

D60S-7

D70S-7

D80S-7

D90S-7

G60S-7

G70S-7



SB2399E06

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D60/70/80/90S-7, G60/70S-7

Operation & Maintenance Manual

Operation & Maintenance Manual

D60S-7, D70S-7

FDB0U, FDB0V (D34NAP/D34P Tier-4)

D80S-7, D90S-7

FDB0W, FDB0X (D34NAP/D34P Tier-4)

G60S-7, G70S-7

FGB0P, FGB0Q (PSI 4.3L Tier-3)

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SB2399E06

Forklifts

Operation & Maintenance Manual

FORKLIFTS

D60S-7, D70S-7

FDB0U, FDB0V (D34NAP/D34P Tier-4)

D80S-7, D90S-7

FDB0W, FDB0X (D34NAP/D34P Tier-4)

G60S-7, G70S-7

FGB0P, FGB0Q (PSI 4.3L Tier-3)

Original Instruction

This document is the informational asset of Doosan Corporation. Thus, unauthorized access, revision, distribution and copying of this document are strictly prohibited.

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.

Diesel truck

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.

LPG truck

WARNING

This product can expose you to chemicals including petroleum, which is known to the State of California to cause cancer and birth defects or other reproductive harm.

For more information go to www.P65Warnings.ca.gov.

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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 tip over, 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 250 Service Hours or Monthly" and "Every 10 Service Hours or Daily".

Environment Management

Note that DOOSAN CPOPORATION INDUSTRIAL VEHICLE BG 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. LIFECYCLE ANALYSIS has also been made throughout 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.



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.

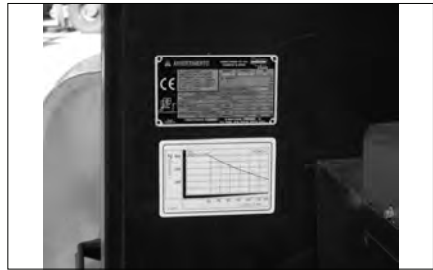
Warning Signs and Labels

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 around left side of seat support.

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 Warnings to Operator



Located on the around left side of seat support.

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.

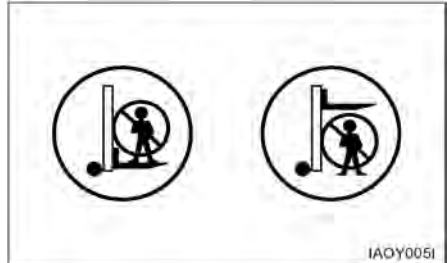


Located on the mast

No Standing On Forks Warning, No Standing Under Forks 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.

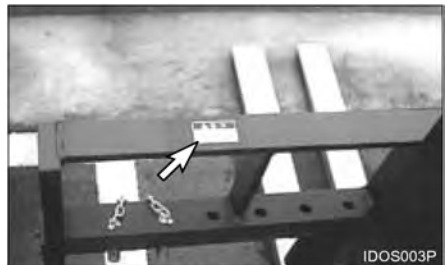


Located on the lift cylinder

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 value.



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

Moving Fan Warning

WARNING

To avoid personal injury, stay clear of moving fan.

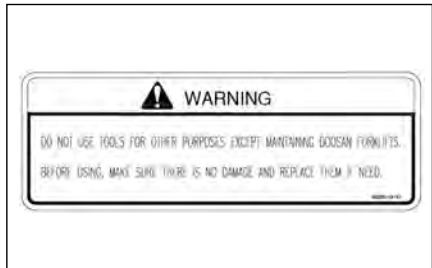


Located inside the engine compartment cover

Tool Warning

WARNING

1. Do not use the tools provided by DOOSAN for other vehicles than DOOSAN's.
2. Check the tools for integrity before use. Do not use a defective tool.



Safety label on the tool box

Parking Brake

Mechanical Parking Brake (If Installed)



Cabin Type



Over Head Guard Type



Pull the lever **BACK** to engage the parking brake.



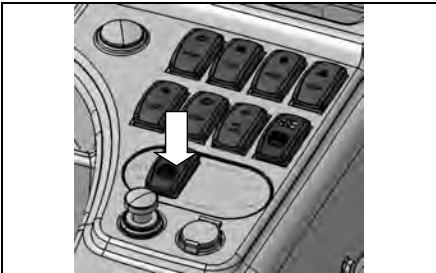
Push the lever **FORWARD** to release the parking brake.



Pushing forward the lever releases the parking brake.



Electronic Parking Brake (If Installed)



Pulling back the lever engages the parking brake.

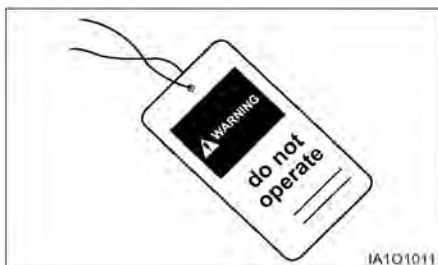
⚠ WARNING

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 alarms (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.

LPG Truck contains 0.6kg of HFC-134a, of which the CO₂ equivalent value is 0.858 tons.

Diesel Truck contains 0.7kg of HFC-134a, of which the CO₂ equivalent value is 1.001 tons.

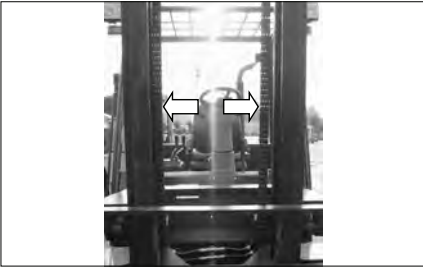
The GWP of HFC-134a is 1,430.

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.
When you handle DEF/ad-Blue, wear protective equipment and observe Precautions for Handling.



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

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.

In order to protect the lift truck's electronic systems (ECU, TCU, etc.) during an electrical work on the vehicle for the purposes below, you should completely remove the ignition key and connectors (or plugs) from the electronic systems: ECU, TCU, and OSS.

Failure to follow the above warnings when performing electrical work, welding, or running an insulation test on the vehicle may cause serious damage to its electronic system due to an external abnormal current, electrical shock, etc.

For any checkup, repair, adjustments, maintenance and all other work concerning your forklift truck, please contact your DOOSAN dealer. We would like to draw your attention to the fact that any secondary damages due to improper handling, insufficient maintenance, wrong repairs or the use of other than original DOOSAN spare parts waive any liability by DOOSAN.

Operation Information

Mounting and Dismounting

Mount and dismount the lift truck carefully.

Clean your shoes and wipe your hands before mounting.

Face the lift truck when mounting and dismounting.

Use both hands 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 seatback.

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 the 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.

Watch the road carefully for any obstacle when driving the truck. Do not go fast over bumps, pot holes or other rough grounds, otherwise the engine might go OFF by a severe impact.

In case of engine going OFF, press the brake pedal at one time as hard as possible in order to stop the truck. Pressing the brake pedal several times has a risk that the brake would not work.



Use special care when operating on grades. Do not angle across or turn on grades. Do not use a 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 an 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, and 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 and 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.

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.

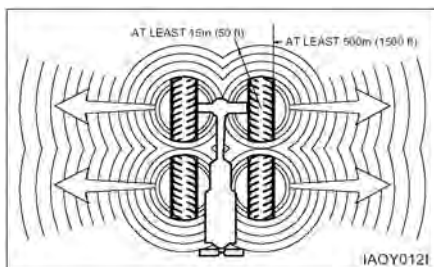
- End fittings damaged or leaking.
- Outer covering chafed or cut and wire reinforcing exposed.
- Outer covering ballooning locally.
- Evidence of kinking or crushing of the flexible part of hose.
- Armoring embedded in the outer cover.
- End fittings displaced.

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 (N₂) 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 inflating 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 (If Equipped)

Warning Signs and Labels

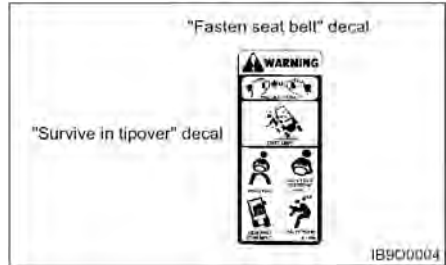
Your DOOSAN lift truck has the following tip over warning decals.

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 Lift Truck 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.

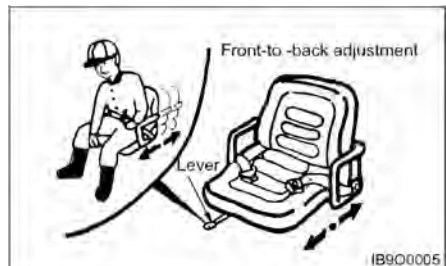
WARNING

Tip over can occur if the truck is improperly operated. In the event of tip over, injury or death could result.



The "Survive in tip over" warning is located on the overhead guard. It shows the proper use of the operator restraint system.

Seat Adjustment



Move the lever, slide the seat to the desired position, and release the lever.

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 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)

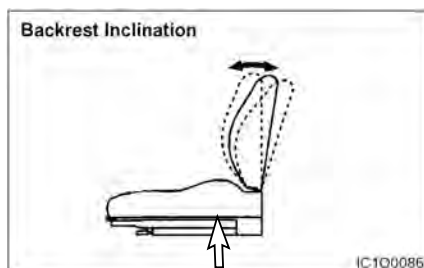
NOTICE

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



Backrest Inclination

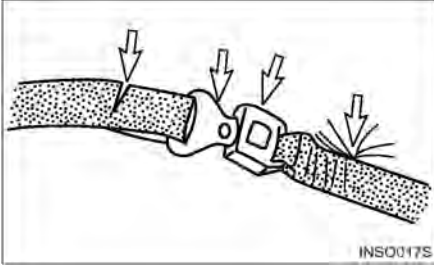
The backrest angle can be adjusted by using the lever on the left side of seat.



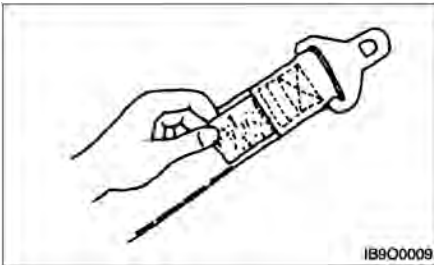
Seat Belt

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

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 tip over, the seat and restraint system should be inspected for damage and replaced, if necessary.

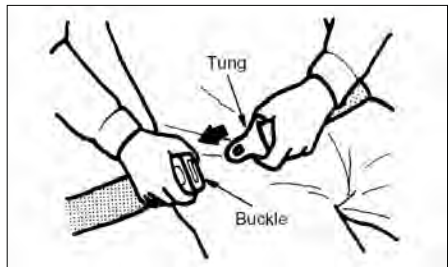
NOTE: Operator restraints shall be examined at the regular truck service intervals. It is recommended that they be replaced if any of the following conditions are found:

- Cut or frayed strap
- Worn or damaged hardware including anchor points
- Buckle or retractor malfunction
- Loosen 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.

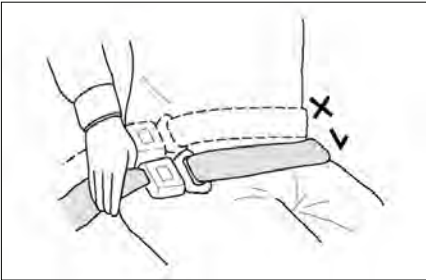
Fasten the Seat Belt



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.

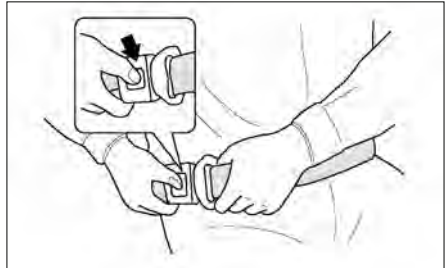
⚠ WARNING

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.

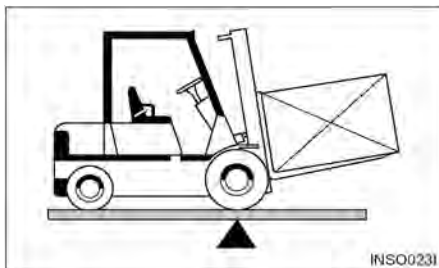
NOTE: The belt is designed to automatically adjust to your size and movement. A quick pull on the belt will confirm that the automatic adjuster will hold the belt position in the event of an accident.

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 Tip over

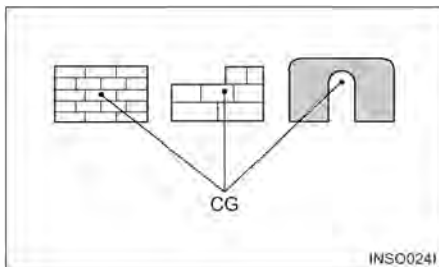
Lift Truck Stability



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.

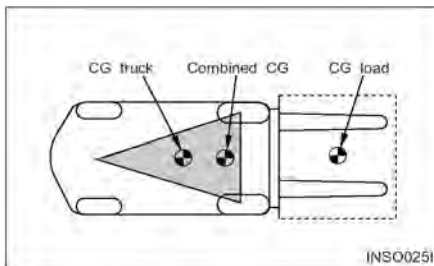
The location of the center of gravity of both the truck and the load is also a factor. This basic principle is used for picking up a load. The ability of the lift truck to handle a load is discussed in terms of center of gravity and both forward and sideways stability.

Center of Gravity (CG)



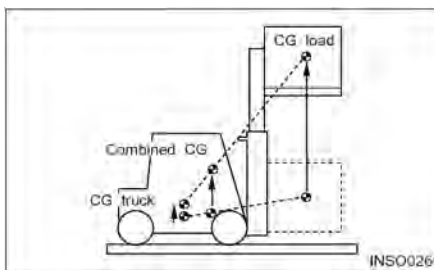
The point within an object, at which the whole weight of the object may be regarded as being concentrated, is called the center of gravity or CG. If the object is uniform, its geometric center will coincide with its CG. If it is not uniform, the CG could be at a point outside of the object. When the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

Stability and Center of Gravity



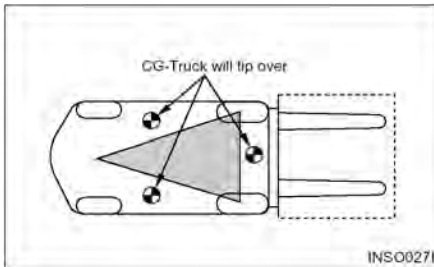
The stability of the lift truck is determined by the location of its CG; or, if the truck is loaded, the combined CG of the truck and load. The lift truck has moving parts and, therefore, has a CG that moves. The CG moves forward or backward as the mast is tilted forward or backward. The CG moves up 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 tip over even when the CG is within the stability triangle.

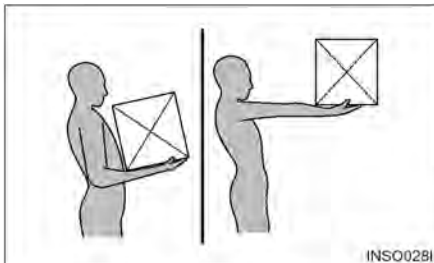
Remember that, unless otherwise indicated, the capacity load shown on the nameplate is for a standard lift truck with standard backrest, forks and mast, and having no special-purpose attachment. In addition, the capacity load assumes that the load center is no further from the top of the forks than it 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.

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.

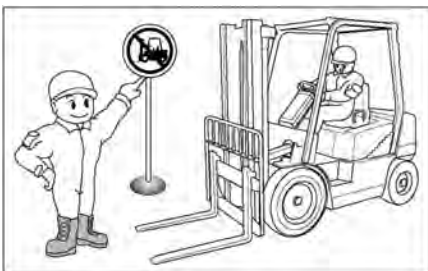
Safety Rules



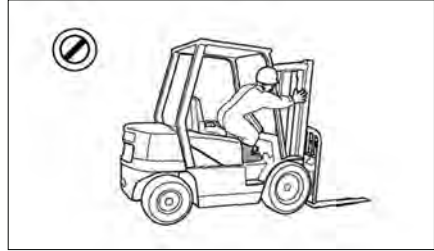
Only properly trained and authorized personnel should operate forklift trucks. Wear a hard hat and safety shoes when operating a lift truck. Do not wear loose clothing.



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

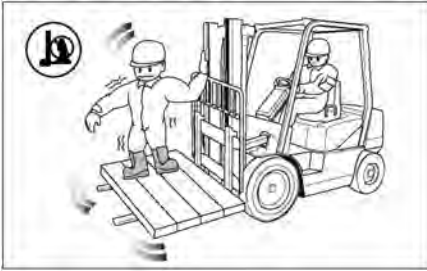


Do not start, stop, turn or change direction suddenly or at high speed. Sudden movement can cause the lift truck to tip over. Slow the speed of your truck and use the horn near corners, exits, entrances, and near people.

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 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 operate your truck without the load backrest extension and overhead guard. Keep the load against the backrest with the mast tilted backward.



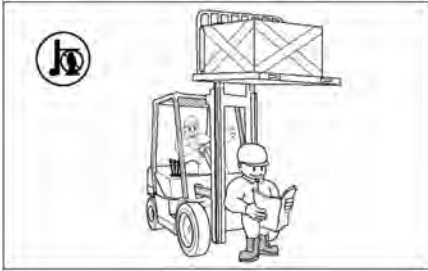
Do not drive on soft ground. Observe all signs, especially those on maximum permitted floor loadings, elevator capacities and clearance heights. Handle loads carefully and check them closely for stability and balance.



