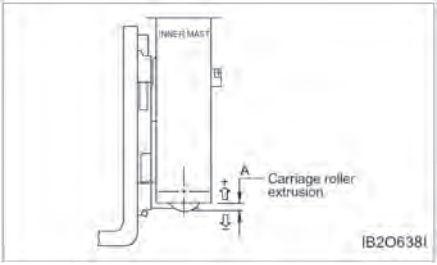
When tires are changed, be sure to clean all rim parts and, if necessary, repaint to stop detrimental effects of corrosion. Sand blasting is recommended for removal of rust.

Check all components carefully and replace any cracked, badly worn, damaged and severely rusted or corroded parts with new parts of the same size and type. If there is any doubt, replace with new parts.

Do not, under any circumstances, attempt to rework, weld, heat or braze any rim components.

Carriage Roller Extrusion – Adjust

1. Set the mast vertical.
2. Lower the carriage completely.
3. On full free lift and full free triple lift models, the bottom of the inner mast must be flush with the bottom of the stationary mast.



4. Measure the distance from the bottom of the inner upright to the bottom of carriage bearing.
5. The measurement (A) must be as follows in Chart below.

2 ~ 2.5 ton		
Height of carriage roller extrusion (A)		
STD mast	FF mast	FFT mast
-6	41	41

DPF Regeneration (Stage5 Only)

DPF Regeneration - Display Pop-up

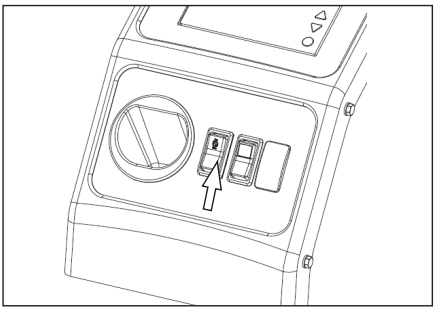
In order that the DPF system may maintain its exhaust cleaning efficiency at a proper level, it should be periodically initialized – "DPF Regeneration".

NOTICE

Keep monitoring the vehicle condition via the SCREEN display.

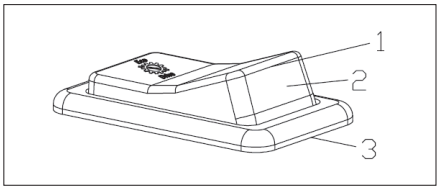
- At a workplace which is near inflammables or, heavily populated, or an indoor space, disable the Regeneration function.
- Be careful of the high temperature of the exhaust tube or other parts during Regeneration.
- Do not operate the vehicle (e.g. pushing the accelerator pedal) during Regeneration.
- Do not switch off the ignition during DPF Regeneration. The DPF System might be damaged.

DOC & SCR Position



Overhead Guard

Cabin



DPF Regeneration switch

Automatic Regeneration

The ECU attempts to start Regeneration during working “Automatic Rege neration” at a proper moment after determining the moment.

Once automatic Regeneration starts, the high temperature indicator lamp lights up with a popup appearing for the operator to notice it.

Display that notifies the operator of automatic Regeneration

If automatic Regeneration is failed due to a low exhaust temperature, you should perform it after the vehicle stops. Therefore, it is recommended to keep the vehicle working as far as possible in order to ensure automatic Regeneration is fully completed. While automatic Regeneration is being carried out, exhaust emissions above 500 °C may cause fires or burns.

Setting this switch to position "3" prohibits automatic DPF Regeneration in an environment subject to dust, explosion or regulated noise level. At position "3", a pop-up appears as shown below:

The switch returns to the normal position of "2" after pressed by the operator to position "1". However, it does not return when pressed to position "3" and the operator shall return the switch from position "3".

DPF Regeneration inhibited

If automatic Regeneration is failed, you should carry it out a while after the vehicle starts working.

A pop-up on the Display warns the operator to perform DPF Regeneration. (3 warnings: at 10 hrs remaining, 5 hrs remaining, Immediate)

Exemplary warning – 10 hrs remaining

Limit the engine power and stop the current work when Regeneration is not used; you will be violating the exhaust regulations if you do not.

To carry out Regeneration safely, observe the following steps:

1. Park the vehicle at a safe place. White smoke can be emitted during Regeneration.
2. Remove the flammable material or stained oil from exhaust system. High temperature of exhaust system and gas can cause fire.
3. Engage the parking brake, and make sure the gear is in neutral.
4. Allow engine to warm up sufficiently; the Regeneration is not possible in cold condition.
5. After holding down the switch at the “3” position for three seconds, check that DPF Regeneration has started.
6. Once Regeneration finishes, the LCD display will show a notification.

Press this switch and release it after 3 sec, SCREEN Cleaning will be started and the engine speed will be increased. Screen pop-up provides information on the warning up and cleaning process.

Warming up process

Proceeding

Completed

Information - correlation between Symbol and message (Display)

As shown in the table below, for your information, we provide Information about correlation between Symbol and message (Display)

No	State	SYMBOL	Lamp	Message on the Display
1	Request Service Regeneration		-	Recommend Regeneration in 10hr Need Engine Warm up
2			ON	Should Do Regeneration in 5hr Need Engine Warm up
3			Blink	Must Do Regeneration Immediately Need Engine Warm up
4	Progressing Passive Regeneration Progressing Service Regeneration		ON	Hot Exhaust Gas
5	Service Regeneration Preparation Lamp		ON	Warming up for DPF Regeneration
6	Under Regeneration		ON	Cleaning Aftertreatment DO NOT STOP ENGINE
7	DPF Regeneration Finish		-	Regeneration completed
8	DPF Regeneration inhibit switch ON		ON	Regeneration is inhibited

Every 10 Service Hours or Daily

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

Inspect Engine for Fluid Leaks

1. Start the engine and allow it to reach operating temperatures.
2. Turn the engine off.
3. Inspect the entire for oil and/or coolant leaks.
4. Repair as necessary before continuing.

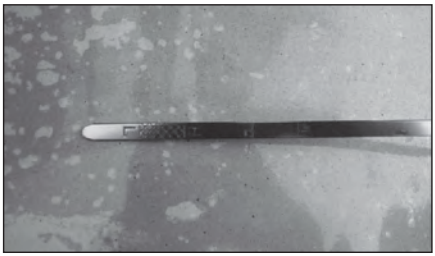
Engine Oil Level - Check

Raise the hood and seat assembly.

⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

Diesel Engines



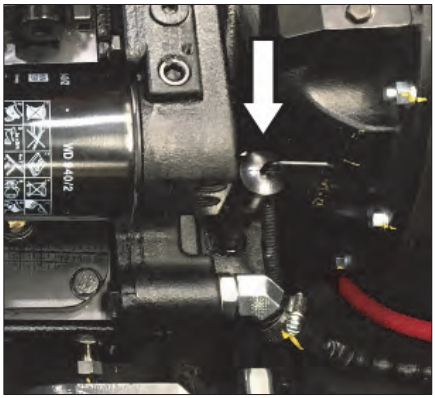
The oil level should be close as possible to upper point of the oil dip stick. Do not refill more than upper point.

Drive Axle Oil Level - Check

⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

1. Start and operate the lift truck until the engine reaches normal operating temperature.
2. Park the lift truck level with the forks lowered, parking brake applied and the transmission controls in NEUTRAL.
3. With the service brake applied and the engine at low idle, shift the directional control lever to forward and then to reverse, to fill the clutches.
4. Shift the direction control lever to the NEUTRAL position.
5. Remove the dip stick/filter cap. Observe the oil level.
6. Maintain the oil level between the Min and Max marks on the dip stick/filter cap. (Based on oil temperature of about 40 degrees)



Coolant Level – Check

⚠ WARNING

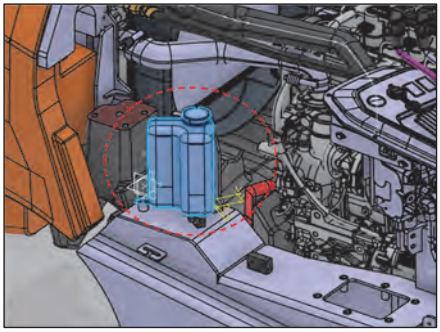
At operating temperature, the engine coolant is hot and under pressure.

Steam can cause personal injury.

Check the coolant level only after the engine has been stopped and the filter cap is cool enough to touch with your bare hand.

Remove the filter cap slowly to relieve pressure.

Cooling system conditioner contains alkali. Avoid contact with the skin and eyes to prevent personal



DM02VA/DM02P Diesel Engine

1. Observe the coolant level with engine cold.
2. Maintain coolant level to the proper line on expansion bottle. If the expansion bottle has no coolant, it will be necessary to check coolant at the radiator filter neck.
3. Remove the radiator cap. Fill radiator to the top of
4. the filter neck. Inspect radiator cap. Replace if damaged. Install the radiator cap.

5. Start and run the engine to stabilize the coolant level in the filter neck. If low, add coolant until it reaches the top of the filter neck. Install the radiator cap. Observe coolant level in the expansion bottle. If necessary, add coolant to bring the coolant to the appropriate line on the

expansion bottle.

6. Stop the engine.
7. Inspect the cooling system for leaks, hose cracks or loose connections.

⚠ WARNING

Pressure air can cause personal injury.

When using pressure air for cleaning, wear a protective face shield, protective clothing and protective shoes.

Maximum air pressure must be less than 205 kPa (30 psi) for cleaning purposes.

8. Blow any dust and lint from the radiator fins.

Inspect Foot Pedal Operation

Verify foot pedal travel is smooth without sticking.

⚠ WARNING

When the acceleration pedal harness is connected or disconnected, should be worked key OFF condition.

If not, occurred malfunction, can cause the personal injury.

Inspect Engine for Exhaust Leaks

1. Start the engine and allow it to reach operating temperatures.
2. Perform visual inspection of exhaust system.
3. Repair any/all leaks found.

Walk - Around Inspection - Inspect

For maximum service life of the lift truck, make a thorough walk-around inspection. Look around and under the truck for such items as loose or missing bolts, debris or dirt buildup, fuel, oil or coolant leaks and cut or gouged tires.

Have any repairs made and debris removed, as needed.

Inspect the tires and wheels for cuts, gouges, foreign objects, inflation pressure and loose or missing bolts.

Inspect the mast and lift chains for wear, broken links, pins and loose rollers.

Inspect the hydraulic system for leaks, worn hoses or damaged lines.

Look for transmission and drive axle leaks on the lift truck and on the ground.

Inspect the operator's compartment for loose items and cleanliness.

Inspect the instrument panel for broken gauges and indicator lights.

Test the horn and other safety devices for proper operation.

Inspect the cooling system for leaks, worn hoses and debris buildup.

Inspect engine compartment for oil, coolant and fuel leaks.

Inspect the forks.

- **Visually inspect forks for cracks, especially in the heel section, around the mounting brackets, and all weld areas.**
- **Inspect for broken or jagged fork tips, bent or twisted blades and shanks.**
- **Make sure positioning lock is in place and working.**
- **Lock the forks in position before using the truck. See Step 7 of "Forks" in "Every 2000 Service Hours or Yearly".**
- **Remove all defective forks from service.**

Mast Channels – Lubricate

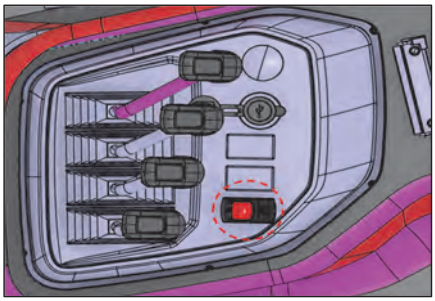
The channels on the roller-type mast require a break-in period. Apply a light film of lubricant on the channels where the rollers ride. This will prevent metal peel until the rollers set a pattern.

Brake Oil Level - Check

1. The brake reservoir is located on the left side of the steering column.
2. Remove the filler cap.
3. Maintain the brake fluid level to the fluid level mark on the brake system reservoir.
4. Clean and install the filler cap

Parking Brake - Inspect

Inspection from Operator's Seat, Engine OFF



Push the front side of the parking brake switch to engage the brake and push the rear side to release it.

Inspection from Operator's Seat, Engine ON

Parking Brake Switch

With the parking brake engaged, the direction control lever in NEUTRAL and the engine running, shift the direction control lever to FORWARD.

The lift truck should not move forward or feel like it wants to move forward, even when the engine is accelerated briefly.

Repeat this procedure in REVERSE. Report truck movement or tendency to move under power with the parking brake engaged.

Parking Brake

NOTE: The parking brake is required to be adjusted to hold the lift truck with capacity load on a 15% grade.

If there is a 15% grade in your workplace, engage a capacity load and drive over to the grade. If the maximum grade in your workplace is less than 15% or if the maximum load carried by the lift truck is less than the lift truck's load capacity, pick up the maximum load and drive to the steepest grade in your workplace.

1. Raise the forks or load engaging attachment about 30 cm (12 in) from the floor.
2. Drive forward up the grade, or in reverse down the grade, and stop the lift truck with the service brakes.
3. Engage the parking brake and release the service brakes.
4. If the lift truck moves down the grade, control its speed with the service brakes, release the parking brake and return directly to the inspection area.
5. Park the lift truck, engage the parking brake, shift the direction control lever to NEUTRAL, lower the forks or load engaging attachment to the floor, shut OFF the engine, remove the key, chock the tires, terminate the inspection, tag the lift truck "Do Not Operate" and immediately report the failure of the parking brake to hold the lift truck.

Hydraulic Oil Level – Check

⚠ WARNING

At operating temperature, the hydraulic tank is hot and under pressure.

Hot oil can cause burns.

Remove the filter cap only when the engine is stopped, and the cap is cool enough to touch with your bare hand. Remove the filter cap slowly to relieve pressure.

Operate the lift truck for a few minutes to warm the oil. Park the lift truck on a level surface, with the forks lowered, mast tilted back, parking brake engaged, transmission in NEUTRAL and the engine stopped.

Raise the hood and seat assembly. Make sure the air lift cylinder securely holds the hood open.

Remove the dip stick/filter cap. Maintain the oil level to the FULL mark on the dip stick/filter cap.

First 50 - 100 Service Hours or a Week

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

Engine Oil & Filter (DM02VA/P Engine Only) - Change

The engine oil in a new engine becomes contaminated from the initial break-in of internal parts. It is very important that the initial oil and filter change is performed as scheduled

NOTE: The oil drain plug may be in another location if an optional oil pan is used.

Checking Engine Oil

1. Check that the engine is at level position.

2. Start and warm up the engine to operating temperature.

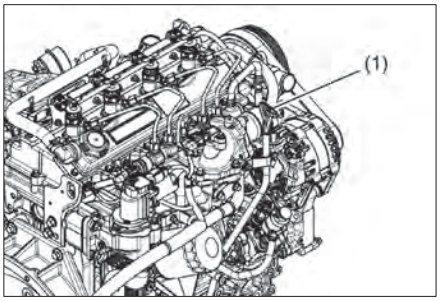
3. Stop the engine and wait for 5~10 minutes.

4. Pull out the oil level gauge (dip stick) (1) upward.

5. Wipe the scale of the oil level gauge with a clean cloth.

6. Insert the oil level gauge (1) into the coil level check hole.

7. Pull out the oil level gauge again to check the oil level.



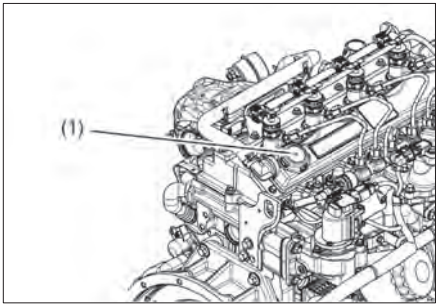
Replenishing Engine Oil

⚠ WARNING

Remove the oil refill cap. Take care that foreign material does not enter the oil tank.