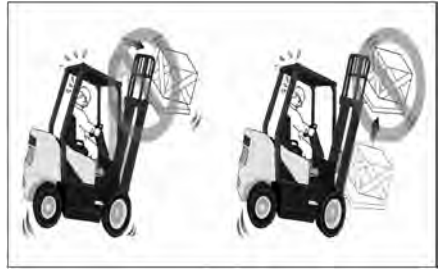
Do not lift or move loads that are not safe. Do not pick up an off center load. Such a load increases the possibility of a tip over to the side. Make sure loads are correctly stacked and positioned across both forks. Always use the proper size pallet. Position the forks as wide as possible under the load. Position loads evenly on the forks for proper balance. Do not lift a load with one fork.



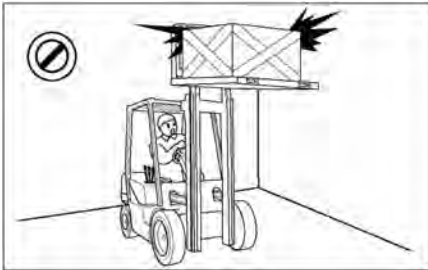
Do not drive on slippery surfaces. Sand, gravel, ice or mud can cause a tip over. If unavoidable, slow down.



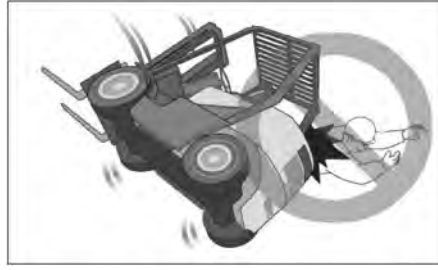
Do not permit anyone to stand or walk under the load or lifting mechanism. The load can fall and cause injury or death to anyone standing below.



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.



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.



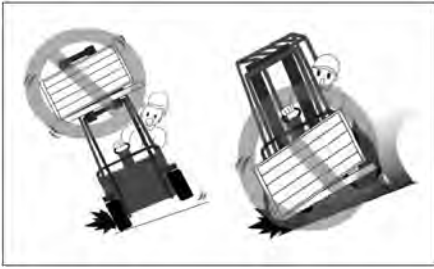
Do not jump off if your truck starts to tip over. Stay in your seat to survive.



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.



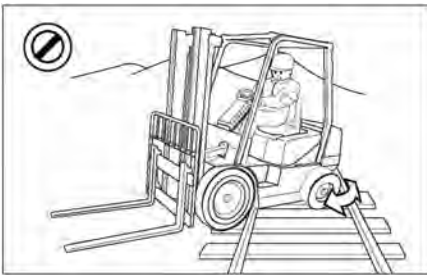
Go up ramps in forward direction and down ramps in reverse direction when moving loads. Never elevate a load with the forklift truck on an incline. Go straight off and straight down. Use an assistant when going up or down a ramp with a bulky load.



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.

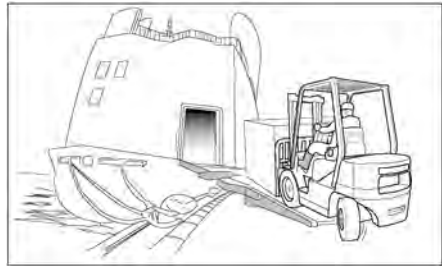


Do not drive in forward direction when loads restrict your visibility. Operate your lift truck in reverse to improve visibility except when moving up a ramp.



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.



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.

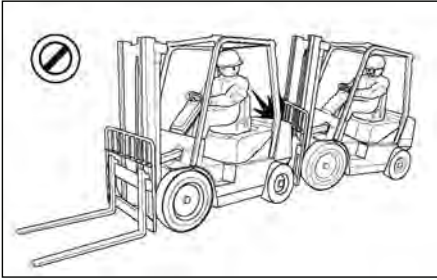
The truck can fall over the edge and cause injury or death.



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 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.



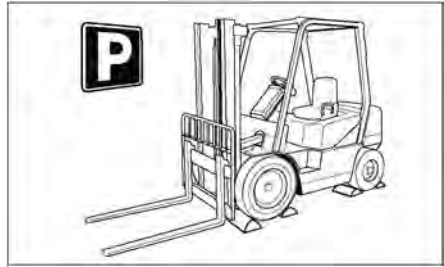
Do not operate your truck close to another truck. Always keep a safe distance from other trucks and make sure there is enough distance to stop safely. Never overtake other vehicles.



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.

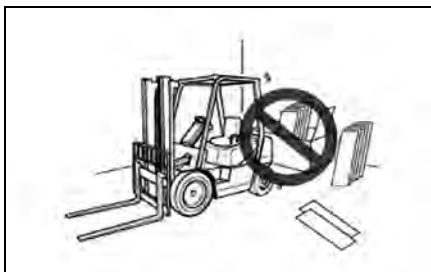


Park your lift truck in authorized areas only. Fully lower the forks to the floor, put direction lever in NEUTRAL position, engage the parking brake, and turn the key to the OFF position. Remove the key and put blocks behind the wheels to prevent the truck from rolling. Shut off your forklift truck when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



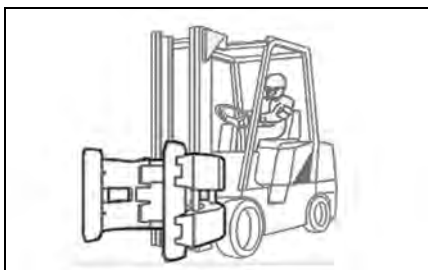
Carrying a load suspended on a chain or a cable may unbalance a truck.

Take extra care around pedestrians with a suspended load as it may sway or even strike them.



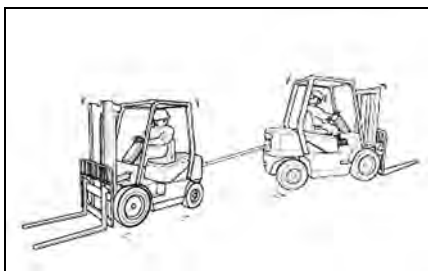
An unloaded forklift may be easier to tip over than a loaded truck.

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.

It is highly recommended that all receive safety education and special training for their operation.



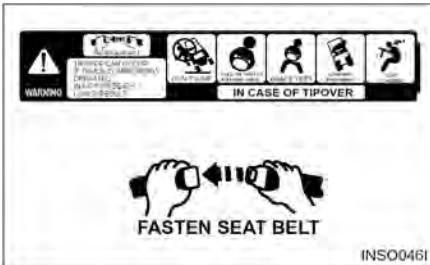
The counterweight draw bar should not be used for towing the forklift or for towing another forklift.

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 Tip over (If Operator Restraint System Equipped)

WARNING

In the event of a tip over, 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 Corporation Industrial Vehicle BG.
468, Injung-ro, Dong-gu, Incheon, Korea 22503

Authorized Representative and Compiler of Technical File According to 2006/42/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 to the appropriate requirements of the Directives 2006/42/EC (Machinery Directive), 2000/14/EC as amended by 2005/88/EC (Noise Emission in the environment by equipment for use outdoors), 97/68/EC amended by 2012/46/EU (Exhaust gas directive) and 2014/30/EU (EMC Directive) based on its design and type, as brought into circulation by us.

Description of the equipment:

Type : Lift Truck, Combustion-engine driven, Counterbalanced

Function : Lifting and Moving materials

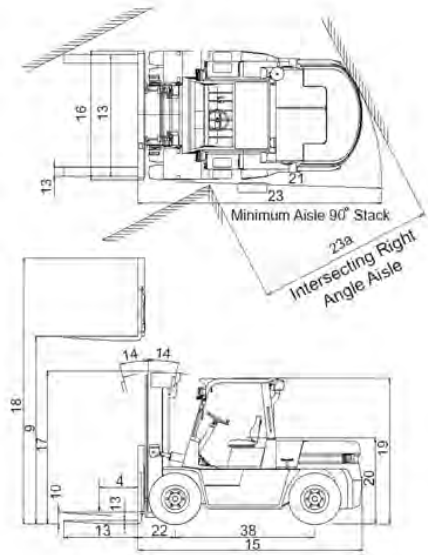
**Family : D70S-7 Series
G70S-7 Series**

**Model Name : D60S-7, D70S-7
D80S-7, D90S-7
G60S-7, G70S-7**

Specifications

CHARACTERISTICS				3 Speed (TIER-IV 80.9KW)	
1	Manufacturer			DOOSAN	DOOSAN
2	MODEL			D60S-7	D70S-7
3	Capacity	at rated load center	kg	6000	7000
4	Load center	distance	mm	600	600
5	Power type	electric, diesel, gasoline, LPG		diesel	diesel
6	Operator type	stand-on, rider-seated		rider-seated	rider-seated
7	Tire type	c=cushion, p=pneumatic		p	p
8	Wheels(x=driven)	number, front/rear		4/2	4/2
DIMENSIONS					
9	Lift with STD	maximum fork height with rated load	mm	3000	3000
10	two stage mast	free lift	mm	205	205
13	Forks	thickness x width x length	mm	60x180x1200	60x180x1200
		fork spacing(minimum x maximum)	mm	410x2032	410x2032
14	Tilt of mast	forward / backward	deg	15/10	43388
15	Overall dimensions	length to face of forks	mm	3618	3697
16		width	mm	2156	2156
17		mast lowered height	mm	2500	2500
18		mast extended height	mm	4340	4340
19		overhead guard height (Cabin)	mm	2468(2535)	2468(2535)
20		seat height	mm	1455	1455
21	Turning radius (minimum outside)		mm	3380	3430
22	Load moment constant		mm	632	632
23	90 stacking aisle	add load length and clearance	mm	3958	4000
23a	90 intersecting aisle		mm	3020	3058
PERFORMANCE					
24	Speed	travel, loaded/unloaded	km/h	30/33.6	29.1/33.3
25		lift, loaded/unloaded	mm/s	485/540	430/470
26		lowering, loaded/unloaded	mm/s	500/450	500/450
28	Drawbar pull	at 1.6 km/h, loaded	kg	6196	6153
30	Gradeability	at 1.6 km/h, loaded	% (deg)	45(24.2)	39(21.4)
WEIGHT					
32	Total weight	unloaded	kg	9093	9783
33	Axle load	with loaded, front/rear	kg	13416/1677	14786/1997
34		without loaded, front/rear	kg	4181/4912	4031/5752
CHASSIS					
35	Tires	number of front/rear		4/2	4/2
36		size, front		8.25x15-14PR	8.25x15-14PR
37		size, rear		8.25x15-14PR	8.25x15-14PR
38	Wheel base		mm	2250	2300
39	Tread width	front/rear	mm	1584/1550	1584/1550
40	Ground clearance	loaded, at the lowest point	mm	196	196
41		loaded, at center of wheelbase	mm	225	225
42	Brakes	service brake		foot/hydraulic	foot/hydraulic
43		parking brake		hand/mechanical	hand/mechanical
DRIVE					
45	Battery	voltage/capacity	v/ah	24/75	24/75
49	Engine	manufacturer/model		DI/D34P	DI/D34P
50		rated output (at rpm)	KW/rpm	80.9/2300 (110ps)	80.9/2300 (110ps)
51		Max. torque	N-m/rpm	375/1600 (38.2Kgf.m)	375/1600 (38.2Kgf.m)
52		cycle/cylinders/displacement	cc	4/4/3409	4/4/3409
55	Transmission	type		Full Auto	Full Auto
56		no. speeds forward/reverse			3/3

3 Speed (TIER-IV 80.9KW)		
DOOSAN	DOOSAN	1
D80S-7	D90S-7	2
8000	9000	3
600	600	4
diesel	diesel	5
rider-seated	rider-seated	6
p	p	7
4/2	4/2	8
3100	3100	9
215	215	10
70x180x1200	70x180x1200	13
410x2092	410x2092	13
43388	43388	14
4014	4040	15
2230	2230	16
2835	2835	17
4375	4375	18
2673(2771)	2673(2771)	19
1526	1526	20
3650	3680	21
725	725	22
4330	4355	23
3308	3327	23a
30.9/46.5	30.2/36.4	24
420/470	410/470	25
500/450	500/450	26
5768	5754	28
31(17.0)	28(15.8)	30
11625	12275	32
17335/2290	18785/2490	33
5095/6530	5015/7260	34
4/2	4/2	35
9.00x20-14PR	9.00x20-14PR	36
9.00x20-14PR	9.00x20-14PR	37
2500	2500	38
1668/1750	1646/1750	39
258	258	40
329	329	41
foot/hydraulic	foot/hydraulic	42
hand/mechanical	hand/mechanical	43
24/75	24/75	45
DI/D34P	DI/D34P	49
80.9/2300 (110ps)	80.9/2300 (110ps)	50
375/1600 (38.2Kgf.m)	375/1600 (38.2Kgf.m)	51
4/4/3409	4/4/3409	52
Full Auto	Full Auto	55
3/3	3/3	56



IA201004

Specifications

CHARACTERISTICS				3 Speed (TIER-IV 55KW)	
1	Manufacturer			DOOSAN	DOOSAN
2	MODEL			D60S-7	D70S-7
3	Capacity	at rated load center	kg	6000	7000
4	Load center	distance	mm	600	600
5	Power type	electric, diesel, gasoline, LPG		diesel	diesel
6	Operator type	stand-on, rider-seated		rider-seated	rider-seated
7	Tire type	c=cushion, p=pneumatic		p	p
8	Wheels(x=driven)	number, front/rear		4/2	4/2
DIMENSIONS					
9	Lift with STD	maximum fork height with rated load	mm	3000	3000
10	two stage mast	free lift	mm	205	205
13	Forks	thickness x width x length	mm	60x180x1200	60x180x1200
		fork spacing(minimum x maximum)	mm	410x2032	410x2032
14	Tilt of mast	forward / backward	deg	15/10	15/10
15	Overall dimensions	length to face of forks	mm	3618	3697
16		width	mm	2156	2156
17		mast lowered height	mm	2500	2500
18		mast extended height	mm	4340	4340
19		overhead guard height (Cabin)	mm	2468(2535)	2468(2535)
20		seat height	mm	1455	1455
21	Turning radius (minimum outside)		mm	3380	3430
22	Load moment constant		mm	632	632
23	90 stacking aisle	add load length and clearance	mm	3958	4000
23a	90 intersecting aisle		mm	3020	3058
PERFORMANCE					
24	Speed	travel, loaded/unloaded	km/h	31.4/34.5	30.8/34.3
25		lift, loaded/unloaded	mm/s	470/540	410/470
26		lowering, loaded/unloaded	mm/s	500/450	500/450
28	Drawbar pull	at 1.6 km/h, loaded	kg	5859	5863
30	Gradeability	at 1.6 km/h, loaded	% (deg)	41.6(22.6)	37.0(20.3)
WEIGHT					
32	Total weight	unloaded	kg	9170	9860
33	Axle load	with loaded, front/rear	kg	13455/1780	14850/2075
34		without loaded, front/rear	kg	4215/4955	4070/5790
CHASSIS					
35	Tires	number of front/rear		4/2	4/2
36		size, front		8.25x15-14PR	8.25x15-14PR
37		size, rear		8.25x15-14PR	8.25x15-14PR
38	Wheel base		mm	2250	2300
39	Tread width	front/rear	mm	1584/1550	1584/1550
40	Ground clearance	loaded, at the lowest point	mm	196	196
41		loaded, at center of wheelbase	mm	225	225
42	Brakes	service brake		foot/hydraulic	foot/hydraulic
43		parking brake		hand/mechanical	hand/mechanical
DRIVE					
45	Battery	voltage/capacity	v/ah	24/75	24/75
49	Engine	manufacturer/model		DI/D34NAP	DI/D34NAP
50		rated output (at rpm)	KW/rpm	55/2300	55/2300
51		Max. torque	N-m/rpm	360/1400	360/1400
52		cycle/cylinders/displacement	cc	4/4/3409	4/4/3409
55	Transmission	type			
56		no. speeds forward/reverse		Full Auto	Full Auto
				3/3	3/3