1. Close the oil refill cap (1) on the engine top.

2. Use the genuine oil approved/recommended by the manufacturer.



⚠ WARNING

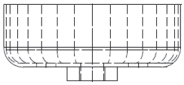
The oil level should be close as possible to upper point of the oil dip stick. Do not refill more than upper point.

3. Having replenished the engine oil, close the oil cap.

4. Run the engine for 5 minutes, check if the engine oil leaks.

Replacing Engine Oil

• Special tools

Figure	Part No. / Name
	Oil /Filter Cap 110910-00628

• Tightening Torque

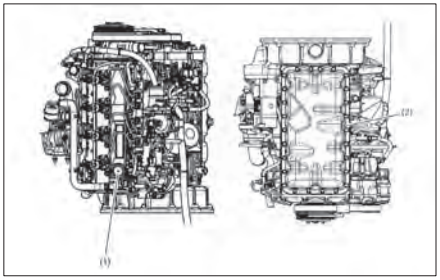
Part	Tightening Torque
Drain plug	3 kgf·m

• Oil capacity

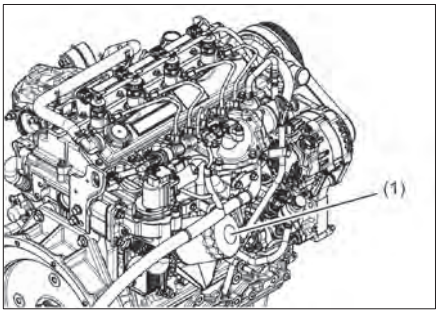
Engine Model	Engine oil capacity (L).		
	Inside the oil pan		Total
	Maximum	Minimum	
D24	8.6	4.5	9.2

1. Place a container under the engine for collecting drained oil.

2. Open the drain plug (1) and drain the engine oil. Remove the oil refill cap (2).



Using the oil filter cap (110910-00628), replace the oil filter (1).



3. Use the genuine engine oil approved / recommended by the manufacturer.

4. Close the oil refill cap (2) and install the oil level gauge.

5. Run the engine for 5 minutes to check engine oil leak, and engine oil level with the oil level gauge.

NOTICE

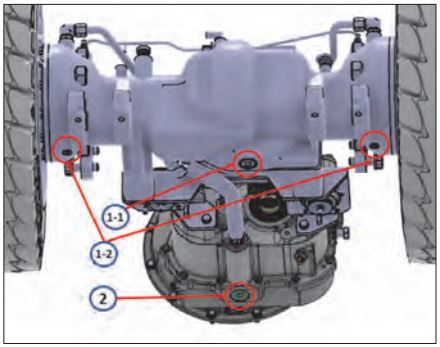
Servicing of the engine oil and oil filter element will largely affect the engine performance as well as the engine life.
Engine oil and filter element must be changed after the first 50 hours.

Drive Axle Oil, Transmission Oil, Oil Filter & Strainer - Check, Clean, Change

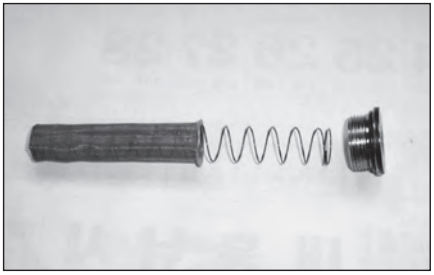
⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

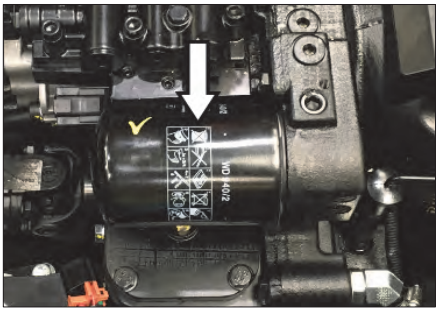
Park the lift truck level, with the forks lowered, parking brake engaged, direction control lever in NEUTRAL and the engine stopped.



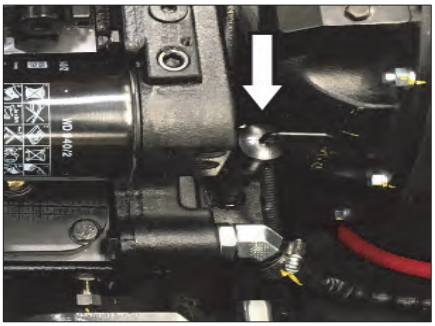
1. Remove drive axle drain plug (1-1), (1-2) and transmission drain plug (2). Allow the oil to drain into a suitable container. Clean the magnetic drain plug. Check O-ring seal and replace if necessary. Remove the spring and the strainer.

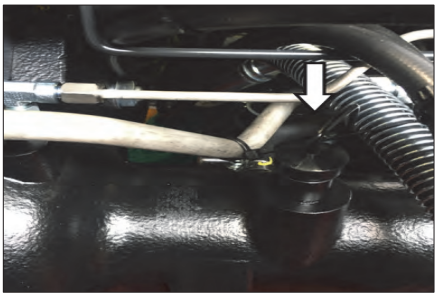


2. Wash the strainer assembly in clean, nonflammable solvent and dry it. Install the strainer assembly.



3. Remove the floor mat and the floor plate.
4. Remove and discard the oil filter.
5. Wipe off the filter base. Make certain that all of the old seal is removed.
6. Apply a small amount of clean oil on the seal of the new filter.
7. Install the filter by hand. When the filter contacts the base, tighten an additional 3/4 turn.
8. Remove the dip stick/filter cap. Fill the compartment with oil. See “Refill Capacities”.
9. Install the dip stick/filter cap.





10. Start the engine.
11. With the service brake applied and engine at low idle, shift the direction control lever to forward and reverse to fill the clutches.
12. Shift the direction control lever into NEUTRAL. Engage the parking brake.
13. Remove the dip stick/filter cap. Observe the oil level.
14. Maintain the oil level between the Min and Max marks on the dip stick/filter cap.
15. Maintain the oil level between the Min and Max marks on the dip stick/filter cap. (Based on oil temperature of about 40 degrees)
16. Check for oil leaks at the filters and drain plug.
17. Stop the engine. Install the floor mat and floor plate

Parking Brake - Test, Adjust

Parking Brake Testing

NOTICE

OSHA requires the parking brake to hold the lift truck, with capacity load, on a 15% grade.
Testing requires a test load equal to the capacity of the truck and a 15% grade.
If the maximum grade in the workplace is less than its capacity, use the Parking Brake inspection procedure covered in 'Inspection from Operator's Seat, Engine On' in "Every 10 Service Hours or Daily" section.

1. Pick up capacity load and drive over to a 15% grade.
2. Drive forward up the 15% grade. Halfway up the grade, stop the lift truck with its service brakes.
3. Engage the parking brake and slowly release the service brake.
4. Engage the parking brake and shift the transmission to NEUTRAL. Slowly release the service brakes.
5. The parking brake adjustment is proper if it holds the lift truck on the grade. The parking brake needs adjusting if it does not hold the lift truck on the grade.

If the lift truck starts to move in reverse down the grade with the parking brake engaged, stop it with the service brakes, disengage the parking brake and reverse slowly down the grade controlling your speed with the service brakes

⚠WARNING

If the parking brake is used for emergency braking while the vehicle is running, the parking brake must be tested.

If the forklift continues to move even when the parking brake is on, park the vehicle in a safe place and insert a block of wood underneath the wheel to prevent the vehicle from moving. Then contact the service center and have the vehicle serviced.

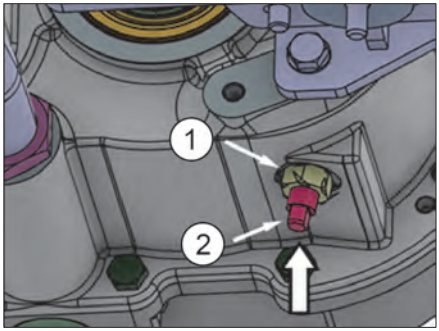
⚠ WARNING

To prevent personal injury, the operator MUST be ready to use the service brake if the parking brake is not adjusted correctly and the lift truck starts to move.

Parking Brake Adjusting

1. Park the lift truck on a level surface, lowered the forks, shift the transmission to NEUTRAL and shut OFF the engine and block the wheels securely.
2. Chock the lift truck's tires to prevent unintentional movement.

3. Remove the floor mat and floor plate.
4. Make sure the parking brake is released. Refer to the “How to release the electronic parking brake” in the operation section



5. Remove the lock nut (1)
6. Fully lock the Parking brake adjust bolt (2) by rotating it clockwise and then, loosen it by rotating for 1/2 turn counterclockwise.
7. Lock the Lock nut (1) with Parking brake adjust bolt fully secured to prevent it from moving.
8. Return the parking brake. Refer to the “How to return the electronic parking brake” in the operation section.
9. Reinstall the floor plate and floor mat.
10. Engage the parking brake, remove the tire chocks and test the parking brake. Refer to ‘Parking Brake Testing’ in the preceding section.

NOTICE

If the parking brake is adjusted several times and there is no normal braking force, the transmission needs to be disassembled to replace the parking brake band.

Every 500 Service Hours or 3 Months

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

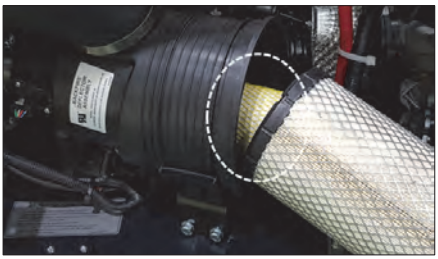
Air Intake System – Change

Changing Primary Element

See topic, “Air Intake System - Check, Clean” in “When Required”

Changing Secondary Element

1. Remove the primary air cleaner element. See topic “Servicing Filter Element.” Clean the inside of the air cleaner housing and cover.



2. Remove the secondary element. Inspect the gasket between the air cleaner housing and the engine inlet. Replace the gasket if it is damaged.

NOTICE

Always replace the secondary element. Do not attempt to reuse it by cleaning.

3. Install a new secondary element. Install a new or cleaned primary element. Install the cover.
4. Tighten the latches.
5. Start the engine and observe the air cleaner service indicator. If the indicator shows RED after installing a new secondary element and a cleaned primary (outer) element, replace the cleaned primary filter with a new element.
6. Stop the engine. Close the hood and seat assembly.

Engine Oil & Filter (DM02VA/P with CJ-4 Grade Only) – Change

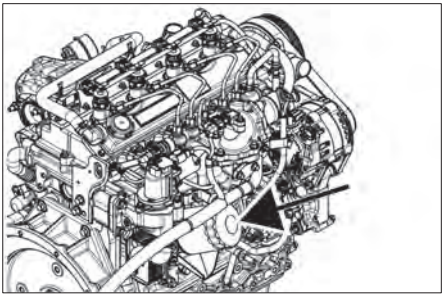
Refer to page 145~146, “Engine Oil & Filter (DM02VA Engine Only) – Change.

⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

1. Remove the crankcase drain plug and allow oil to drain into a suitable container. Clean and install drain plug.
2. Raise the hood and seat assembly.

DM02VA/P



3. Remove and discard oil filter element.

4. Wipe sealing surface of oil filter element mounting base. Make sure the entire old gasket is removed.

5. Before installing a new filter element, apply a small amount of clean engine oil to the filter element gasket.

6. Install the new filter element. When the gasket contacts the base, tighten it 3/4 of a turn more. Do not over-tighten.

7. Raise the lift truck, remove the blocking and lower the lift truck.

8. Fill the crankcase. See “Refill Capacities”.

9. Start the engine and allow the oil to fill the filter and passages.

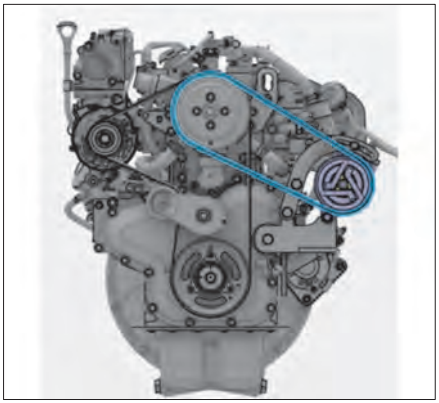
10. Check for oil leaks.

DM02VA/P

11. Stop the engine and measure the oil level. Maintain the oil level to the FULL mark on the dip stick.

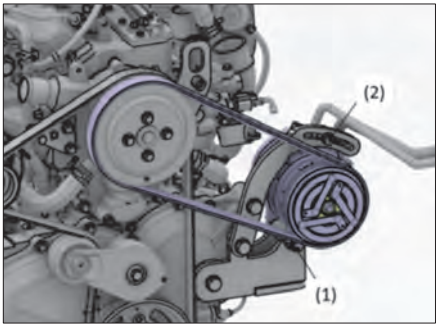
12. Close hood and seat assembly

Belts - Check, Adjust (Only for Air-con Compressor)



Typical Example

1. Check the condition and adjustment of the belt. Correct adjustment allows 10 mm (3/8 inch) deflection under 110 N (25 lb) of force.



NOTICE

Failure to loosen air-con compressor mounting bolt (2) will cause excessive stress and break the alternator mounting ear.

2. To adjust the tension of the air-con compressor drive belt, loosed the adjustment bolts (1) and (2) and move the belt, as necessary.

Mast Hinge Pin – Lubricate

Typical Example

Lower the forks and tilt the mast forward.

Lubricate the two fittings for the mast hinge pins, one on each side of the mast.

Tilt Cylinders - Check, Adjust, Lubricate

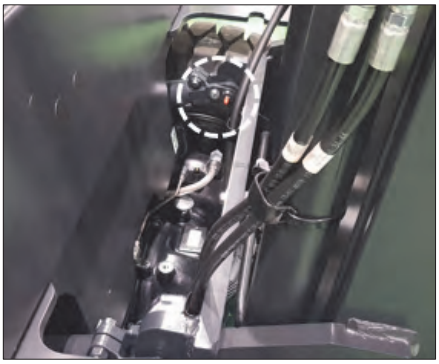
Chassis Pivot Eyebolts - Lubricate

Typical Example

Lubricate two fittings for the pivot eyebolts, one on each tilt cylinder.

Check the pivot eye pins for loose retainer bolts and wear.

Mast Pivot Eyes - Lubricate



Typical Example

Lubricate two fittings for the mast pivot eyes, one on each side of the pin.

Check the pivot eye pins for loose retainer bolts and wear.

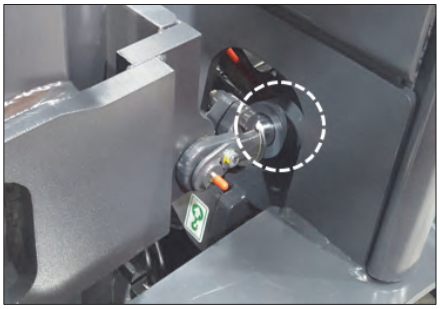
Cylinder Rod Extension – Adjust

NOTE: The following description is for forward tilt. For cylinder rod back tilt, the collar should be stationary by the tilt eye. If it is not, the O-ring inside the collar may need to be replaced. To adjust back tilt, spacers must be added or removed.

Typical Example

Check to make sure the tilt cylinders extend and retract evenly.

If one cylinder continues to move after the other cylinder has stopped in full forward or backward tilt, an adjustment must be made to one cylinder.



Typical Example

To adjust the cylinder rod extension, move the spacer to the rear and loosen the pinch bolt on the clevis.