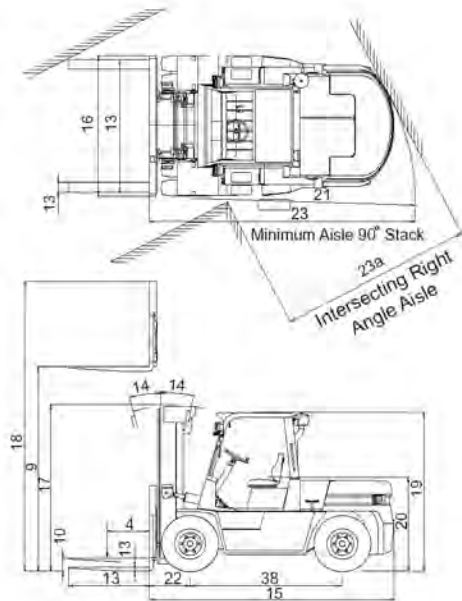
Specifications

CHARACTERISTICS				2 Speed (TIER-IV 55KW)	
1	Manufacturer			DOOSAN	DOOSAN
2	MODEL			D60S-7	D70S-7
3	Capacity	at rated load center	kg	6000	7000
4	Load center	distance	mm	600	600
5	Power type	electric, diesel, gasoline, LPG		diesel	diesel
6	Operator type	stand-on, rider-seated		rider-seated	rider-seated
7	Tire type	c=cushion, p=pneumatic		P	p
8	Wheels(x=driven)	number, front/rear		4/2	4/2
DIMENSIONS					
9	Lift with STD	maximum fork height with rated load	mm	3000	3000
10	two stage mast	free lift	mm	205	205
13	Forks	thickness x width x length	mm	60x180x1200	60x180x1200
		fork spacing(minimum x maximum)	mm	410x2032	410x2032
14	Tilt of mast	forward / backward	deg	15/10	15/10
15	Overall dimensions	length to face of forks	mm	3618	3697
16		width	mm	2156	2156
17		mast lowered height	mm	2500	2500
18		mast extended height	mm	4340	4340
19		overhead guard height (Cabin)	mm	2468(2535)	2468(2535)
20		seat height	mm	1455	1455
21	Turning radius (minimum outside)		mm	3380	3430
22	Load moment constant		mm	632	632
23	90 stacking aisle	add load length and clearance	mm	3958	4000
23a	90 intersecting aisle		mm	3020	3058
PERFORMANCE					
24	Speed	travel, loaded/unloaded	km/h	23.0/25.0	22.6/24.6
25		lift, loaded/unloaded	mm/s	400/430	380/430
26		lowering, loaded/unloaded	mm/s	500/450	500/450
28	Drawbar pull	at 1.6 km/h, loaded	kg	4668	4630
30	Gradeability	at 1.6 km/h, loaded	% (deg)	33.1(18.3)	28.8(16.1)
WEIGHT					
32	Total weight	unloaded	kg	8950	9630
33	Axle load	with loaded, front/rear	kg	13285/1655	14655/1975
34		without loaded, front/rear	kg	4050/4890	3900/5730
CHASSIS					
35	Tires	number of front/rear		4/2	4/2
36		size, front		8.25x15-14PR	8.25x15-14PR
37		size, rear		8.25x15-14PR	8.25x15-14PR
38	Wheel base		mm	2250	2300
39	Tread width	front/rear	mm	1584/1550	1584/1550
40	Ground clearance	loaded, at the lowest point	mm	196	196
41		loaded, at center of wheelbase	mm	225	225
42	Brakes	service brake		foot/hydraulic	foot/hydraulic
43		parking brake		hand/mechanical	hand/mechanical
DRIVE					
45	Battery	voltage/capacity	v/ah	24/75	24/75
49	Engine	manufacturer/model		DI/D34NAP	DI/D34NAP
50		rated output (at rpm)	KW/rpm	55/2300 (74.8ps)	55/2300 (74.8ps)
51		Max. torque	N-m/rpm	330/1400 (33.6Kgf.m)	330/1400 (33.6Kgf.m)
52		cycle/cylinders/displacement	cc	4/4/3409	4/4/3409
55	Transmission	type		Power Shift	Power Shift
56		no. speeds forward/reverse		2/2	2/2

Specifications

CHARACTERISTICS				2 Speed (TIER-3 PSI 4.3L)		
1	Manufacturer			DOOSAN	DOOSAN	1
2	MODEL			G60S-7	G70S-7	2
3	Capacity	at rated load center	kg	6000	7000	3
4	Load center	distance	mm	600	600	4
5	Power type	electric, diesel, gasoline, LPG		LPG	LPG	5
6	Operator type	stand-on, rider-seated		rider-seated	rider-seated	6
7	Tire type	c=cushion, p=pneumatic		p	p	7
8	Wheels(x=driven)	number, front/rear		4/2	4/2	8
DIMENSIONS						
9	Lift with STD	maximum fork height with rated load	mm	3000	3000	9
10	two stage mast	free lift	mm	205	205	10
13	Forks	thickness x width x length	mm	60x180x1200	60x180x1200	13
		fork spacing(minimum x maximum)	mm	410x2032	410x2032	
14	Tilt of mast	forward / backward	deg	15/10	15/10	14
15	Overall dimensions	length to face of forks	mm	3618	3697	15
16		width	mm	2156	2156	16
17		mast lowered height	mm	2500	2500	17
18		mast extended height	mm	4340	4340	18
19		overhead guard height(Cabin)	mm	2468(2535)	2468(2535)	19
20		seat height	mm	1455	1455	20
21	Turning radius (minimum outside)		mm	3380	3430	21
22	Load moment constant		mm	632	632	22
23	90 stacking aisle	add load length and clearance	mm	3958	4000	23
23a	90 intersecting aisle		mm	3020	3058	23a
PERFORMANCE						
24	Speed	travel, loaded/unloaded	km/h	22.6/23.7	22.5/23.4	24
25		lift, loaded/unloaded	mm/s	380/410	380/410	25
26		lowering, loaded/unloaded	mm/s	490/460	490/460	26
28	Drawbar pull	stall, loaded	kg	5489	5477	28
		at 1.6 km/h, loaded	kg	4262	4236	
30	Gradeability	at 1.6 km/h, loaded	%	30	26.5	30
WEIGHT						
32	Total weight	unloaded	kg	8745	9425	32
33	Axle load	with loaded, front/rear	kg	13250/1495	14585/1840	33
34		without loaded, front/rear	kg	4040/4705	3835/5590	34
CHASSIS						
35	Tires	number of front/rear		4/2	4/2	35
36		size, front		8.25x15-14PR	8.25x15-14PR	36
37		size, rear		8.25x15-14PR	8.25x15-14PR	37
38	Wheel base		mm	2300	2300	38
39	Tread width	front/rear	mm	1584/1550	1584/1550	39
40	Ground clearance	loaded, at the lowest point	mm	176	176	40
41		loaded, at center of wheelbase	mm	205	205	41
42	Brakes	service brake		foot/hydraulic	foot/hydraulic	42
43		parking brake		hand/mechanical	hand/mechanical	43
DRIVE						
45	Battery	voltage/capacity	v/ah	12/75	12/75	45
49	Engine	manufacturer/model		PSI4.3L(TIER-3)	PSI4.3L(TIER-3)	49
50		rated output (at rpm)	KW(hp)/rpm	70(93.8)/2500	70(93.8)/2500	50
51		max. torque	N-m(lb-ft)/rpm	283.9(209.4)/1800	283.9(209.4)/1800	51
52		cycle/cylinders/displacement	cc	4/6/4294	4/6/4294	52
55	Transmission	type		Power Shift	Power Shift	55
56		no. speeds forward/reverse		2/2	2/2	56

2 Speed (Non Certi. PSI 4.3L)		
DOOSAN	DOOSAN	1
G60S-7	G70S-7	2
6000	7000	3
600	600	4
LPG	LPG	5
rider-seated	rider-seated	6
p	p	7
4/2	4/2	8
3000	3000	9
205	205	10
60x180x1200	60x180x1200	13
410x2032	410x2032	
15/10	15/10	14
3618	3697	15
2156	2156	16
2500	2500	17
4340	4340	18
2468	2468	19
1455	1455	20
3380	3430	21
632	632	22
3958	4000	23
3020	3058	23a
22.6/23.7	22.5/23.4	24
380/410	380/410	25
490/460	490/460	26
5489	5477	28
4262	4236	
30	26.5	30
8745	9425	32
13250/1495	14585/1840	33
4040/4705	3835/5590	34
4/2	4/2	35
8.25x15-14PR	8.25x15-14PR	36
8.25x15-14PR	8.25x15-14PR	37
2300	2300	38
1584/1550	1584/1550	39
176	176	40
205	205	41
foot/hydraulic	foot/hydraulic	42
hand/mechanical	hand/mechanical	43
12/75	12/75	45
PSI4.3L(TIER-3)	PSI4.3L(TIER-3)	49
70(93.8)/2500	70(93.8)/2500	50
283.9(209.4)/1800	283.9(209.4)/1800	51
4/6/4294	4/6/4294	52
Power Shift	Power Shift	55
2/2	2/2	56



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Noise &Vibration

Noise

Model		Noise Level [Unit : dB(A)]	
		Sound Pressure Level at Operator's ear (Leq.)	Guaranteed Sound Power Level (L _{WA})
		prEN 12053	by new Directive 2000/14/EC
D60S-7, D70S-7, D80S-7, D90S-7 (3 speed)	OVHD	85	107
	With Cabin	79.7	107
D60S-7, D70S-7 (2 speed)	OVHD	84	107
G60S-7, G70S-7 (2 Speed)	OVHD	79.7	107
	With Cabin	81.5	107

- * Test Model: D70S-7 (3 speed, Overhead Guard)
- * Test Model: D80S-7 (3 speed, Cabin)
- * Test Model: D70S-7 (2 speed, Overhead Guard)
- * Test Model: G70S-7 (2 speed, Overhead Guard, Cabin)

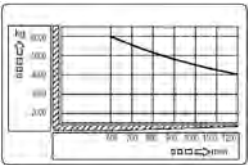
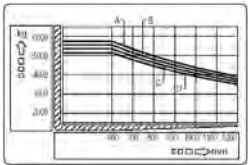
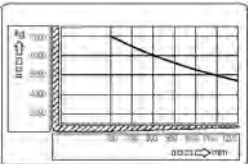
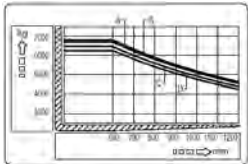
Vibration (weighted overall value)

Unit: m/sec²

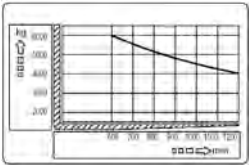
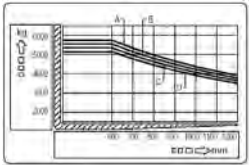
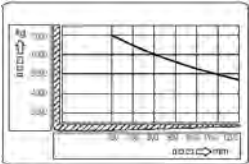
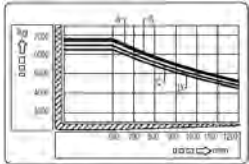
Model	Measuring Place		
	Seat	Steering Wheel	Floor Plate
D60/70/80/90S-7 (3 speed)	0.06	0.2	0.03
D60/70S-7 (2 speed)	0.03	0.35	0.04
G60/70S-7 (2 speed)	0.04	0.2	0.05

* Test course: Concrete road

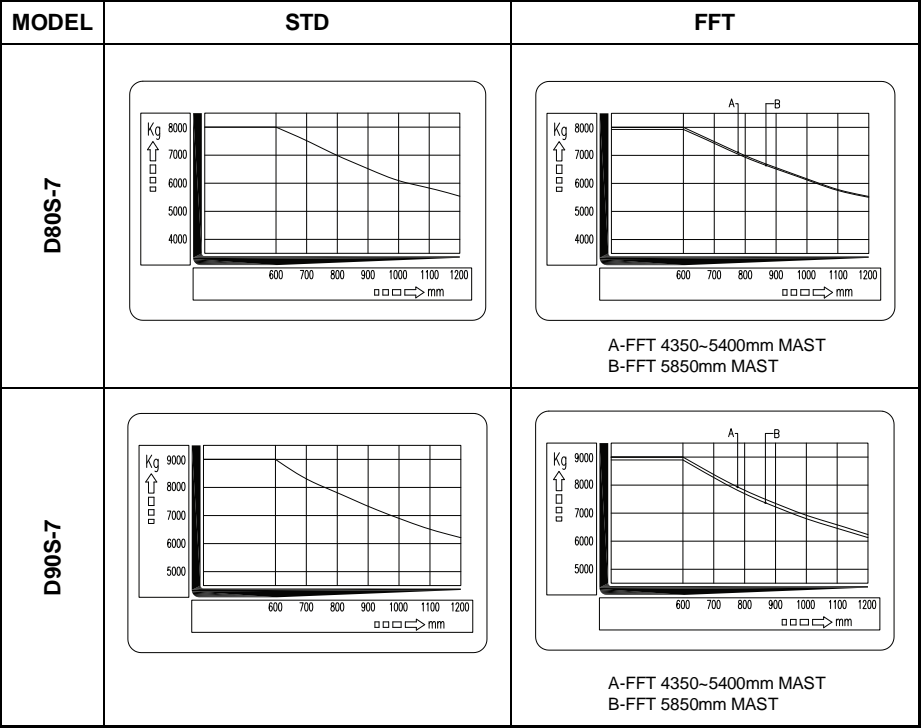
Capacity Chart - Without Side Shifter

MODEL	STD	FFT
D60S-7		 <p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p>
D70S-7		 <p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p>

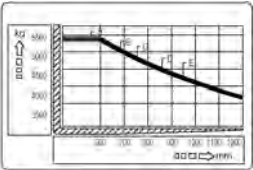
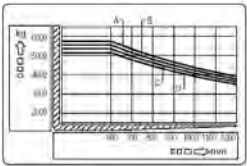
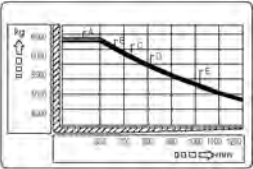
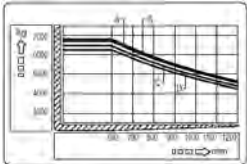
Capacity Chart - Without Side Shifter

MODEL	STD	FFT
G60S-7		 <p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p>
G70S-7		 <p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p>

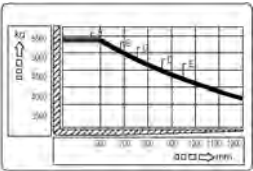
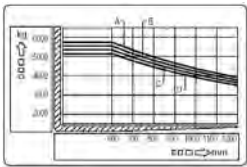
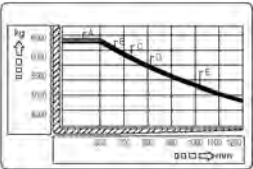
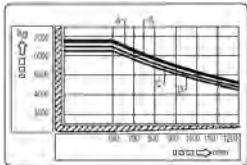
Capacity Chart - Without Side Shifter



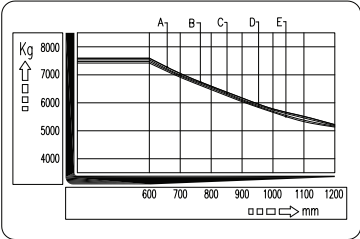
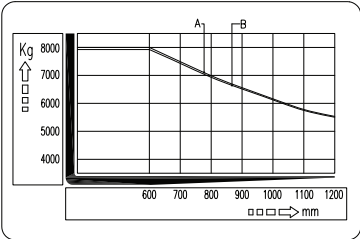
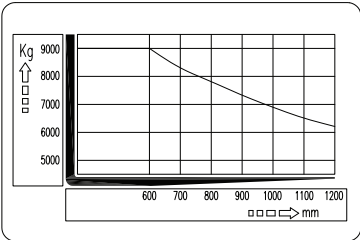
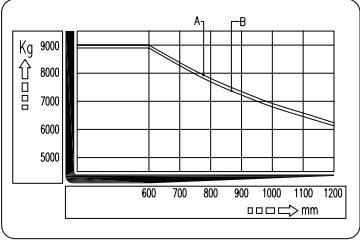
Capacity Chart - With Side Shifter

MODEL	STD	FFT
D60S-7	<div><p>A. 3000 ~ 4000 mm (118 in - 158 in) MFH MAST B. 4500 mm (177 in) MFH MAST C. 5000 mm (197 in) MFH MAST D. 5500 mm (217 in) MFH MAST E. 6000 mm (236 in) MFH MAST</p></div>	<div><p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p></div>
D70S-7	<div><p>A. 3000 ~ 4000 mm (118 in - 158 in) MFH MAST B. 4500 mm (177 in) MFH MAST C. 5000 mm (197 in) MFH MAST D. 5500 mm (217 in) MFH MAST E. 6000 mm (236 in) MFH MAST</p></div>	<div><p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p></div>

Capacity Chart - With Side Shifter

MODEL	STD	FFT
G60S-7	<div><p>A. 3000 ~ 4000 mm (118 in - 158 in) MFH MAST B. 4500 mm (177 in) MFH MAST C. 5000 mm (197 in) MFH MAST D. 5500 mm (217 in) MFH MAST E. 6000 mm (236 in) MFH MAST</p></div>	<div><p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p></div>
G70S-7	<div><p>A. 3000 ~ 4000 mm (118 in - 158 in) MFH MAST B. 4500 mm (177 in) MFH MAST C. 5000 mm (197 in) MFH MAST D. 5500 mm (217 in) MFH MAST E. 6000 mm (236 in) MFH MAST</p></div>	<div><p>A. FFT 4550mm MAST B. FFT 5000mm MAST C. FFT 5600mm MAST D. FFT 6050mm MAST</p></div>

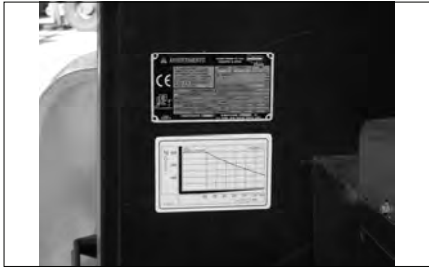
Capacity Chart - With Side Shifter

MODEL	STD	FFT
D80S-7	<div><p>A1-STD 3100~3600mm MAST B1-STD 4100mm MAST C1-STD 4600mm MAST D1-STD 5100mm MAST E1-STD 5600mm MAST</p></div>	<div><p>A-FFT 4350~5400mm MAST B-FFT 5850mm MAST</p></div>
D90S-7	<div></div>	<div><p>A-FFT 4350~5400mm MAST B-FFT 5850mm MAST</p></div>

Serial Number

Serial Number Locations

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



Typical Example

Lift Truck Serial Number



Typical Example

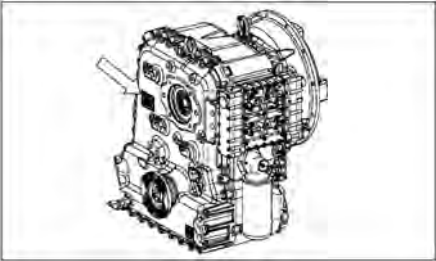
Diesel Engine(G2 D34)

G2 D34

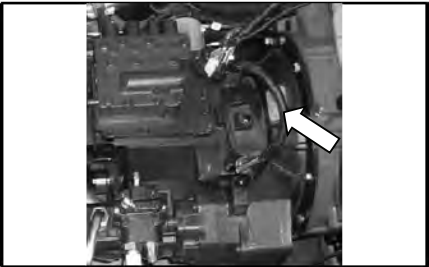


PSI 4.3L

Engine Serial Number



D60/70/80/90S-7 (3 speed)

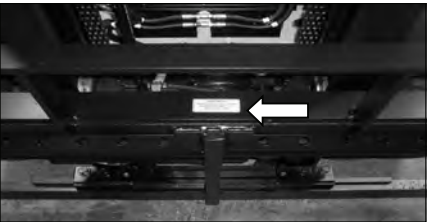


D(G)50/60/70S-7 (2 speed)

Transmission Serial Number



Drive Axle Serial Number (OCDB type)



Side shifter Serial Number (If equipped)

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.