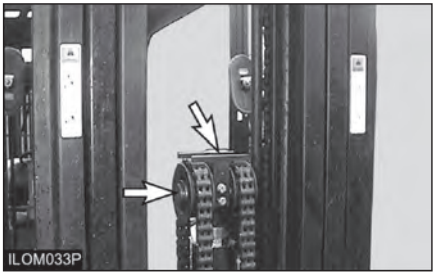
Turn the cylinder rod in or out of the clevis to obtain the proper adjustment. Turning the rod into the clevis shortens the stroke. Turning the rod out of the clevis lengthens the stroke.

Tighten the pinch bolts to a torque of 95±15 Name (70 ± 10 abaft). Check the cylinder rods again for even travel.

Crosshead Rollers - Inspect

Check Operation

Operate the mast through a lift cycle. Watch the chains move over the crosshead rollers. Make sure the chain is tracking over the rollers properly.



Typical Example

Check for damaged crosshead rollers, guards and retainer rings.

Mast, Carriage, Lift Chains & Attachments - Inspect, Lubricate

Operate the lift, tilt and attachment controls. Listen for unusual noises. These may indicate a need for repair.

Inspect for loose bolts and nuts on the carriage.

Remove any debris from the carriage and mast.

Inspect the forks and attachments for free operation and damage. Have repairs made if necessary.

Brush a film of oil on all links of the chain.

Raise and lower the carriage a few times to allow lubricant to enter into the chain links.

NOTICE

Lubricate chains more frequently than normal in applications where the lift truck is operating in an atmosphere which could cause corrosion of components or when lift truck must work in rapid lift cycles.

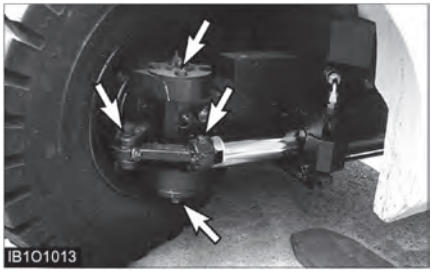
Inspect the chain anchors and individual links for wear, loose pins or cracked leaves**.**

Overhead Guard – Inspect

Check tightness of overhead guard mounting bolts at 95 N·m (70 lb·ft).

Check overhead guard for bent or cracked sections. Have repairs made if needed.

Steering Mechanism - Check, Lubricate

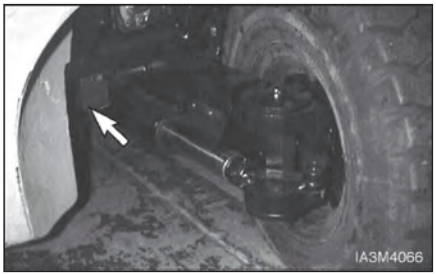


Lubricate the steer axle king pins, total of four fittings. Two on the right side and two on the left side.

Lubricate the steering link bearings, total of four fittings. Two on the right side and two on the left side

Check for any worn or loose components of the steering mechanism. Remove any debris or trash as

Steer Suspension – Inspect



Inspect the suspension mounting bolts. Tighten suspension mounting bolts, if necessary, to 240 ± 30 N·m (180 ± 20 lb·ft).

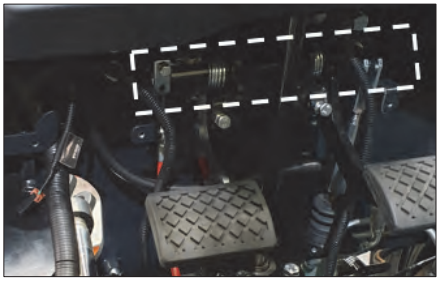
Look for leaks at the power steering hose connections.

Remove any trash buildup on the suspension or the steer axle.

Parking Brake - Test, Adjust

See topic, “Parking Brake - Test, Adjust” in “First 50-100 Service Hours or a Week”.

Inching & Braking Control Shaft - Lubricate



Lubricate three fittings for the inching and brake pedal control shaft.

Horn and Lights (If Equipped) - Check

Press horn button, to determine if horn is operational.

Check and replace all defective gauges.

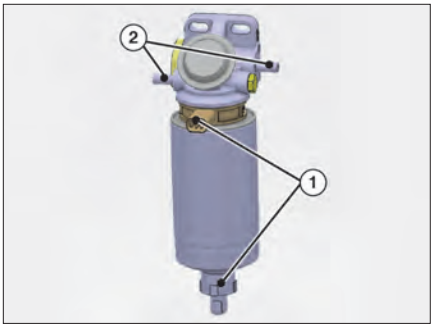
Check all lights such as warning, directional, backup, driving and flood lights for correct operation. Replace all burned out bulbs.

Have repairs made if needed.

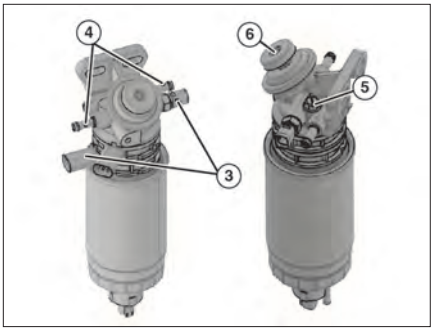
Fuel Filter (DM02VA/P Engine with Main Filter only) - Change

The fuel filter element must be replaced on a regular basis to prevent foreign materials from entering the diesel fuel system.

1. Stop and cool down the engine.
2. Disconnect wire harness connector (1) and disconnect the fuel hose (2) connected to the fuel pre filter port.



3. When removing the fuel filter, hold it carefully to prevent fuel from flowing out. Wipe and clean spilled fuel.
4. Install a new fuel filter and assemble the fuel filter ap.
5. Connect the wire harness connector and fuel hose connector. When connecting the fuel hose, take care to prevent foreign material from entering the hose.
6. Disconnect wire harness connector (3) and disconnect the fuel hose (4) connected to the fuel main filter port.
7. When removing the fuel filter, hold it carefully to prevent fuel from flowing out. Wipe and clean spilled fuel.



8. Install a new fuel filter and assemble the fuel filter cap.
9. Connect the wire harness connector and fuel hose connector. When connecting the fuel hose, take care to prevent foreign material from entering the hose.
10. After replacing the fuel filter or element, or having exhausted fuel, it is necessary to remove the air in the fuel system for safe engine start up.
11. Loosen the plug of air bleed port (5).
12. Press the pump (6) with your hand until the oil comes out. In this operation, all the fuel hose (2) and (4) must be connected.
13. Retighten the plug of air bleed port (5).
14. Check the fuel leakage.

Maintenance Interval of Fuel Filter

Maintenance Interval of Fuel Filter is different from each region. Please check this table below and change fuel filter.

Region	Maintenance Interval (hrs)	
	w/o Pre Fuel Filter	w/ Pre Fuel Filter
KOREA/JAPAN	1,000	1,000
NORTH AMERICA/ EUROPE	500	1,000
OTHER REGION	500	1,000

Wheel Bolts & Nuts – Inspect

Inspect Tightness

Steer Wheels

Typical Example

Inspect tightness of wheel bolts in a sequence opposite each other 110 N·m (75 lb·ft).

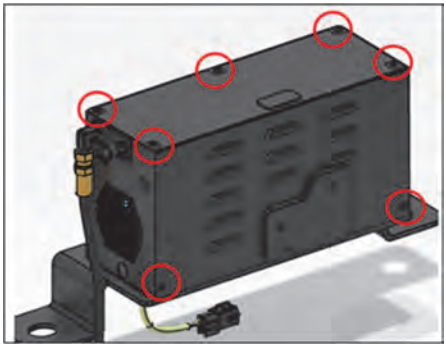
Drive Wheels

Typical Example

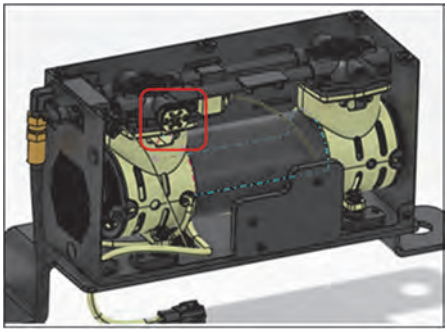
Inspect tightness of wheel nuts in a sequence opposite each other to 610 N·m (450 lb·ft).