WARNING

The load capacity of lift truck should never be exceeded. Overloading of the lift truck could be a hazard to the safety of others, material, or damage the truck.

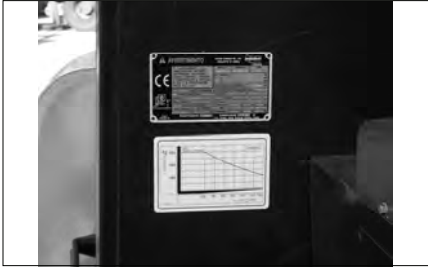
Operator's Warning Plate



Typical Example

Located on the left side of operator's seat

Identification, Lift Capacity and Attachment Plate



Typical Example

Located on the right side of operator's seat

Lift Truck Capacity Rating

DO NOT exceed allowable lift truck working capacity load ratings.

The capacity of the lift truck is given by weight and distance to the load center. For example: a capacity of 1200kg(2640 lb) at 600mm(24in) means that the lift truck can lift 1200kg(2640lb) if the load center is 600 mm (24in) from both the vertical and horizontal faces of the forks.

Before attempting to lift any load, ensure that the weight and load center combination is within the capacity of the lift truck as shown on the capacity rating plate. To determine the load center, measure the distance from the face of the carriage to the gravitational center of the load.

The rated capacity on the plate refers to the capacity of the lift truck as it left the factory. Subsequent changes of any form to the equipment or battery can alter the lift truck's rating.

The rated capacity of the lift truck applies to operating conditions where the lift truck is on level ground. The capacity of the lift truck is reduced on inclines.

Below are abbreviations that may appear on the Identification, Lift Capacity and Attachment Plate and their meanings.

Mast Abbreviations

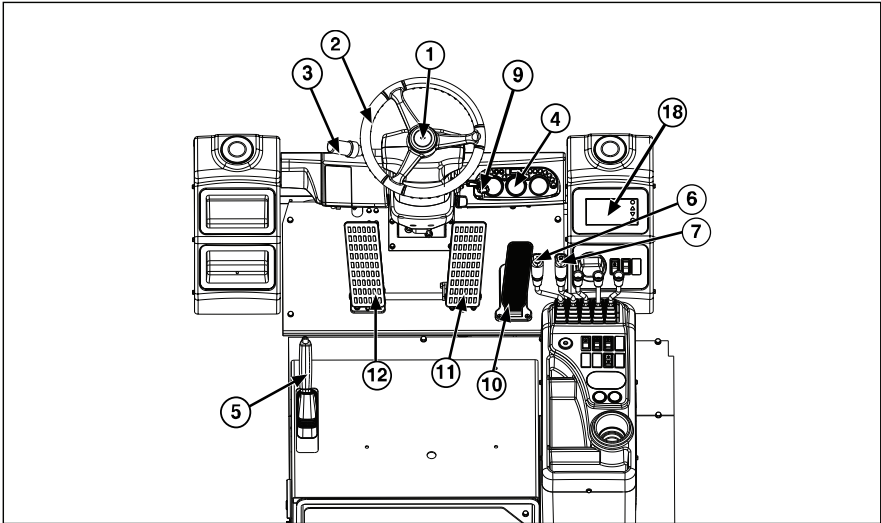
- STD -** Standard Mast
(single inner member, low free lift)
- FF -** Full Free Lift Mast
(single inner member with high free lift duplex cylinder)
- FFT -** Triple Lift Mast (two inner members) with either low or full free lift characteristics.
- QUAD** Quadruple (Quad) Mast (with three inner members)

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

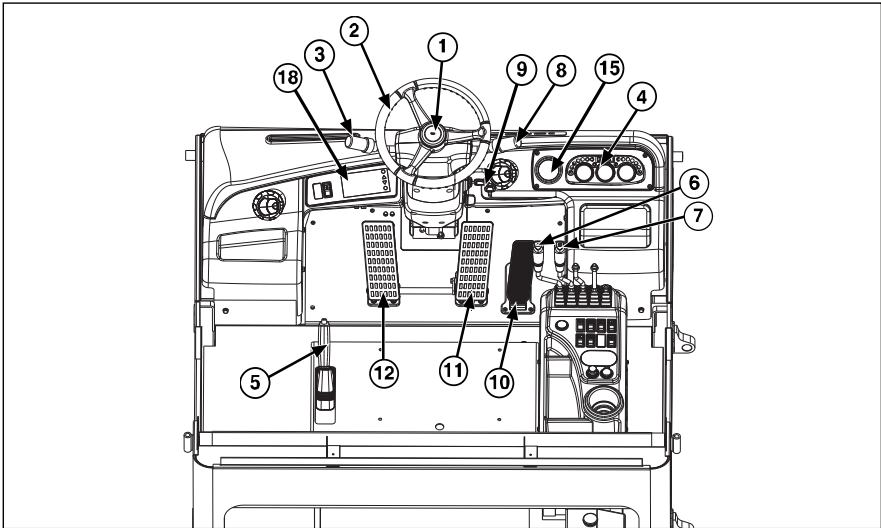
Attachment Abbreviations (includes Special Forks)

- SC-** Special Carriage-increased width, height or outreach
- SSS -** Shaft-type Side shift Carriage
- HSS -** Hook-type Side shift Carriage (ITA)
- CW -** Counterweight
- SF -** Special Forks
- SWS -** Swing Shift, Side shift
- RAM -** Ram or Boom
- DBC BH -** 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 -** Side shift-Side Tilt Carriage

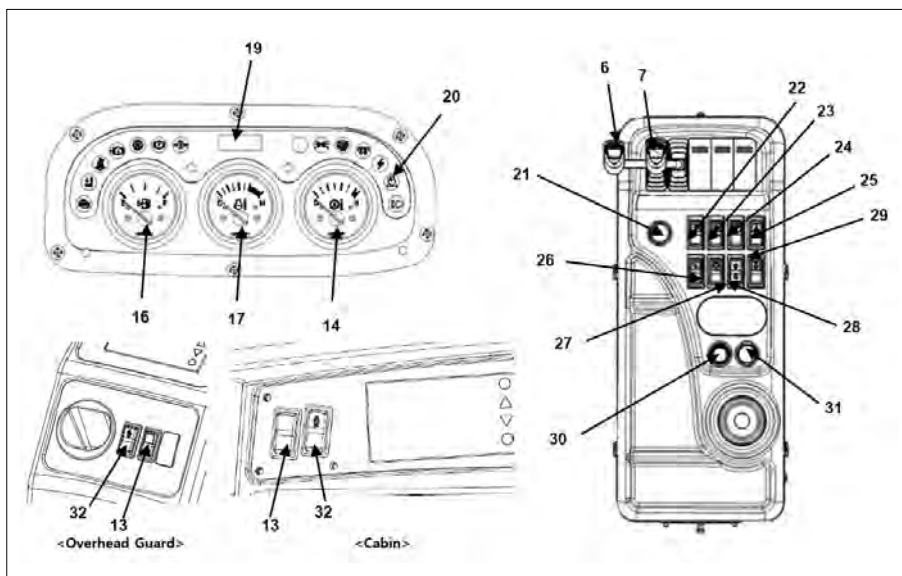
Operator's Station and Monitoring Systems



Overhead Guard



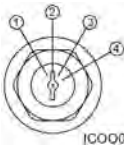
Cabin



- | | |
|--|---|
| 1. Horn Switch | 17. Engine Coolant Temperature Gauge |
| 2. Steering Wheel | 18. SCR Display (81kW Engine Only) |
| 3. Forward/Backward Control Lever | 19. Hour Counter |
| 4. Instrument Panel | 20. Warning Lamp Panel |
| 5. Parking Brake Lever. | 21. Plug |
| 6. Lift Lever | 22. Headlamp & Light Switch |
| 7. Tilt Lever | 23. Automatic Transmission Switch(Diesel) |
| 8. Turn Signal Lever | 24. Inching Switch (fuel saving, 3 speed) |
| Front wiper & washer (optional) | 25. Danger Lamp Switch (optional) |
| 9. Start Key Switch | 26. Rear Lamp Switch (optional) |
| 10. Accelerator Pedal | 27. Rear Wiper, Washer Switch (cabin) |
| 11. Service Foot Brake Pedal | 28. Idle RPM Selector Switch (Diesel) |
| 12. Inching Control Pedal | 29. Emergency Engine Stop Switch (Diesel) |
| 13. SCR Cleaning-DeSOx Switch (Diesel) | 30. Cigar Jack Connector (24V, cabin) |
| 14. Transmission Oil Temperature Gauge | 31. Power Jack Connector (12V, cabin) |
| 15. Speedometer (cabin option) | 32. Multi Torque Switch (Diesel) |
| 16. Fuel Level Gauge(Diesel) | |

Instrument Panel

1. Engine Ignition Start Switch



The key switch is a four position switch. Position (1) is ACCESSORY ON. Position (2) is OFF. Position (3) is ON or RUN and accessory ON.

Position (4) is START, which engages the starter.

After the key has been turned to the START position, the key must be returned to the OFF position before it can be turned to the START position again.

2. Engine Coolant Gauge



Indicates engine coolant temperature. If the pointer moves into the red band while operating the lift truck, the engine is overheated. Pull over the lift truck and stop the engine. Inspect the cooling system for any problem. The

pointer will be in the red band when the coolant temperature reaches approximately 110 °C on all engines.

3. Transmission Oil Temperature Gauge



Indicates transmission oil temperature. If the pointer moves into the red band while operating the lift truck, the transmission is overheated. Pull over the lift truck and stop the engine.

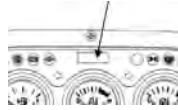
Check the system for a malfunction. The pointer will be in the red band when the transmission oil temperature reaches approximately 125 °C.

4. Fuel Level Gauge



Indicates current level of fuel in the fuel tank. Replenish fuel when the Level Gauge approaches the "E" marking during operation.

5. Hour Counter



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.

6. Speedometer

Indicates the truck travelling speed (km/h).



7. Turn Signal Lever (Optional)



This is the lever to indicate the turning direction of the lift truck. As this lever is maneuvered, the signal lamp blinks.

R	Turn to the right
N	Neutral
L	Turn to the left

8. Horn Switch



To give alarm to fellow worker(s) around and in the path of your truck, press the rubber at the center of the hand wheel.

⚠ WARNING

Don't run the truck while the alarm is sounding. It is dangerous to do so, since poor effect is expected.

9. Light Switch

Switch \ Light	1 st Step	2 nd Step
Clearance Lamp	O	X
Tail Lamp	O	X
License plate Lamp	O	X
Instrument Lamp	O	X
Head Lamp	O	X

O: means "lights on"

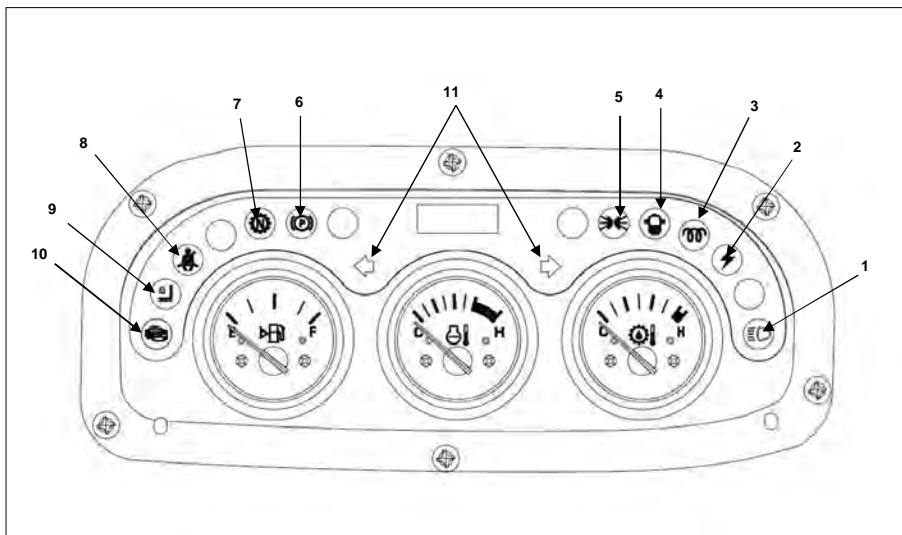
X: means "lights off"

These lamps light up regardless of position of the ignition switch.

10. Hazard Lamp Switch (Optional)

Push the button to activate the hazard lamp. Hazard lamp put the same with turn signal lamp.

Instrument Panel



- | | |
|--|--|
| 1. Upper indicator light | 7. Transmission neutral position light |
| 2. Alternator indicator light | 8. Seat belt warning light |
| 3. Diesel engine start preheat indicator light | 9. Seat leaving warning light |
| 4. Water-in-fuel warning light | 10. Engine warning light |
| 5. Front flood light | 11. Directional turning indicator lights |
| 6. Parking brake indicator light | |

(1) Upper Indicator Light



Indicates the upper indicator light is on.

(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.

WARNING

If the alternator light (2) flickers, there may be a problem in the charging function of the equalizer. Contact a nearby service center to protect the batteries from being damaged.

(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-up.

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) Water-in-fuel Warning Light (Diesel)



Indicates the fuel contains water. Open the sensor under the fuel filter to remove the water.

(5) Front Floodlights



Push down the switch (22), to the first step, to turn the front floodlights on.

(6) Parking Indicator Light



The light will come ON when the parking lever is in applied position.

⚠ WARNING

Flashing parking indicator lamp (6) warns a malfunction detected in the charging function of the brake system which can lead to a serious accident. Stop the operation and call the nearest dealer to check up the brake system.

(7) Transmission Neutral Position Light



Indicates neutral position of the transmission.

(8) Seat Belt Warning Light



Indicates when the seat belt is not fastened by operator.

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

The light should go off after engine is started.

(9) Seat Leaving Warning Light



When operator leaves seat without stopping the engine, hydraulic control lever will not function.

(10) Engine Check Lamp



The Engine Control System has built-in fault diagnostics. Detected system faults can be displayed by the Engine Check Lamp 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 engine check lamp 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). After the ignition key is turned ON and push acceleration pedal 3times quickly, engine check lamp will blink as Diagnostic Fault Codes (DFC) or flash codes. Once a fault occurs the engine check lamp will light up and remain ON.

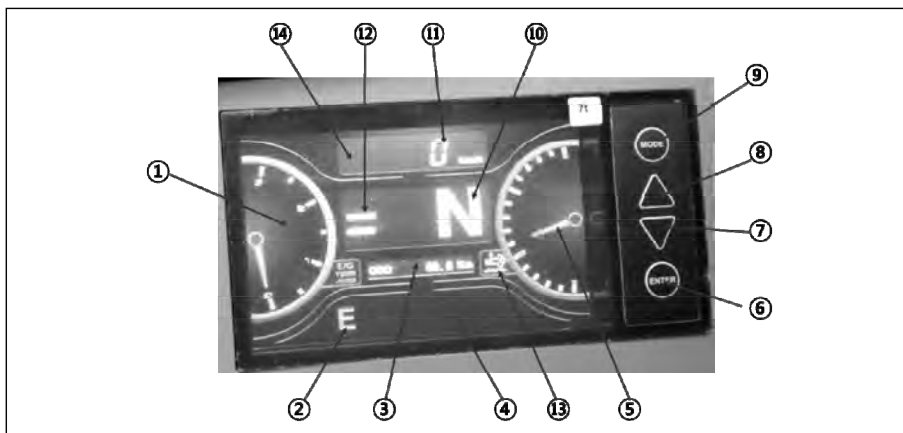
This signals the operator that a fault has been detected by the ECU.

(11) Directional Turning Indicator Light

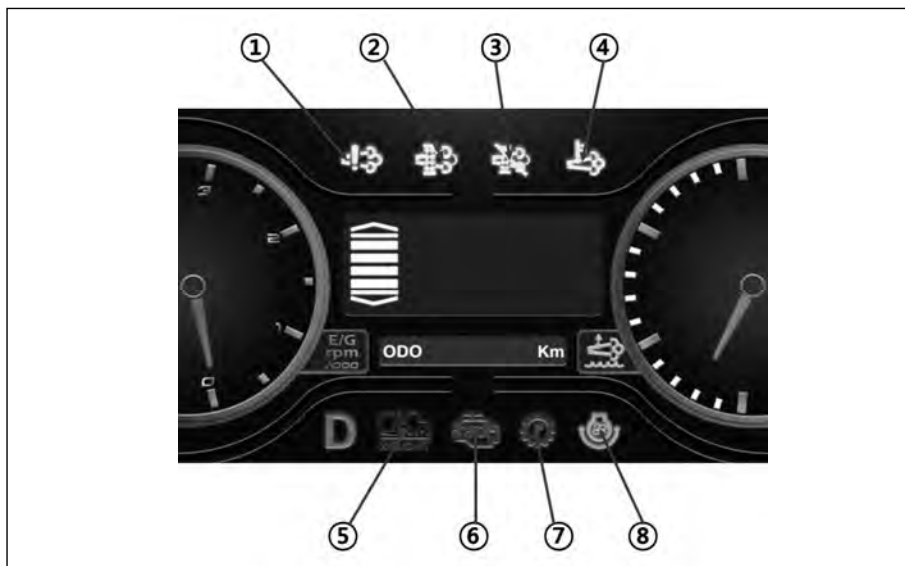


Pull the lever to activate the right turn signal. Push the lever to activate the left turn signal.