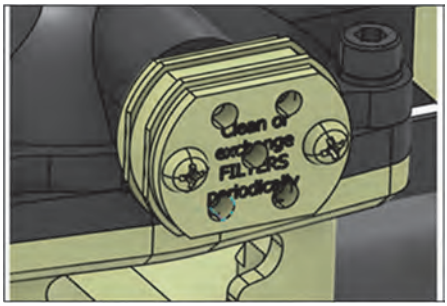
Filter in the Air Compressor (optional) - Check, Replacement

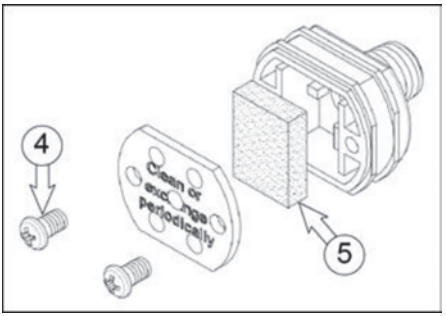
1. The air filter should be checked every 250 hours and replaced every 500 hours.
2. When checking and replacing the air filter, remove the screws as indicated below.



3. After removing the cover, check and replace the air filter in the area marked below.







4. Open the filter cap after loosening the two cross bolts.
5. Take out the sponge filter and remove any foreign materials from it, or replace it.

Every 1000 Service Hours or 6 Months

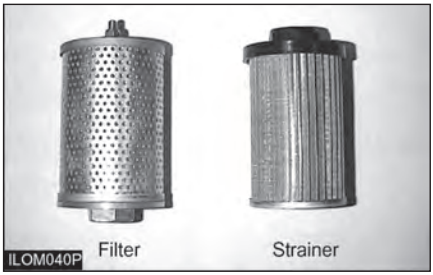
You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

Hydraulic Return Filter, Breather & Strainer - Check, Change

⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

Park the lift truck level with the forks lowered, parking brake engaged, transmission in NEUTRAL and the engine stopped.



1. Loosen the bolts of the hydraulic tank top plate assembly.
2. Remove the return filter from tank top plate assembly.
3. Install new return filter by hand.
4. Remove the suction strainer from the tank.
5. Install the new strainer by hand.
6. Install the tank top plate assembly and fasten the bolts.

Typical Example

7. Remove and discard the air breather.
8. Install a new air breather.
9. Start the engine and operate the hydraulic controls, and the steering system, through a few cycles to fill the lines. Look for oil leaks.
10. Stop the engine and check the oil level. With all cylinders retracted, maintain the oil level to the FULL mark on the dipstick/filter cap assembly.

Lift Chains - Test, Check, Adjust

Lift Chain Wear Test

Inspect the part of the chain that is normally operated over the cross head roller. When the chain bends over the roller, the movement of the parts against each other causes wears.

Inspect to be sure that chain link pins do not extend outside of the link hole. If any single link pin is extended beyond its connecting corresponding link, it should be suspected of being broken inside of its link hole. Lift chains are required to check for wear about every 1,000 service hours or 6 months.

Chain wear test is a measurement of wear of the chain links and pins. Take the following steps to check chain wear.

1. Lift the mast and carriage enough for getting tension on lift chains.

Typical example

2. Measure precisely ten links of chain distance at the center of pins in millimeter.

3. Calculate chain wear rate*.

4. If the chain wears rate is 2% or more, replace the lift chain.

*Chain wear rate (%)

$$= \left(\frac{\text{Actual measurement - Pitch** X 10}}{\text{Pitch** X 10}} \right) \text{x100}$$

1) FOR STD, FF, FFT MAST 19.05mm(0.75 in) for 2~3 ton truck.

25.4mm(1 in) for 3.3~Light 3.5 ton truck.

2) FOR QUAD MAST (for 2.5 ton)

19.05mm(0.75 in) for inner mast chain.

25.4mm(1 in) for carriage and outer mast chain.

Check for Equal Tension

Typical example

Lift the carriage and the mast high enough for getting tension on lift chains. Check the chains, and make sure the tension is the same. Lift chains are required to check for equal tension about every 1,000 service hours or 6 months.

⚠ WARNING

Personal injury can be caused by sudden movement of the mast and carriage. Keep hands and feet clear of any parts that can move.

Lift Chain Adjustment

Typical example for carriage equal tension

If the tension is not the same on both chains, take the procedure as follows.

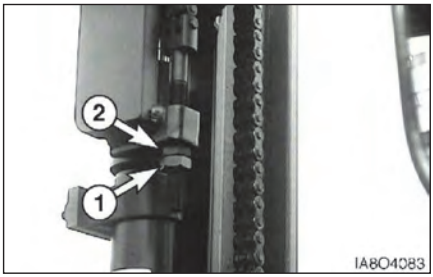
NOTE: If carriage height is not correct, make adjustments by following procedures.

Carriage Chain Adjustment

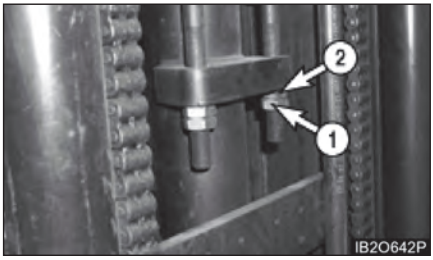
Make sure that carriage height is correct. If correct, adjust the chain for equal tension. If not, adjust the chain for correct carriage height by adjusting anchor nuts (1), (2).

NOTE: See the previous section, “Carriage Roller Extrusion” in “When Required” for proper height of carriage.

1. Fully lower the carriage and tilt mast forward or lift the carriage and put blocks under the carriage to release the tension from the lift chains.
2. Loosen nut(1) and adjust nut(2) to get proper distance from bottom of inner upright to the bottom of carriage bearing.



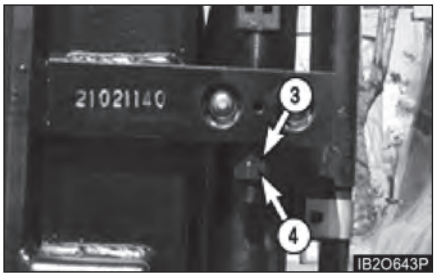
Typical example for carriage chain of STD mast



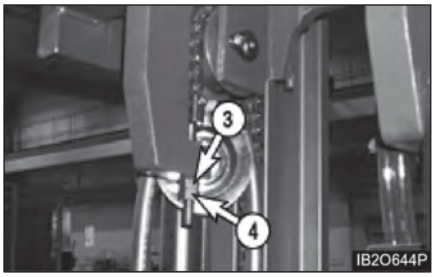
Typical example for carriage chain of FF, FFT mast

3. Make adjustment anchor nut (1), (2) for equal chain tension.
4. Set the mast vertical and raise the carriage and check equal chain tension. If not equal, repeat the same procedure as step 1 through step 3.
5. Put LOCTITE No. 242 Tread lock on the threads of the anchor nuts (1), (2) after the adjustment is completed.

Mast Chain Adjustment - FF, FFT Mast



Typical example for FF mast



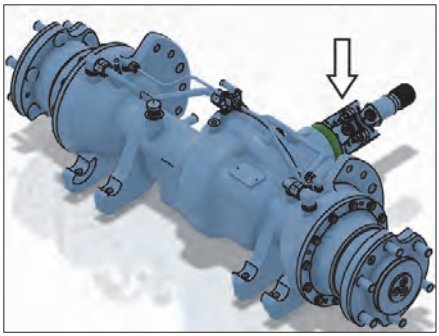
Typical example for FFT mast

Make sure that mast height is correct. If correct, adjust chain for equal tension. If not, adjust mast chain for correct mast height by adjusting anchor nuts (3), (4).

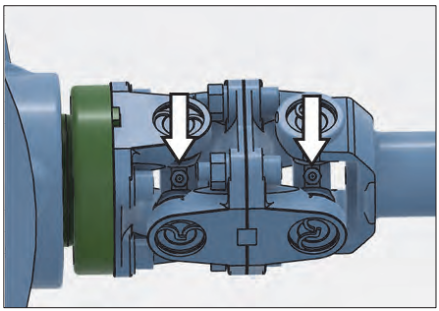
NOTE: See the previous section, “Carriage Roller Extrusion” in “When Required” for proper inner mast height.

1. Lift the inner mast and put blocks under the inner mast to release the tension from the lift chains.
2. Loosen nut (3) and adjust nut (4) to make inner mast rail flush with outer mast rail bottom.
3. Make adjustment anchor nuts (3), (4) for equal chain tension.
4. Raise the inner mast and check equal chain tension. If not equal, repeat the same procedure as step 1 through step 3.
5. Put LOCTITE No. 242 tread lock on the threads of the anchor nuts (3), (4) after the adjustment is completed.

Universal Joint – Inspect



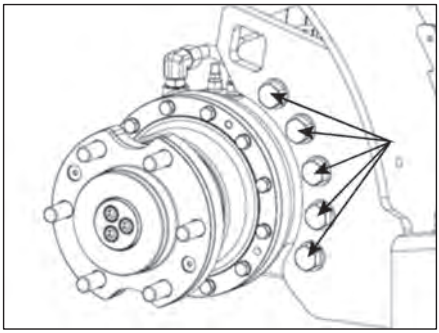
Check the bearings for wear and damage; if any are worn or damaged, replace them. Check for any loose bolts, and tighten bolts if necessary.



Inject a sufficient amount of grease into the grease nipples on the universal joint.

Drive axle – Inspect

Inspect Tightness



Check the bolt and washer for loosen bolt or nut ; if any are worn or damaged, replace them. Check for any loose bolts and nuts, and tighten bolts and nuts if necessary(460±60 N·m or 340±44 lbf·ft)

Engine Oil Filter – Change (DM02VA/P Engine)

Refer to page 145~146, “Engine Oil & Filter (DM02VA Engine Only) – Change.

⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

Engine Oil – Change (DM02VA/P Engine with CK-4 Grade Only)

Refer to page 141~142, “Engine Oil & Filter (DM02VA Engine Only) – Change”.

⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

Fuel Filter (DM02VA/P Engine with Pre/Main Filter only) - Change

Refer to page 157, “Fuel Filter (DM02VA/P Engine with Main Filter only) – Change”.

Maintenance Interval of Fuel Filter

Maintenance Interval of Fuel Filter is different from each region. Please check this table below and change fuel filter.

Region	Maintenance Interval (hrs)	
	w/o Pre Fuel Filter	w/ Pre Fuel Filter
KOREA/JAPAN	1,000	1,000
NORTH AMERICA/ EUROPE	500	1,000
OTHER REGION	500	1,000

Every 2000 Service Hours or Yearly

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedure.

Drive Axle Oil, Transmission Oil, Oil Filter & Strainer - Clean, Change

See the topic, "Drive axle Oil, Transmission Oil, Oil Filter & Strainer - Clean, Change" in First 50-100 Service hours or a week.

Engine Valve Lash (Diesel Engine Only) – Check, Adjust

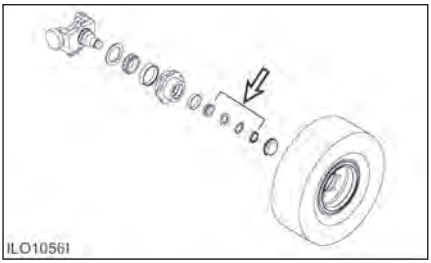
See topic “Engine valve Lash (Diesel Engine Only) – Check, Adjust”. In Every 1000 Service Hours or 6 Months.

Steer Wheel Bearings - Reassemble

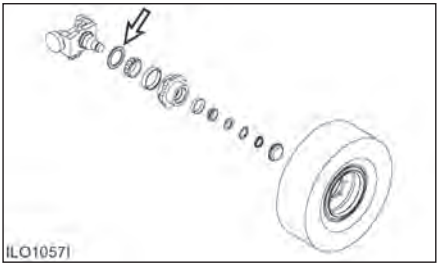
Park the lift truck level with the forks lowered, parking brake engaged, transmission in NEUTRAL and the engine stopped.

Typical Example

1. Lift the steer wheels off the ground. Place stands or blocking under the frame and steer axle to support the lift truck.
2. Remove the hub cap which is pressed into the wheel hub.
3. Straighten the lock washer tangs.



4. Remove the locknut, lock washer and flat washer.



5. Remove the outer wheel bearing.
   Remove the wheel assembly. Examine the seal for damage and wear. Replace the seal if necessary.
6. Remove the inner bearing. Clean and lubricate the steering knuckle. Reassemble both the inner and outer bearing cones.
7. Install the inner bearing. Lubricate the seal and install the wheel assembly on the knuckle.
8. Install the outer wheel bearing and the out washer. Install a new lock washer and fit the locknut.

Typical Example

9. Tighten the locknut to 135 N·m (100 lb·ft), while

turning wheel hub to seat the bearing.

10. Loosen the locknut. Retorque it to 50 ± 5N·m (37 ± 4 lb·ft). Bend the lock washer tang to secure locknut.

11. Install the hub cap.

12. Raise the lift truck and remove the blocking.

13. Lower the lift truck to the ground.

Cooling System – Clean, Change

⚠ WARNING

At operating temperature, the engine coolant is hot and under pressure.

Steam can cause personal injury.

Check the coolant level only after the engine has been stopped and the filler cap is cool enough to touch with your bare hand.

Remove the filler cap slowly to relieve pressure.

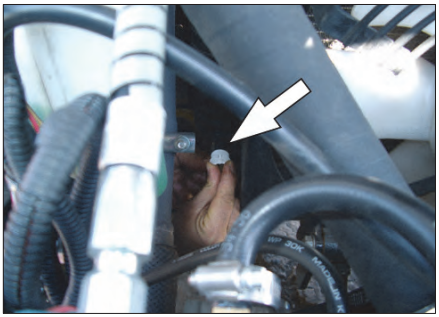
Coolant is included antifreeze for forbidding corrosion. Avoid contact with the skin and eyes to prevent personal injury.

Use all cleaning solution with care.

The Lift truck must be level, the forks lowered, the parking brake engaged, the transmission in NEUTRAL and the engine stopped and cool.

1. Turn the radiator cap slowly to relieve the pressure, and then remove the cap.

2. Remove the drain plug or water hose on engine block.



D24NAP Diesel Engine

3. Open the radiator drain valve. Allow the coolant to drain into a suitable container.
Drain the recovery bottle.

NOTICE

Hold the drain port when the radiator drain valve is turned because the tank and the drain port are separated.

4. After draining the coolant completely, close the radiator drain valve and the block drain plug, fill the engine and the radiator full with a radiator cleaner, and clean the engine and the radiator.

5. Start and run the engine for 30 minutes.

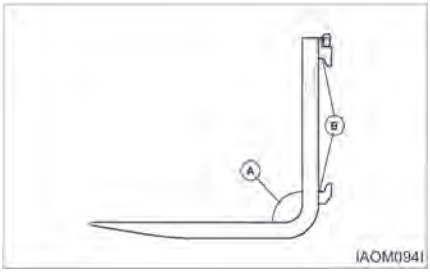
6. Stop the engine and drain the cleaning solution into a suitable container.

7. Flush the system with clean water, until draining water is clear.

8. Close the drain valve and install the block drain plug. Fill coolant to top of the filler neck.

9. Start and run the engine to stabilize the coolant level. See topic, “Coolant Level – Check” in “Every 10 Service hours or Daily”.