SCR Display (Diesel 81kW Only)



1. Tachometer (RPM GAUGE)
 - Display engine RPM with 1/1000 unit.
2. MULTI TORQUE MODE for engine
 - Display mode of multi torque, for setting mode, refer page 72.
 - "S" means "standard mode" with registered in specification sheet. "E" means "economic mode" and this mode shall restrict max rpm 2320 and derate max torque and power. "D" means "driving mode" and this mode shall restrict max rpm 2520 and derate max torque and power. Refer to service manual for the derated max torque level and power of "E" and "D" mode.
3. ODOMETER
 - Accumulated total mileage.
4. WARNING LAMP
 - Warning Lamp for Transmission and engine etc.
5. DEF/Ad-Blue LEVEL GAUGE
 - Display DEF/Ad-Blue Level, residual quantity of DEF/Ad-Blue in DEF/Ad-Blue Tank (DEF /Ad-Blue: Fluid for SCR System)
6. ENTER (SELECT)
 - Key for operating LCD Display.
7. DOWN (RIGHT)
 - Key for operating LCD Display.
8. UP (LEFT)
 - Key for operating LCD Display.
9. MODE (BACK)
 - Key for operating LCD Display by pressing button.
10. DIRECTION (T/M STATUS)
 - Display Status for direction. "N" or "F" or "R"
11. SPEEDOMETER
 - Display the current vehicle speed.
12. GEAR DISPLAY (AUTO / MANUAL)
 - The gear range indicator bars will indicate which gear is selected by displaying the corresponding number of bars. The forward and reverse indicator bars will be "OFF" when the transmission is in "MANUAL MODE". When transmission is in "AUTOMATIC MODE", all the gear range indicator bars and both travel direction indicators will be "ON".
13. DEF/Ad-Blue Level Indicator
 - Indicator lamps for DEF/Ad-Blue Level
 - a. **For USA**
 - Over 10%: Green ON
 - 5~10%: Yellow ON
 - 2.5~5%: Red ON
 - Below 2.5%: Red Blink
 - b. **For Europe**
 - Over 10%: Green ON
 - 5~10%: Yellow ON
 - Below 5%: Red Blink
14. Speed limit Symbol
 - If speed limit option selected, the symbol is on.



1. DEF/Ad-Blue FAULT WARNING

- If the lamp is turned on, after-treatment system should be checked.
- Refer page. 85 (Section "Detecting control failure")

2. SCR Cleaning-DeSOx Request / On

- In order that the SCR system may maintain its exhaust cleaning efficiency at a proper level, it should be periodically initialized - "SCR cleaning."
- Once the indicator lamp lights up, you should conduct the SCR cleaning process. During this process you can't use the vehicle.
- Pop-up window and the lamp will be turned on 10 hours before if "Service SCR Cleaning-DeSOx" needed.
- "Service SCR Cleaning-DeSOx" will take about 30 minutes; the lamp will blink during the process.
- Press the "SCR Cleaning-DeSOx" switch continuously for 3 sec, SCR cleaning will be started. For detailed instructions refer to p.72.

3. SCR Cleaning-DeSOx Inhibition

- When the symbol is turned on and "Active SCR Cleaning-DeSOx" is inhibited by pressing the inhibition switch. In places where there is a risk of fire or explosion, to prevent fire or explosion caused by flammable substances or particles inhibition switch should be used.

4. High Exhaust System Temperature (HEST)

- While SCR Cleaning-DeSOx for after-treatment, the temperature of exhaust gas will increase over 600℃. If this lamp on, operator should warn passengers around the truck not to approach or touch exhaust system especially rear side. And if the place of your truck has flammable material (Gas, Particle etc.) please replace truck to other safety zone.

5. Weight Scale Mode

- Press "MODE" once, Display will change to weight scale mode, for detailed instructions, refer to page 61.

6. Engine Check Lamp (RED)

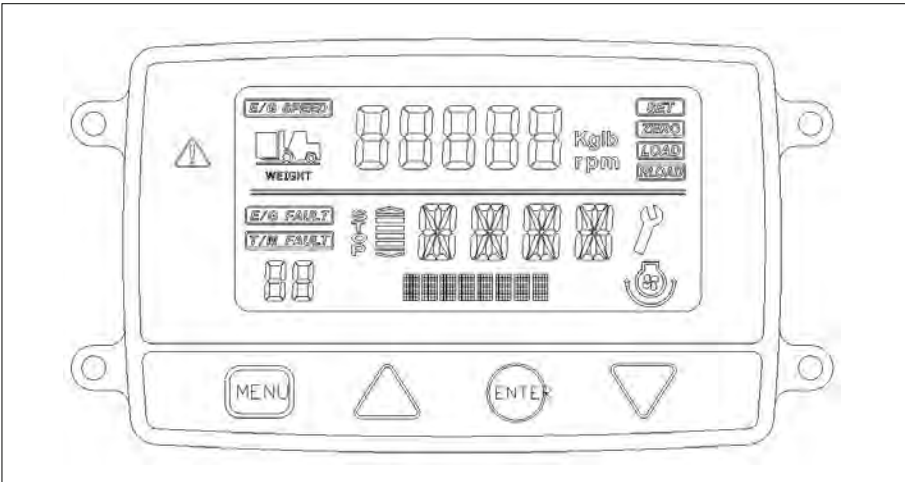
- Malfunction or necessary for diagnostic of engine, this lamp will light on.
- To check error, press "MODE" 3 seconds, display will converse to main menu then you can use check function. For detailed instructions refer to p.85.

7. Transmission Check Lamp (RED)

- Malfunction or necessary for diagnostic of transmission, this lamp will light on.
- To check error, press "MODE" 3 seconds, display will converse to main menu then you can use check function. For detailed instructions refer to p.69.

8. Fan Reverse (For D100 Model)

LCD Instrument Panel (Option) - (Diesel 55kW Only)



1. Mode (Function) Configuration

- Engine RPM mode
- Transmission information display mode
- Weight scale (load) display mode
- Transmission error (TCU FAULT) display mode
- Engine error (ECU FAULT) display mode

2. Operation Method

The initial screen at start-up shows engine RPM and transmission information. The upper column shows engine RPM and weigh scale, and the lower column shows transmission information, transmission error and engine error.

1) How to change modes



Pressing the 'UP' button switches engine RPM and weight scale.



Pressing the 'DOWN' button switches; transmission information → engine error → transmission error

2) Weight scale operation

(1) Initial setting

Weight scale requires initial setting for operation. Perform setting under no-load, load (of known weight), and max. load conditions.

- How to change weight scale

Press MENU button for 2 seconds to light up the SET and ZERO at the top right screen. Then, press MENU button for 3 times to blink the current weight scale. Change the scale (unit) with UP and DOWN buttons, and press ENTER for 1 second to save the setting.

- No-load (zero) setting

Press MENU button for 2 seconds to light up the SET and ZERO at the top right screen. When '----' blinks in the figure display field, enter '0' using UP and DOWN buttons. After entering the weight, press ENTER for 1 second to save the setting (ZERO blinks for 3 seconds).

- Setting in loaded condition

Press 'MENU' button for 2 seconds to light up the SET and ZERO at the top right screen. Then, press MENU button again to light up the SET and LOAD. When '----' blinks in the figure display field, enter the weight of the load using UP and DOWN buttons. After entering the weight, press ENTER for 1 second to save the setting (SET and LOAD blink for 3 seconds).

- Setting in max. load condition

Press 'MENU' button for 2 seconds to light up the SET and ZERO at the top right screen. Then, press MENU button twice to light up the SET and RLOAD. When '----' blinks in the figure display field, enter the weight of the load using UP and DOWN buttons. After entering the

weight, press ENTER for 1 second to save the setting (SET and RLOAD blink for 3 seconds).

3) Error display

- In the initial screen (engine RPM & transmission information) if there is any error, ECU ERR or TCU ERR appears.
- If both transmission (TCU) error and engine error (ECU FAULT) occur, TCU DIAG and ECU DIAG appear in turns.
- When switched to the engine error mode after an engine error (ECU FAULT), the sequential number and the code of the error are displayed sequentially. The code is ECU DIAG.
- When switched to the transmission error mode after a transmission error (TCU FAULT), the sequential number and the code of the error are displayed sequentially. The code is TCU DIAG.
- CAN ERR appears in case of a communication error.

3. Caution

The product is not an objective of measurement related act.

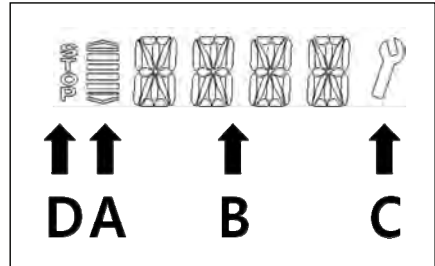
Therefore, the product is not a measuring device which requires type approval or verification, the measurement made with this product cannot be used for legal measurement purposes such as selling or evidence directly.

However, the accuracy should be regularly checked and calibrated as necessary by initial adjustment.

4. Detail Description

b. Transmission

A transmission display is to the right of the steering wheel on the dash. The LCD indicates gears, direction of travel and error codes.



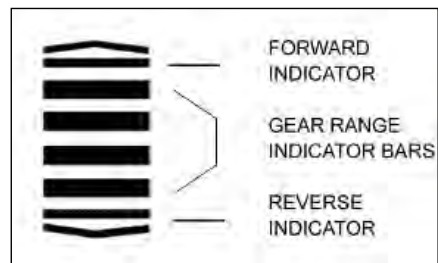
(A) Indicates travel direction and gear selection. See the figure below for more detailed information

(B) Indicates normal operation and error codes. For a list of error codes, see "Transmission Error Codes" in "When Required" maintenance section.

NOTE: Most codes are only two digits.

(C) Indicates that error codes have occurred and are stored.

(D) Indicates that operation must be stopped immediately to prevent damage to transmission and hazardous operation condition.

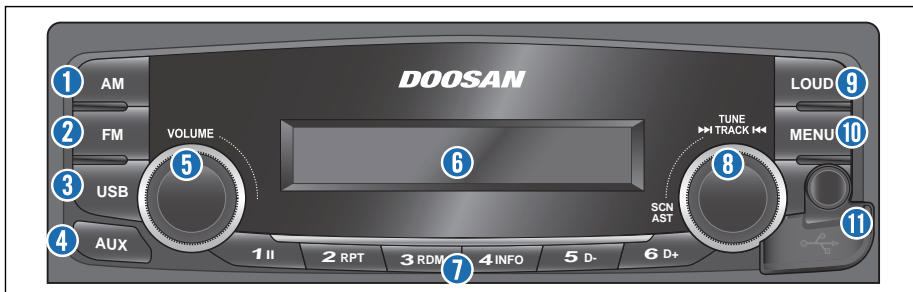


The gear range indicator bars will indicate which gear is selected by displaying the corresponding number of bars.

The forward and reverse indicator bars will be "OFF" when the transmission is in "MANUAL MODE." When transmission is in "AUTOMATIC MODE," all the gear range indicator bars and both travel direction indicators will be "ON".

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** [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 ([4 INFO] 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.

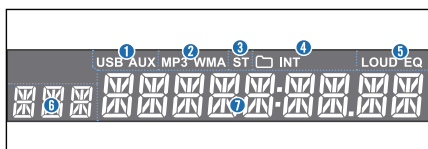
10. **MENU** button: Enter the sound setting mode (press); show/hide the clock or when power is off, enter the clock setting mode (press and hold).

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



: Intro playback



: Repeat playback



: Random playback

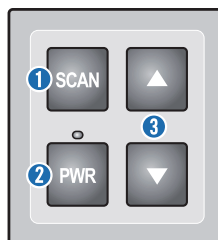
5. **LOUD/EQ** indicators for sound effect

LOUD: Loudness mode on

EQ: EQ mode on

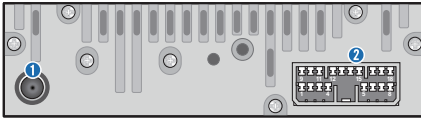
6. **Multi-function** display area for showing the information

Wired remote controller



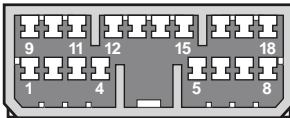
1. **SCAN** button: In Radio mode, tune up the frequency(press): find a station (press and hold).
2. **POWER [PWR]** button: Turn on the power or mute on/off(press): turn off the power (press and hold).
3. **Volume [▲/▼]** buttons: Adjust the volume.

Rear view/Connectors



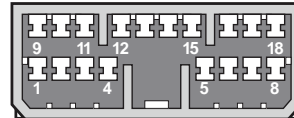
1. **Antenna** jack: To plug the FM antenna cable.
2. **I/O** connector: To plug the I/O cable.

<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

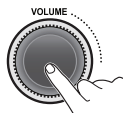
Getting started

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.

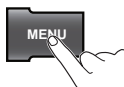
Adjusting volume directly



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

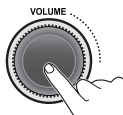


1. Press the **LOUD** button to turn loudness mode on/off.

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  and press  +  more 3 seconds




FM: 87.7 - 107.9 MHz (200 kHz step)

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

- South America : Hold down  and press  +  more 3 seconds




FM: 87.5 - 108.0 MHz (100 kHz step)

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

- Asia : Hold down  and press  +  more 3 seconds

FM: 87.5 - 108.0 MHz (100 kHz step)

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

- Europe: Hold down  and press  +  seconds

FM: 87.5 - 108.0 MHz (50 kHz step)

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

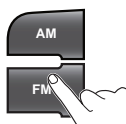
2. Please wait for more 5 seconds with no operation, the unit will save and apply your's setting.

If the region setting is not selected correctly to your country or region, the radio reception can not 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 Store 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 TRACK** 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.

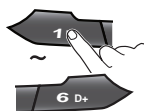
Radio

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.

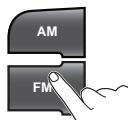


2. After selecting the frequency, press and hold the **PRESET [1 ||] - [6 D+]** button.

The frequency is saved to the selected preset button.

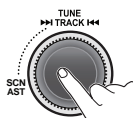
A total of 24 frequencies with 6 preset frequencies each for FM1/FM2/AM1/AM2 modes can be saved.

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

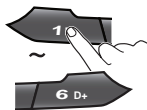


1. Press **AM** or **FM** button repeatedly to select the band.

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 ||] - [6 D+] button

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

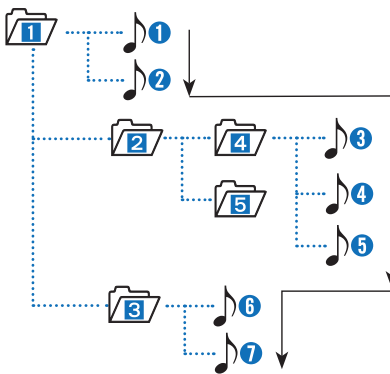
USB player

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 ||] 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. Turn 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.



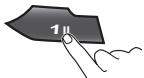
2. While the ►► | TRACK | ◄◄ dial is being turned and held, the file will rewind or fast forward at high speed. Once released, the file will begin playing at normal speed.

- 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.



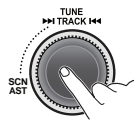
3. Press the [5 D-] or [6 D+] button to moves to the previous or next folder.

- [5 D-]: move to previous folder
- [6 D+]: move to next folder



- While folder moving, the 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.

- **↺** : All files of current folder play in random order
- **↺** : All 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 some time 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

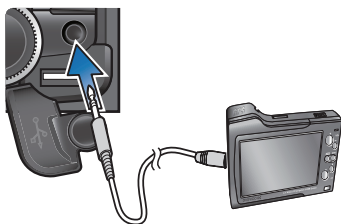
Listening to auxiliary audio equipment

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.

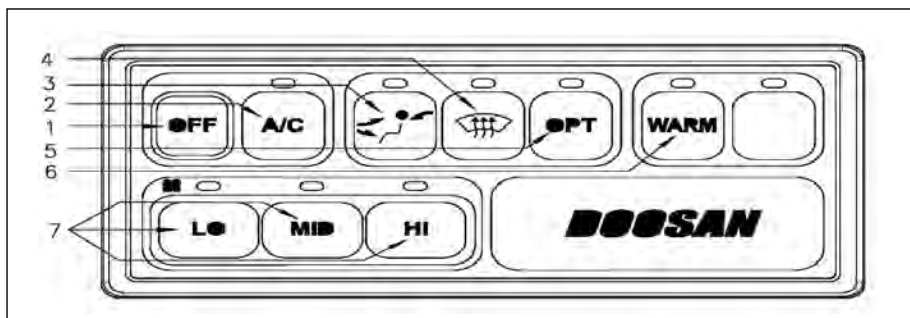
Calling via Handsfree (If Equipped)

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

B. Air Conditioner Controller (Optional)



1. OFF button

- Stops all the functions and turns off power

2. A/C button

- Pressing A/C button when power is off, or in heater mode or anti-fog mode will turn on the air conditioner.

WARNING

At the activation of the A/C button, engine low idle speed is increased to 950 rpm and the truck may speed up. Apply foot brake to stop or control the traveling speed.

5. OPT button – no resultant action

6. WARM button

- Pressing WARM button when power is off, or in air conditioner mode or anti-fog mode will turn on the heater.

7. Fan speed control button

- Fan speed is controlled in 3 steps:

- LO button: low
- MID button: medium
- HI button: high

3. Air discharge outlet select button

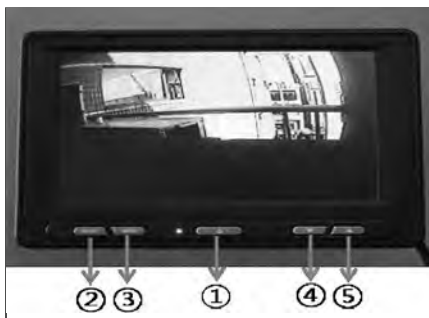
- Select air discharge outlet

4. Anti-fog button

- Pressing this button operates anti-fog function for 3 minutes Press A/C or WARM button during operation to return to air conditioner or heater mode.

Rear View Camera (optional)

a. Front display (basic operation menu)



1. 'POWER' button
- Turns power on and off
2. 'SELECT' button
- Switches camera and AV input image
3. 'MENU' button
- Press shortly to adjust image
- Press 3 seconds to enter set up menu
4. '▲' button
- Increases speaker volume
5. '▼' button
- Reduces speaker volume

b. Operating Method

► Color tone control



1. Press MENU button for 0.5~1 second.
2. Select brightness, value of color, color tone and color depth using SELECT button.
3. Adjust each title using UP and DOWN buttons.
 - The basic level is set up at 25.

► **Main MANU (SETUP MENU) setting method**

- Call SETUP MENU window by pressing MENU button for 2 seconds.
- OSD menu disappears if no entry for 5 seconds.

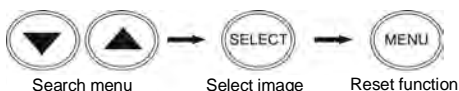
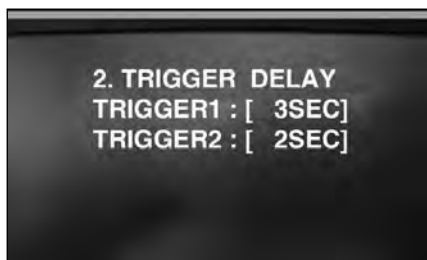


1. NORMAL / MIRROR



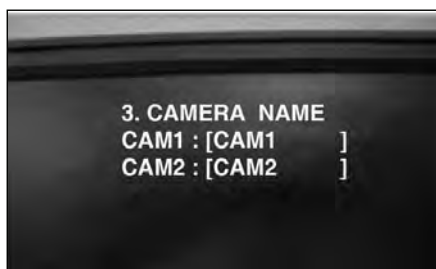
- This function turns the camera image right ↔ left.

2. TRIGGER DELAY



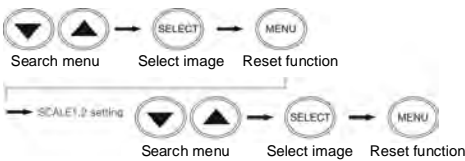
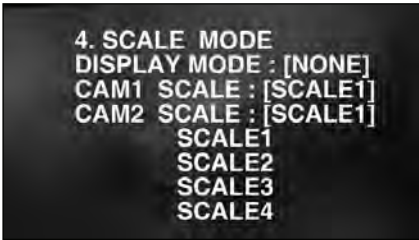
- When 2 trigger signals are active, each trigger source can be selected.
- When trigger signal is activated, the selected image appears in the screen.
- Each trigger signal can be set up with 0-20 seconds of delay.

3. CAMERA NAME



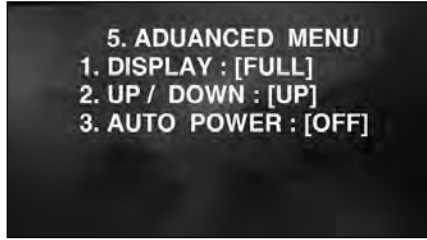
- Name of each camera can be registered and displayed in the screen OSD.

4. SCALE MODE



- To show distance together with the camera image on the monitor, this function controls figures and dots of a certain size.
- Other scale modes of CAM1~CAM2 can be set up, which can be turned ON/OFF in DISPLAY MODEP.
- SCALE1 and SCALE2 are indicated with adjustable figures.
- When trigger signal is activated, the scale OSD set up in the screen appears.
 - This is simply an electrical expression of the distance from the truck.

5. ADVANCED MENU



- DISPLAY
 - FULL: images are displayed in a 16:9 ratio.
 - NORMAL: images are displayed in a 4:3 ratio.
- UP/DOWN
 - Turns images upside down.
- AUTO POWER
 - If AUTO POWER is set to ON, the monitor turns 'AUTO ON' when the vehicle power is turned on.
 - If AUTO POWER is set to OFF, the monitor is not turned on automatically when the vehicle power is turned on.

6. AUTO SCAN

6. AUTO SCAN

AUTO SCAN : [OFF;ON]

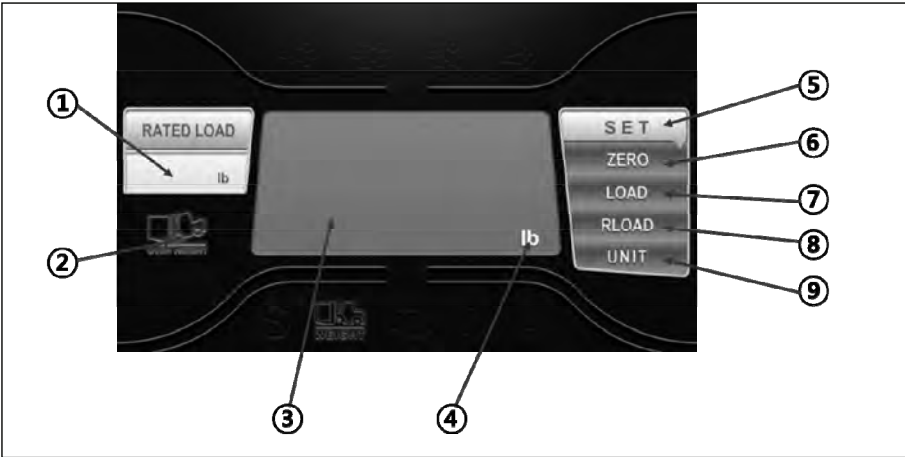
SCAN CAM1 : [1SEC TO 20SEC]

SCAN CAM2 : [1SEC TO 20SEC]



- If AUTO SCAN is set to ON, images are displayed in the sequence of CAM1→CAM2.
- The duration of an image display can be set to 0~20 seconds. '0' setting eliminates the image.
- Press the SELECT button to stop repeating images, and press it again to see the images repeatedly.

Weight Scale Optional (Hydraulic Pressure Sensing Type)



If weight scale option (Hydraulic Pressure Sensing Type) equipped, operator can measure and limit load with display. Press "MODE" to convert display from normal to weight scale.

a) Initial setting

To use weight Scale option, need initial setting. i) Unload (Zero) mode, ii) Load mode, iii) Rated load mode.

i) Unload (Zero) Setting

Press "MODE" 2 sec, 'SET (⊙)' and 'ZERO (⊙)' light will on. Weight digit will blink with " - - - - ". Then Press Δ , ∇ button and set "0". Finish with 'Enter'

button 1 sec. ('SET(⊙)' and 'ZERO(⊙)' lamp will blink 3 second and off)

ii) Unload Setting

Press "MODE" 2 sec, 'SET(⊙)' and 'ZERO(⊙)' light will on. Press "MODE" one more time. 'SET(⊙)' and 'LOAD(⊙)' light will on. Weight digit will blink with

" - - - - ". Then Press Δ , ∇ button and set weight of the load. Finish with

'Enter' button 1 sec. ('SET(⊙)' and 'LOAD(⊙)' lamp will blink 3 second and off)

iii) Rated Load Setting

Press "MODE" 2 sec, 'SET(⊙)' and 'ZERO(⊙)' light will on. Press "MODE" twice.

'SET(⊙)' and 'RLOAD(⊙)' light will on. Weight digit will blink with " - - - - ". Then press Δ , ∇ button and set weight of the load. Finish with 'Enter' button 1 sec. ('SET(⊙)' and 'RLOAD(⊙)' lamp will blink 3 second and off)


b) Unit change

Press "MODE" 2 sec, 'SET(⊙)' and 'ZERO(⊙)' light will on. Press "MODE".

'SET(⊙)' and 'RLOAD(⊙)' light will on. Load unit(⊙) will blink. User can change unit by using Δ , ∇ button. Finish with 'Enter' button 1 sec.

c) If operator try to lift weight over rated load, warning lamp(⊙) will be on.

Weight Scale Optional (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 , you can start settings.

1. Entering the Calibration Mode

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



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



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."



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



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



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.**



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



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



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



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 7 ton capacity model for example, use a 3.5 to 4 ton load).



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



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



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



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.
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 has been finished.

Use this device after fully lowering the load for the indicator to display 0 kg.



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 leaves 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.

NOTICE

1. Prior to operating the lift truck, be sure to understand and check the SEAT SWITCH SYSTEM.
2. 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.
3. 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.
4. If seat or seat switch replacement becomes necessary, be sure to use genuine DOOSAN Industrial Vehicle lift truck parts. Lift trucks should never be operated without an operational SEAT SWITCH SYSTEM.

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.

Steering Wheel Column Tilt Angle Adjustment



Typical Example

The steering wheel column tilt angle is adjustable within 15 degrees to fit for the operator position. The steering column is unlocked by turning the lever counter clockwise and locked by turning it clockwise.

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 circuit.

Tow Eye



Typical Example

It is for emergency use in towing a disabled vehicle or being towed by another truck when your truck is disabled. Use wire rope strong enough according to the weight and size of the vehicle to be towed.

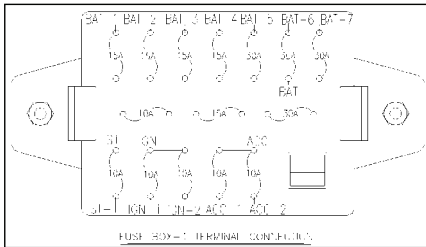
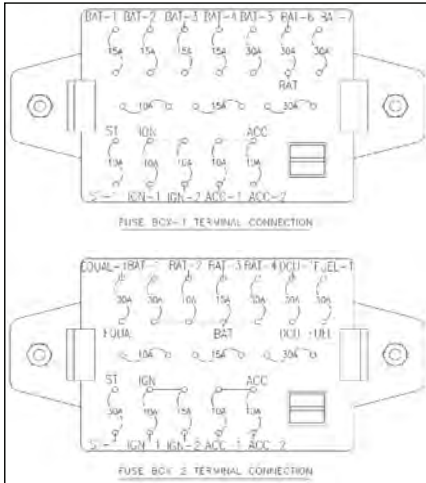
Fuse Box



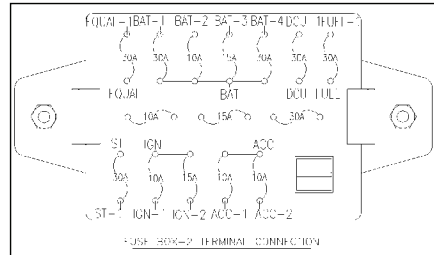
Typical Example

Fuse Locations

1. D60/70/80/90S-7 (3 SPEED)



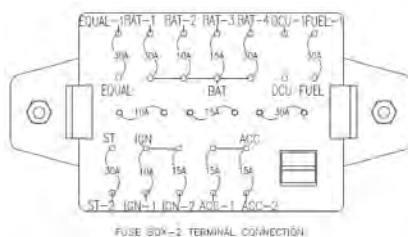
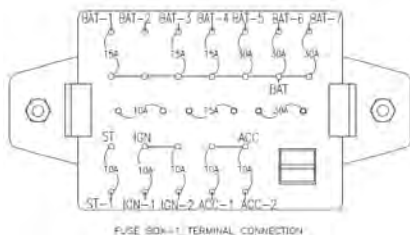
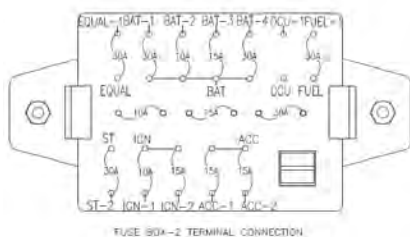
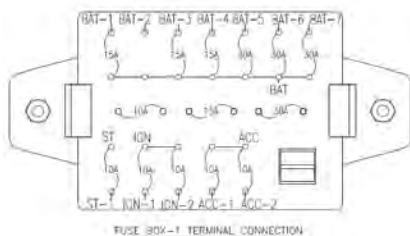
Fuses protect the electrical system from damage caused by overloaded circuits. Change a fuse if the element separates. If the element of a new fuse separates, have the circuit checked and repaired.



No.	Description	Rated Capacity
1	START RELAY	10A
2	OSS CONTROLLER(IGN) PARKING BRAKE CONTROLLER	10A
3	LCD DISPLAY, TCU F/R LEVER	10A
4	HAZARD SWITCH, CABIN RELAY	10A
5	GAUGE LAMP, ENGINE CHECK LAMP, CHARGE LAMP, PREHEAT LAMP	10A
6	HORN	15A
7	TCU POWER	15A
8	COMBI LAMP, REAR LAMP	15A
9	WORKING LAMP	15A
10	FRONT WIPER	30A
11	MAIN POWER (KEY SW-BAT)	30A
12	CABIN POWER (AUDIO,REAR WIPER)	30A

No.	Description	Rated Capacity
1	CIGAR LIGHTER, WIPER TIMER	30A
2	ECU KEY POWER, FUEL HEATER RELAY	10A
3	ISO 3691 VALVE, TCU AUTO NEUTRAL, PARKING	15A
4	CAMERA OPTION (ACC)	15A
5	STOP LAMP, AIRCON/HEATER RELAY, CD PLAYER	15A
6	ECU POWER	30A
7	AIRCON/HEATER	30A
8	OSS CONTROLLER (BAT)	10A
9	OPTION (BAT)	15A
10	POWER PACK (OPTION)	30A
11	DCU POWER	30A
12	FUEL HEATER	30A

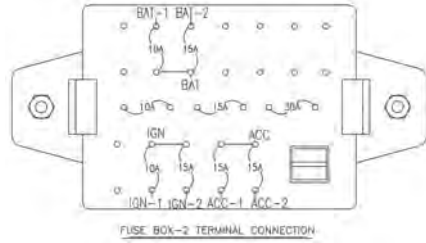
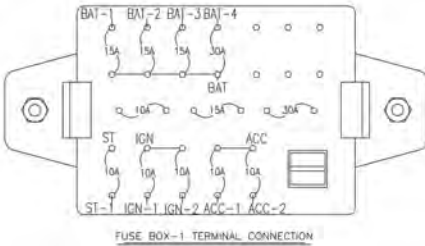
2. D60/70/80/90S-7 (2 SPEED)



No.	Description	Rated Capacity
1	START RELAY	10A
2	OSS CONTROLLER(IGN) PARKING BRAKE CONTROLLER	10A
3	LCD DISPLAY, TCU F/R LEVER	10A
4	HAZARD SWITCH, CABIN RELAY	10A
5	GAUGE LAMP, ENGINE CHECK LAMP, CHARGE LAMP, PREHEAT LAMP	10A
6	HORN	15A
7		
8	COMBI LAMP, REAR LAMP	15A
9	WORKING LAMP	15A
10	FRONT WIPER	30A
11	MAIN POWER (KEY SW-BAT)	30A
12	CABIN POWER (AUDIO,REAR WIPER)	30A

No.	Description	Rated Capacity
1	CIGAR LIGHTER, WIPER TIMER	30A
2	ECU KEY POWER, FUEL HEATER RELAY	10A
3	ISO 3691 VALVE, TCU AUTO NEUTRAL, PARKING	15A
4	CAMERA OPTION (ACC)	15A
5	STOP LAMP, AIRCON/HEATER RELAY, CD PLAYER	15A
6	ECU POWER	30A
7	AIRCON/HEATER	30A
8	OSS CONTROLLER (BAT)	10A
9	OPTION (BAT)	15A
10	POWER PACK (OPTION)	30A
11		
12	FUEL HEATER	30A

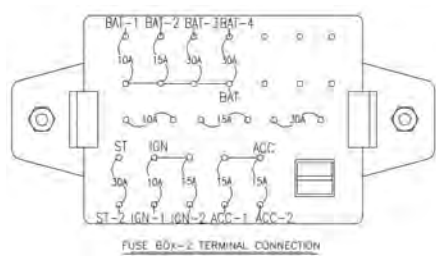
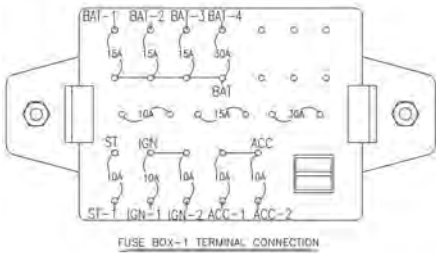
3. G60/70S-7 (2 speed, Overhead Guard)



No.	Description	Rated Capacity
1	VIC CONN (START)	10A
2	OSS CONTROLLER (IGN)	10A
3	AS CONTROLLER POWER F/R LEVEL	10A
4	HAZARD LAMP	10A
5	GAUGE LAMP ENGINE CHECK LAMP CHARGE LAMP	10A
6	HORN	15A
7	BACK BUZZER FLASH UNIT REAR LAMP	15A
8	WORKING LAMP	15A
9	MAIN POWER (KEY SW-BAT)	30A
10		
11		
12		

No.	Description	Rated Capacity
1		
2	VIC CONN (IGN)	10A
3	FWD RELAY CREEP SPEED RELAY ISO SOL V/V	15A
4	CAMERA OPTION (ACC)	15A
5	STOP LAMP STROBE	15A
6		
7	OSS CONTROLLER (BAT)	10A
8	OPTION (BAT) FRONT WIPER	15A
9		
10		
11		
12		

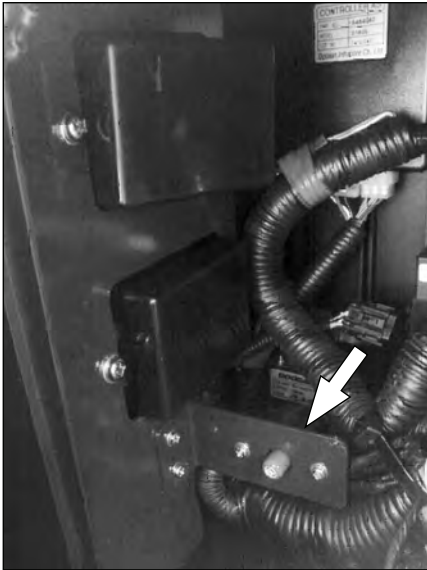
4. G60/70S-7 (2 Speed, Cabin)



No.	Description	Rated Capacity
1	VIC CONN (START)	10A
2	OSS CONTROLLER (IGN)	10A
3	AS CONTROLLER POWER F/R LEVEL	10A
4	HAZARD LAMP CABIN RELAY	10A
5	GAUGE LAMP ENGINE CHECK LAMP CHARGE LAMP	10A
6	HORN	15A
7	BACK BUZZER FLASH UNIT REAR LAMP	15A
8	WORKING LAMP	15A
9	MAIN POWER (KEY SW-BAT)	30A
10		
11		
12		

No.	Description	Rated Capacity
1	CIGAR LIGHTER WIPER TIMER	30A
2	VIC CONN (IGN)	10A
3	FWD RELAY CREEP SPEED RELAY ISO SOL V/V	15A
4	CAMERA OPTION (ACC)	15A
5	STOP LAMP, STROBE AIRCON/HEATER RELAY CD PLAYER	15A
6	OSS CONTROLLER (BAT)	10A
7	OPTION (BAT) FRONT WIPER	15A
8	CABIN RELAY POWER	30A
9	AIRCON/HEATER RELAY POWER CAR AUDIO	30A
10		
11		
12		

Circuit Breaker



Typical Example Diesel Engine Truck

Circuit Breaker protects the main electrical circuit. It is located under the fuse box.