Forks – Inspect



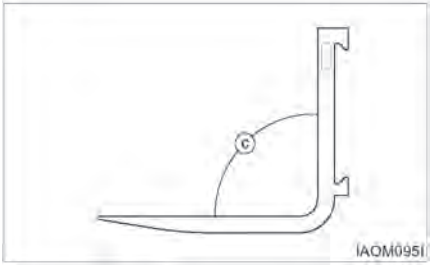
Forks should be inspected, at a minimum, every 12 months. If the truck is being used in a multi-shift or heavy duty operation, they should be checked every six months.

1. Inspect the forks carefully for cracks. Special attention should be given to the heel section (A), all weld areas and mounting brackets (B). Inspect the top and bottom hooks on forks used on hook type carriages and tubes on shaft mounted forks.

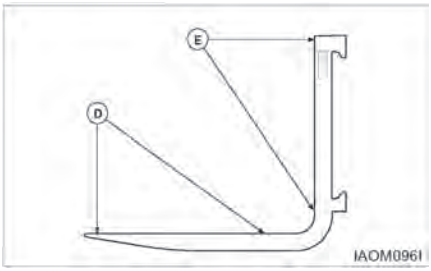
Forks with cracks should be removed from service.

"Wet Test" magnetic particle inspection is generally preferred due to its sensitivity and the ease of interpreting the results. Portable equipment is usually recommended so it can be moved to the lift truck.

Inspectors should be trained and qualified in accordance with The American Society for Non Destructive Testing, Level II Qualifications.

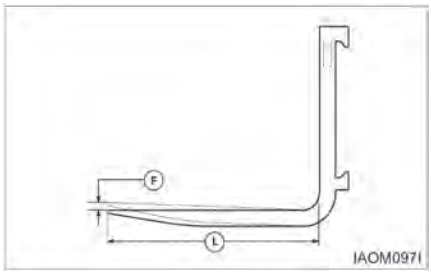


2. Check the angle between the upper face of the blade and the front face of the shank. The fork should be withdrawn from service if angle (C) exceeds 93 degrees or deviates by more than 3 degrees from an original angle other than 90 degrees, as may be found in some special application forks.



3. Check the straightness of the upper face of blade (D) and the front face of shank (E) with a straight edge.

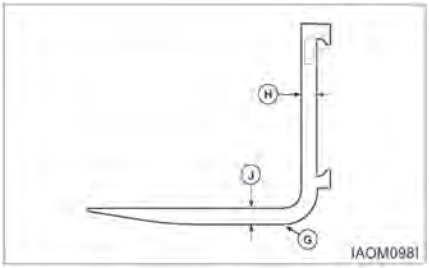
The fork should be withdrawn from service if the deviation from straightness exceeds 0.5 percent of the length of the blade and/or the height of the shank respectively 5 mm/1000 mm (0.18"/36").



4. Check the difference in height of one fork tip to the other when mounted on the fork carrier. A difference in fork tip height can result in uneven support of the load and cause problems with entering loads.

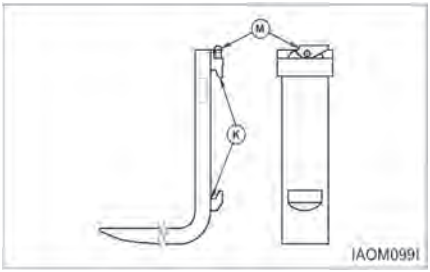
The maximum recommended difference in fork tip elevation (F) is 6.5 mm (0.25") for pallet forks and 3 mm (0.125") for fully tapered forks. The maximum allowable difference in fork tip elevation between the two or more forks is 3 percent of blade length (L).

Replace one or both forks when the difference in fork tip height exceeds the maximum allowable difference. Contact your local DOOSAN Lift Truck Dealer for further information.



5. Check the fork blade (J) and shank (H) for wear with special attention to the heel (G). The fork should be withdrawn from service if the thickness is reduced to 90 percent or less of the original thickness.

Fork blade length may also be reduced by wear, especially on tapered forks and platens. Remove the forks from service when the blade length is no longer adequate for the intended loads.



6. Check the fork mountings (K) for wear, crushing and other local deformation, which can cause excessive side to side wobble of the forks.

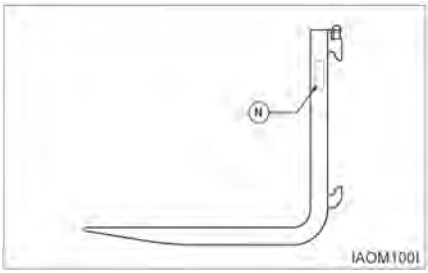
Excessive clearance on hook type forks may allow them to fall from the carrier. Forks which show visible signs of such damage should be removed from service.

7. Check the positioning lock and other fork retention devices to make sure they are in place and working.

Hook type forks use a spring loaded pin (M), located in the top hook, to engage notches in the top carriage bar to hold the fork in place.

When adjusting the fork spacing, the forks are prevented from sliding off the end of the carriage by stop blocks. These stop blocks are at both ends of the carriage and in the path of the bottom fork hook. The load backrest extension may be used in place of the stop blocks in some cases.

Shaft mounted forks may use set collars or spacers on the shaft to either side of the fork. They may also use U bolts, pins, or similar devices which engage the fork through the top structure of the carriage.



8. Check fork markings (N) for legibility. Renew markings as required to retain legibility.

9.a. Lift the mast and operate the tilt control lever, until the top surface of the forks is parallel with the floor. Place two straight bars that are the same width as the carriage, across the forks as shown.

b. Measure the distance from the bottom of each end of the two bars to the floor. The forks must be parallel within 3 mm (.12 in) for Full Tapered and Polished (FTP) forks, all other forks 6.4 mm (.25 in), for their complete length.

c. Put one fork, one third from the tip, under a fixture that will not move. Then operate the tilt control with caution until the rear of the truck lifts just off the floor. Follow the same procedure with the second fork. Repeat Step a.

Every 2500 Service Hours or 15 Months

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

Hydraulic Oil - Check, Clean, Change

⚠ WARNING

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

Park the lift truck level with the forks lowered, parking brake engaged, transmission in NEUTRAL and the engine stopped.

1. Remove the hydraulic tank drain plug. Allow the oil to drain into a suitable container. Clean and install the plug.
2. Remove the dipstick/filter cap assembly.
3. Fill the hydraulic tank. See topic “Refill Capacities”. Install the dipstick/filter cap assembly.
4. Start the engine and operate the hydraulic controls, and the steering system, through a few cycles to fill the lines. Look for oil leaks.
5. Stop the engine and check the oil level. With all cylinders retracted, maintain the oil level to the FULL mark on the dipstick/filter cap assembly.

Inspect Battery System

1. Clean battery outer surfaces with a mixture of baking soda and water.
2. Inspect battery outer surfaces for damage and replace as necessary.
3. Remove battery cable and clean, repair and/or replace as necessary.

Every 5000 Service Hours or 30 Months

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

DPF Maintenance (DM02VA Stage5 Engine Only) - Ash Cleaning

⚠ WARNING

Ash cleaning services is recommended by the designated repair shop, if not, it can lead to damage of the product and system.

Visit designated Repair & Inspection Shop for Ash Cleaning service every 5000 Hours or 30 Months. If not the efficiency of filtering and performance of back pressure would be reduced.

<DPF, Stage5>

Use recommended engine oil to reduce the amount of generated ash (CJ/CK-4 Grade in US / ACEA-E9 or higher in EU).

Environment Protection

When servicing this lift truck, use an authorized servicing area and an approved container to collect coolant, oil, fuel, grease, electrolyte and any other potential environmental pollutant before any lines, fittings or related items are disconnected or removed. After servicing, dispose of those materials in an authorized place and container. When cleaning the lift truck, be sure to use an authorized area.

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