To reset the circuit breaker, push the button in. If the button comes back out, have the electrical circuits checked.

Seat

Seat Adjustment

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.



Typical Example

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



Typical Example

Forward – Reverse

F	Forward
N	Neutral
R	Reverse

Speed Select

1	1st
2	2nd
3	3rd (3 speed ONLY)

Rotating the direction control lever changes the speed of travel. With handle rotated counter clockwise (towards the operator), the lift truck is in FIRST speed.

Rotate the lever clockwise (away from the operator) for the SECOND and THIRD speeds.

Always brake to a full stop before reversing the direction of travel.

Do not fail to place the forward-reverse lever in the neutral position before starting the engine.

Neutral Lever Lock (3 Speed Only)

A transmission neutral lever lock is in base of the direction control lever. This neutral lever lock prevents the direction control lever from being moved out of "NEUTRL".

N "NEUTRAL LOCK" position. Prevents the direction control lever to be moved out of "NEUTRAL".

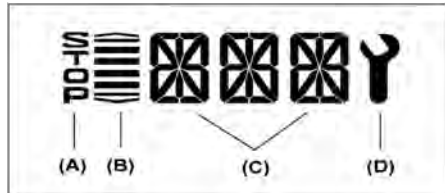
D "DRIVE" position. Allows the direction control lever to be moved from "NEUTRAL" to "FORWARD and REVERSE".

WARNING

"LOCK" the direction control lever. Whenever machine is parked, "LOCK" the direction control lever in "NEUTRAL" to prevent accidental machine movement.

Transmission Display(3 Speed Only)

A transmission display is to the right of the steering wheel on the dash. The LCD indicates gears, direction of travel and error codes.



(A) Indicates travel direction and gear selection. See the figure below for more detailed information.

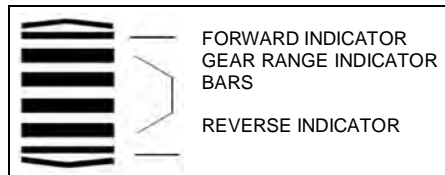
(B) Indicates normal operation and error codes. For a list of error codes, see "Transmission Error Codes" in "When Required" maintenance section.

NOTE: Most codes are only two digits.

(C) Indicates that error codes have occurred and are stored.

(D) Indicates that operation must be stopped immediately to prevent damage to transmission and hazardous operation condition.

(E) Indicates the mileage.



The gear range indicator bars will indicate which gear is selected by displaying the corresponding number of bars.

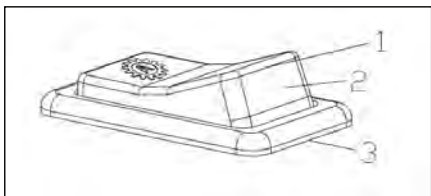
The forward and reverse indicator bars will be "OFF" when the transmission is in "MANUAL MODE".

When transmission is in "AUTOMATIC MODE", all the gear range indicator bars and both travel direction indicators will be "ON".

Automatic Transmission Switch (3 Speed Only)



Automatic speed range:
 . FORWARD: 3 speeds.
 . REVERSE: 3 speeds.

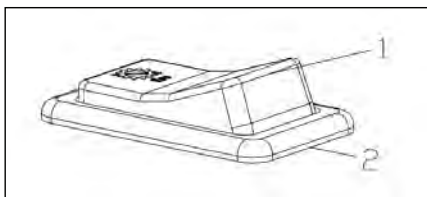


1. Set this switch at "1" (Auto 2nd), the speed will be controlled at the 2nd and 3rd gear ratio automatically, according to the load and engine speed.
2. Set this switch at "2" (Auto 1st), the speed will be controlled at the 1st, 2nd and 3rd gear ratio automatically, according to the load and engine speed.
3. When this switch is at '3'(manual) position, travel mode is switched to "MANUAL" and allows operator to choose speeds manually.

Inching Switch(3 Speed Only)



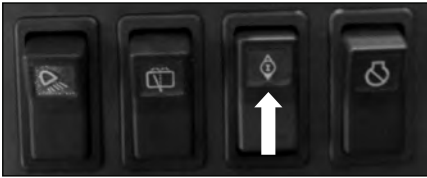
This switch changes over the modes of the inching control pedal, inching and no-inching.



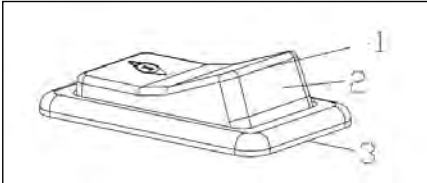
1. In the "1" position, "NO INCHING" mode is selected. In the "NO INCHING" mode, the inching pedal is not operable but braking with the inching pedal is available.
2. In the "2" position, "INCHING" mode is selected. In the "INCHING" mode, normal inching operation is available using the inching pedal.

NOTE: When driving a middle or long distance without using the inching function, set this switch to "1" position to prevent the transmission clutch pedals from unnecessary wear or overheat.

IDLE Select Switch (Diesel Only)



This switch controls engine idle speed.



1. When this switch is at "1" position, the engine idle rpm is increased from 875 (basic speed) to 1600 at a 50 rpm step.
 2. At '2' position, the basic condition is maintained.
 3. At '3' position, (1.5 sec), the engine idle rpm returns to 875 (basic speed).
 4. With this switch is at '1' position, step on the accelerator pedal and release the switch, the engine will keep running at the accelerated speed.
- * To use this function while the engine is running, set the switch to "3" position to "Open" the function.

WARNING

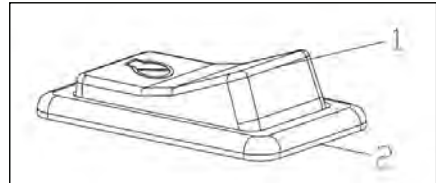
If you increase engine rpm with using this switch, truck creep speed will be faster than normal mode.

Before change direction lever, press brake pedal and release smoothly to prevent accident cause a sudden movement.

Emergency Engine Stop Switch (Optional)

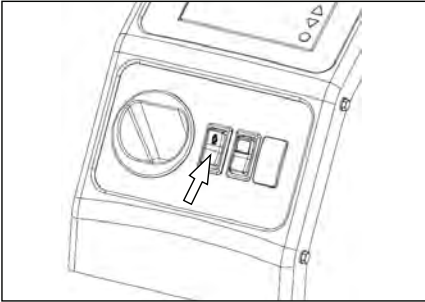


This switch stops the engine under an emergency condition.

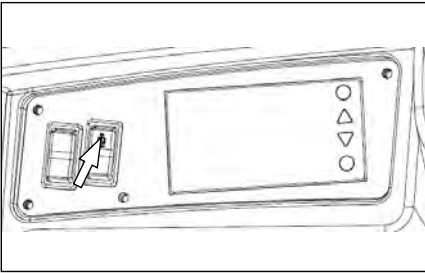


1. At this position, the engine stops.
2. At this position, the basic condition is maintained.

Multi Torque Switch (Diesel Only)

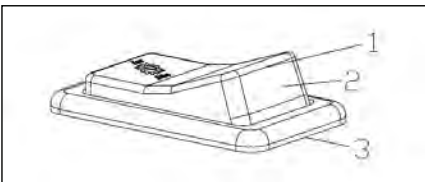


<Overhead Guard>



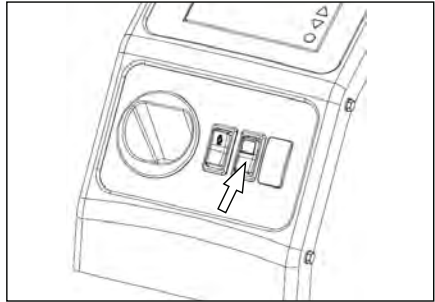
<Cabin>

This switch changes truck operation mode.

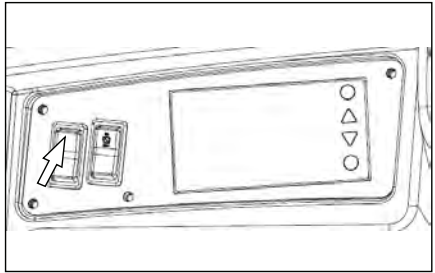


- 1) At "1" position, the truck enters "ECO Mode" to save fuel consumption.
- 2) At "2" position, the truck enters "POWER Mode" to increase torque and power to the maximum levels.
- 2) At "3" position, the truck enters "DRIVE Mode" to deliver smooth and fast traveling.

SCR Cleaning - DeSOx Switch (81kW, Diesel Engine Only)



<Overhead Guard>



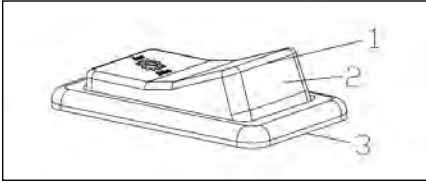
<Cabin>

This switch initiates regular regeneration process of the post-treatment device.

- 1) A pop-up on the SCR Display warns the operator to perform SCR Cleaning. (3 warnings: at 10 hrs remaining, 5 hrs remaining, Immediate)



Exemplary warning – 10 hrs remaining



- 2) Press this switch and release it after 3 sec, SCR 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



Cleaning process



Completed

- 3) 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".

- 4) Setting this switch to position "3" prohibits automatic SCR Cleaning in an environment subject to dust, explosion or regulated noise level. At position "3", a pop-up appears as shown below:



SCR Cleaning inhibited

Transmission Inching Control Pedal



Typical Example



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 Foot Brake Pedal



Typical Example



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



Typical Example



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



RELEASE the pedal to decrease engine rpm (speed).

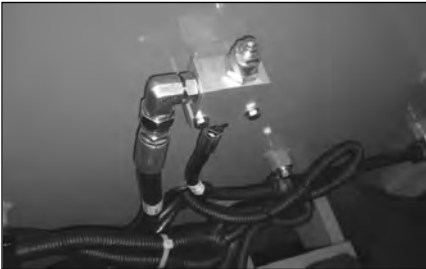
Emergency Lowering Device

WARNING

If the carriage fails to descend when the lift lever is pushed forward, it can be lowered using the emergency lowering valve in the control box. Do not stay beneath or near the carriage when using the emergency lowering valve, otherwise, you may get severely injured.

Observe the following procedure when using the emergency lowering valve.

1. Stop the engine and open the door of the control box on the right side of the operator.
2. Turn the nut and adjusting screw of the emergency lowering valve by 2 turns counterclockwise. The carriage will descend slowly.
3. When the carriage is on the ground, tighten the adjusting screw and nut to prevent further settlement by the valve.
4. Close the control box door.



Parking Brake Lever

NOTICE

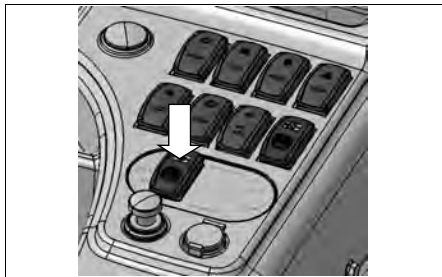
Do not engage the parking brake while the lift truck is moving unless an emergency exists. The use of the parking brake as a service foot brake in regular operation will cause severe damage to the parking brake system.

Mechanical Parking Brake (If Installed)



The parking brake lever is located at the left side of the steering wheel.

Electronic Parking Brake (If Installed)



How to Operate

How to Release the Parking Brake

1. Sit on the operator's seat and check that the lever is in neutral.
2. With the brake pedal pressed, start the ignition.
3. Check that the instrument panel's parking brake lamp is on.
4. Press the parking brake switch, which is located on the right side of the seat. Then, check that the parking brake lamp turns off and the buzzer sounds three times.
5. Put the direction control lever in forward or reverse.
6. Release the brake pedal and operate the vehicle.

⚠ WARNING

After pressing the parking brake switch, hold down the brake pedal to keep the vehicle stationary until the buzzer sounds three times.

The buzzer sound indicates a complete release of the parking brake.

Releasing the brake pedal before the buzzer sounds may cause a move of the vehicle or damage on the parking brake components.

NOTICE

When the ignition is off, the parking brake always stays engaged and you cannot release it even using the parking brake switch.

If the vehicle needs to be towed with the ignition off, the parking brake has to be released.

For how to tow the vehicle, refer to the Operation Section.

How to Engage the Parking Brake

1. Hold down the brake pedal to keep the vehicle stationary.
2. Put the direction control lever in neutral.
3. Press the parking brake switch, which is located on the right side of the seat.
4. Once it is checked that the parking brake lamp turns on and the buzzer sounds three times, release the brake pedal.

⚠ WARNING

Never engage the parking brake while the vehicle is driving, except for when emergency braking is necessary.

The engagement of the parking brake during the driving of the vehicle causes a sudden stop, which can lead to a tipover of the vehicle or a fall of the load. In addition, this may bring about mechanical damage on the parking brake and a consequent loss of its braking force. These troubles will eventually result in damage on the vehicle or load and personal injuries.

Be sure to engage the parking brake only when the vehicle is stationary.

Safety Function

Once the operator leaves the seat for three seconds with the parking brake released, the parking brake gets engaged by itself to keep the vehicle from moving.

At the same time, the transmission automatically shifts into neutral. The parking brake warning buzzer then sounds for 10 minutes. You can turn it off by pushing the parking brake switch.

To release the parking brake while the warning is sounding, sit on the seat and perform the following steps:

Procedure

1. Press the brake pedal.
2. Put the direction control lever in neutral.
3. Engage the parking brake and then release it again.
4. The release of the parking brake is indicated by the three times sounding of the buzzer.

⚠ WARNING

If the seat switch is short-circuited, the parking brake's safety function will not work.

⚠ WARNING

Make sure to check that the parking brake is normally engaged before getting out of the vehicle.

Emergency Braking Function

In an emergency where the vehicle should be stopped, push the parking brake switch for emergency braking.

⚠ WARNING

After an emergency stop, inspect for any damage on the parking brake and, if necessary, adjust or repair the parking brake components.

The use of the parking brake for emergency braking can cause an abnormal wear of the frictional part or damage on other components. This problems can lead to a poor braking force vulnerable to safety accidents.

For how to inspect and adjust the parking brake, refer to the Maintenance Section.

Lift Control



The forks can be raised or lowered by pulling backwards or pushing forwards on this lever. The lift speed is controlled by tilt angle of the lever and accelerator pedal effort. The lowering speed can be controlled by tilt angle of the lever. The engine speed or accelerator pedal has nothing to do with the lowering speed of the forks.

Tilt Control



The mast can be tilted by operation of this tilt lever. Pulling on this lever backwards will tilt the mast backwards, and pushing it forwards will tilt the mast forwards. The tilt speed can be controlled by tilt angle of the lever and accelerator pedal effort.

Fuel Replenishment

Diesel Engine

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.

1. Park the lift truck only at a designated safe location. Place the transmission in Neutral. Lower the forks on the ground. Apply the parking brake. Stop the engine.



Typical Example

2. Remove the filler cap.
3. Fill the fuel tank slowly. Refer to the section on 'Refill Volume.' Close the filler cap. If spillage occurs, wipe off excess fuel and absorb any excess fuel with absorbent material.

NOTE: Remove the drain plug under the fuel tank to drain the water and sediment in the tank, occasionally, or as necessary. In addition, 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.



Typical Example

Changing LP Tanks

WARNING

Only trained, authorized personnel should fill or exchange LP tanks.

Personnel engaged in filling of LP containers should wear protective clothing such as face shield, long sleeves and gauntlet gloves. Do not refuel or store LP powered lift trucks near any underground entrance, elevator shafts or any other place where LP could collect in a pocket causing a potentially dangerous condition.

Examine all LP containers before filling and again before reuse, for damage to various valves, liquid gauge, fittings and hand valve wheels.

All defective or damaged LP containers must be removed from service.

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 indoor locations.

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

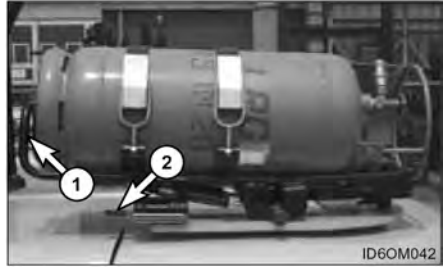
The careless handling of LP containers can result in a serious accident.

Use extreme care when transporting containers to prevent damage to them.

1. Park the lift truck on level ground, with the parking brake applied, the transmission in NEUTRAL, the forks lowered and the engine running at low idle.



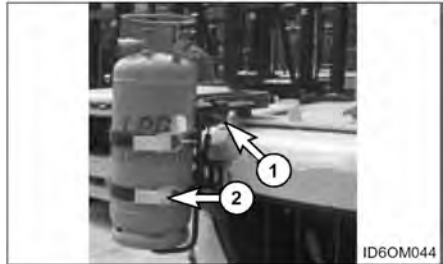
2. Close the fuel inlet valve at the LP - Gas tank. Run the engine until it stops, then turn off the ignition switch and the electrical disconnect switch (if equipped).
3. Disconnect the fuel supply line.



4. Grasp the tank support bar (1). Pull and release the latch switch (2).
5. Grasp the tank support bar (1) and rotate cradle slowly to the rear of a tank.



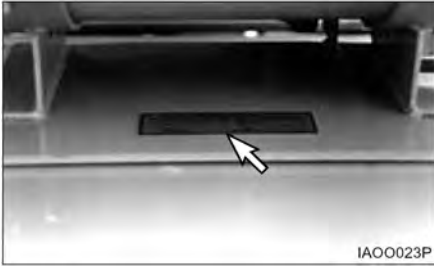
6. Pull the release knob (1) and then push down the tank.



7. Lock the tank cradle by knob (1). Loosen the retaining clamps (2) and remove the tank.
8. Check the mounting to be sure the locating pin (dowel) is not missing or broken.

NOTICE

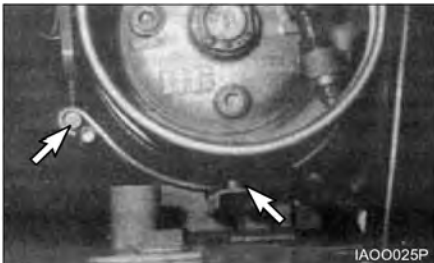
If the location pin (dowel) is missing or broken, be sure the pin is replaced.



9. Check to be sure that the LP warning plate is in position on the lift truck, and is legible.
10. Check to be sure the replacement tank is of the correct type.
11. Inspect the replacement tank for damage such as dents, scrapes or gouges and for indication of leakage at valves or threaded connections.



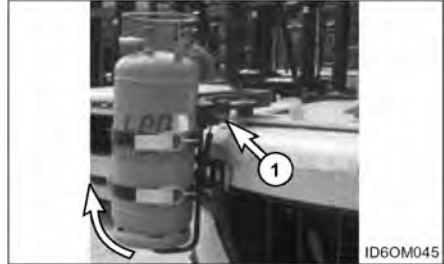
12. Check for debris in the relief valve, for damage to various valves and liquid level gauge.
13. Inspect the quick-disconnect couplings for deterioration, damage or missing flexible seals.



14. Position the replacement tank so that the locating pin (dowel) is in place.

⚠ WARNING

The LP tank must not extend past the counterweight.



15. Grasp a new tank and clamp securely. Pull the release knob (1) and push the tank cradle upward when locked.
16. Rotate the tank cradle forward of the truck and lock it with latch. Connect the fuel supply line.
17. Open the fuel valve by slowly turning the valve counterclockwise. If the fuel valve is opened too quickly, a back pressure check valve will shut off the fuel supply. If this happens, close the fuel valve completely. Wait five seconds and then open the fuel valve very slowly.
18. Inspect the LP fuel lines and fittings with a soap solution after filling the tank or when looking for leaks.

DEF/Ad-Blue Replenishment (81kW Diesel Engine Only)

NOTICE

Do not allow the lift truck to become low on DEF(Ad-Blue) or completely run out of /DEF (Ad-Blue). Sediment or other impurities in the DEF(Ad-Blue) Tank could be drawn into the after treatment. This could result in damage to components.

Do not fill the DEF(Ad-Blue) tank to the top. DEF(Ad-Blue) Tank could be damaged because of volume expansion during DEF(Ad-blue) freezing in cold condition.



Typical Example

1. Park the lift truck only at a designated safe location. Place the transmission in Neutral. Lower the forks on the ground. Apply the parking brake. Stop the engine.
2. Using the start key, open the DEF/Ad-Blue tank door beside the frame. Open the blue DEF/Ad-Blue tank filler cap.



Typical Example

3. Fill the DEF/Ad-Blue tank slowly. Refer to the section on 'Fuel and DEF/Ad-Blue Refill Volume.'
4. After the refill, close the DEF/Ad-Blue tank cap firmly. Remove spilt DEF/Ad-Blue, if any, with an adsorbent.

CAUTION

LOW DEF/Ad-Blue LEVEL WILL DISTURB AFTER TREATMENT FOR EPA TIER-IV (EURO STAGE IV) EXHAUST GAS EMISSION, AND CAN BE CAUSE OF SERIOUS DAMAGE TO ENGINE AND SYSTEM.

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.



Typical Example

1. Inspect the operator's compartment for loose items and cleanliness.
2. Inspect the instrument panel for broken or damaged indicator lights or gauges.
3. Test the horn and other safety devices for proper operation.



Typical Example

4. Inspect the mast and lift chains for wear, broken links, pins and loose rollers.
5. Inspect the carriage, forks or attachments for wear, damage and loose or missing bolts.

6. Inspect the tires and wheels for cuts, gouges, foreign objects, inflation pressure and loose or missing bolts.
7. Inspect the overhead guard and cabin for damage and loose or missing mounting bolts.
8. Inspect the hydraulic system for leaks, worn hoses or damaged lines.
9. Look for transmission and drive axle leaks on the lift truck and on the ground.
10. Inspect the common parts and drive axle, mast etc. for damaged, loosen or missing mounting bolts.
11. Inspect the engine compartment for oil, coolant and fuel leaks.



Typical Example

Diesel Engine (G2 D34)



Typical Example

LPG Engine (PSI4.3L)



Typical Example

Diesel Engine



Typical Example

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

⚠ WARNING

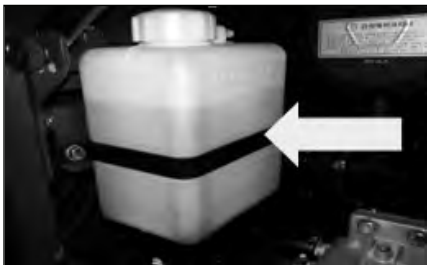
Personal injury may occur from accidents caused by improper seat adjustment. Always adjust the operator's seat before starting the lift truck engine. Seat adjustment must be done at the beginning of each shift and when operators change.



Typical Example

LP Engine

12. 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.



Typical Example

Coolant Water Reservoir Tank

13. 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.



Typical Example

15. To position the seat, PUSH the lever away from the seat track and move the seat forward or backward to a comfortable position.
16. Inspect seat belt for wear and correct operation.

Starting the Engine

Prestart Conditions

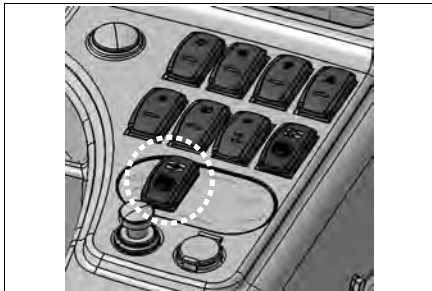
NOTE: The engine will not start unless the transmission directional control lever is in the NEUTRAL position.

Mechanical Parking Brake (If Installed)



Typical Example

Electronic Parking Brake (If Installed)



Typical Example

1. Engage the parking brake, if not already engaged.
2. Place the transmission directional control lever in NEUTRAL 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 the ignition key to the ON position. The start preheat 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.

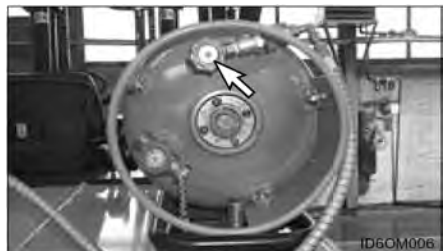
Starting Diesel Engine at Warm (Mechanical engine)

1. Turn the ignition key to the ON position and then to START position, without waiting for the preheat light to go OFF. At the same time fully depress the accelerator.
2. Release the ignition key when the engine starts and release the accelerator pedal to a low idle position.
Release the ignition key after engine starting and check the engine conditions.

LP Engine

⚠ WARNING

LP fuel is flammable and can cause personal injury. Inspect LP fuel lines and fitting for leaks. Inspect tank for secure mounting.



1. Open the tank fuel valve by slowly turning the valve counterclockwise. Observe the LP gauge (if equipped).
2. Turn the ignition switch to the START position. Release it when the engine starts.
3. If the engine does not start, Do not press on the accelerator pedal. Turn the starter switch to OFF position, the repeat step 2 and depress the accelerator pedal slightly during cranking.
4. Allow the engine to warm up slowly.

Starting From a 12/24 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.



Typical Example

Diesel Engine Truck



Typical Example

LP Engine Truck

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.

Starting with Jumper Cables

WARNING

Batteries give off flammable fumes that can explode.

Prevent sparks near the batteries. They could cause vapors to explode. Do not allow jump cable ends to contact each other or the lift truck. Do not smoke when checking battery electrolyte levels.

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

Always wear eye protection when starting a lift truck with jump cables.

Improper jump procedures can cause an explosion resulting in personal injury.

Always connect battery positive (+) to battery positive (+) and battery negative (-) to battery negative (-).

Jump only with a battery source and with the same voltage as the stalled lift truck.

Turn off all lights and accessories on the stalled lift truck. Otherwise, they will operate when the jump source is connected.

NOTICE

When starting from another machine, make sure the machines Do not touch. This could prevent damage to engine bearings and electrical circuits.

Turn on (close) the disconnect switch prior to the boost connection to prevent damage to electrical components on the stalled machine.

Severely discharged maintenance free batteries might not fully recharge by the alternator alone after jump starting.

The batteries must be charged to the proper voltage by the battery charger.

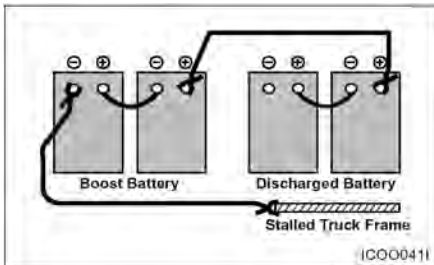
Many batteries thought to be unusable, are still rechargeable.

This machine has a 24 volt starting system. Use only equal voltage for jump starting. Use of a welder or higher voltage equipment will damage the electrical system.

Use of Jumper Cables

When auxiliary start receptacles are not available, use the following procedure.

1. Make initial determination as to failure of lift truck to crank. Procedure applies even if lift truck does not have diagnostic connector.
2. Place the directional control in NEUTRAL on the stalled lift truck. Engage the parking/secondary brake. Lower all attachments to the ground. Move all controls to HOLD (CENTER).
3. On stalled lift truck, turn the start switch to OFF. Turn off all accessories.
4. On stalled lift truck, turn on (close) the disconnect switch (if equipped).
5. Move boost start lift truck near enough to stalled lift truck for cables to reach, but DO NOT ALLOW LIFT TRUCKS TO TOUCH.
6. Stop the engine on the boost lift truck. Or, if using an auxiliary power source, turn off the charging system.
7. Make sure battery caps are all in place and tight on both lift trucks.



Typical Example of 24 Voltage

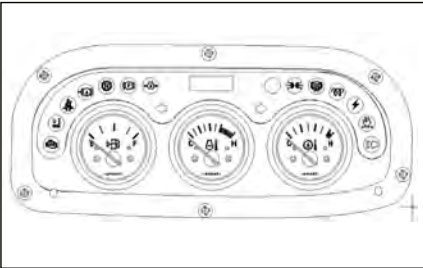
8. Connect positive (+) jumper cable (red) to positive (+) cable terminal of discharged battery, or battery set on the stalled lift truck. Do not allow positive cable clamps to touch any metal other than battery terminals.
9. Connect the other end of this positive jumper cable (red) to positive (+) terminal of boost battery. Use procedure of Step 8 to determine correct terminal.
10. Connect one end of the negative (-) jumper cable to the other terminal (negative) of the boost battery.
11. Make final connection of negative (-) cable to the stalled truck frame (not battery negative post) away from battery, fuel or hydraulic lines, or moving parts.
12. Start the engine on the boost lift truck, or energize the charging system on the auxiliary power source.
13. Wait a minimum of two minutes for the batteries in the stalled lift truck to partially charge.
14. Attempt to start the stalled engine. Refer to section on 'Engine Starting'.
15. Immediately after starting the stalled engine, disconnect the jumper cables in reverse order.
16. Conclude failure analysis on starting/charging system of the stalled lift truck as required with the engine running and charging system in operation.

After Starting the Engine

Observe all indicator lights and gauges frequently during operation, to make sure all systems are working properly.

WARNING

If any light comes on, have corrections made before operating truck.



Typical Example

1. Alternator indicator light will be OUT in normal operation. If the light comes ON with the engine running, the alternator is not charging.



Typical Example

2. Observe fuel gauge and service hour meter frequently to assure they are operating properly.
3. Observe the brake air pressure gauge and indicator light frequently (if equipped) while engine is running. Air pressure indicator must be in the green range. If light comes on, it indicates loss of air pressure.

NOTE: Do not idle engines for prolonged periods of time. These engines can be started easily, even when hot.

NOTE: At an oil temperature in the shifting circuit lower than -12°C , the transmission must be warmed-up for some minutes. This must be carried out in Neutral with an increased engine speed (about 1500 rpm). Until this oil temperature is reached, the Electronics remains in Neutral, and the symbol of the cold start phase will be indicated on the Transmission Display.

Indication on the SCR Display to be located on cowl cover

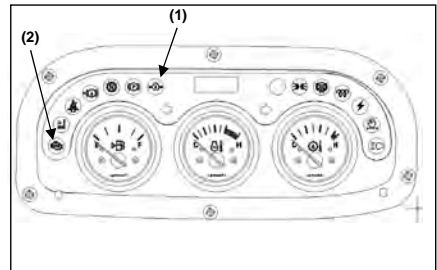


After the indication on the Transmission Display is extinguished, the full driving program can be utilized out of "NEUTRAL".

4. The engine oil pressure indicator light (1), 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 LP engine MIL (Malfunction indicator Light) will not come ON with engine running, unless the fault or faults are stored in the memory of the engine control module (ECM). Stop the engine and check the electric engine control system if the light comes ON. Refer PS14.3L LP Engine of this section.

If MIL does not disappear, please contact service center.



- (1) Engine oil pressure indicator light
(2) Engine malfunction indicator light

Diesel Engine

Engine and After-treatment System

Introduction

The D34 engine which is a high-power engine in compliance with the EPA/CARB TIER-4 (EURO STAGE IV) Engine Emissions Standard is provided with various systems. The D34 engine is equipped with a turbo charger intercooler system that compresses and cools air and feeds it to the intake manifold. Here, MAF 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 the order in which the fluids are controlled. Surplus fuel after injection returns to the fuel tank via a return hose. The exhaust gas recirculation (EGR) system controls the quantity of re-circulating 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). SCR (Selective Catalytic Reduction) 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). For SCR process, DEF (Diesel Exhaust Fluid or Ad-Blue) is required.

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

NOTICE

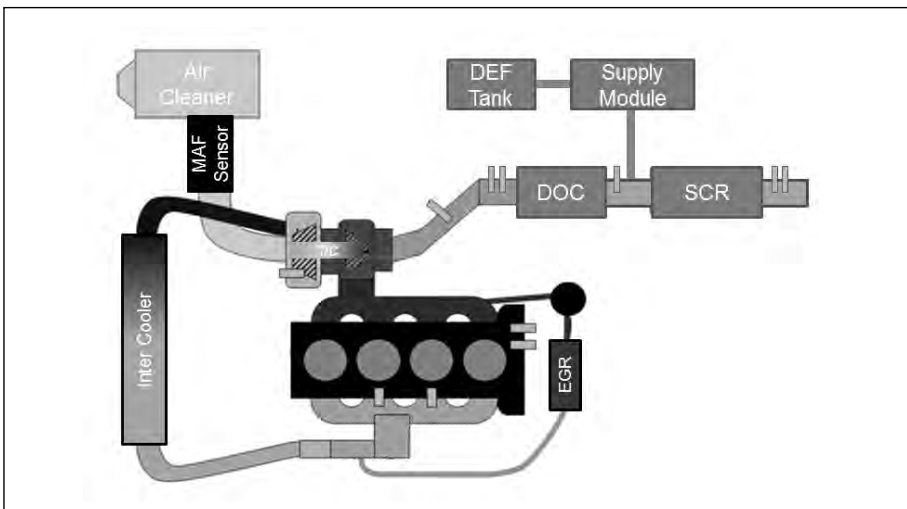
It is normal to hear a slight knocking or pinging sound from the engine during operation. This is the ECU regulating the amount of fuel necessary for fuel injection to meet emission standards.

When the engine is regularly turned off using the ignition key after operation, the supply module starts up (after-run) in order to remove the DEF/Ad-Blue remaining in the after-treatment system by returning it into the DEF tank. This is to prevent the hose from bursting due to a freeze-up or any other kind of obstruction. A sound is produced during the after-run.

. Do not cut off the battery's main supply during the after-run.

. If the after-run does not begin after the engine is turned off, inspect the system.

White Smoke can be emitted during SCR Cleaning.



Detecting Control Failure

As shown in the table below, the ECU / DCU performs self diagnosis. If a fault/failure is detected, engine check lamp lights up and failure code (DTC) is indicated by the number of flashes of the engine check lamp. To check failure code(DTC) refer page.48 #6 Engine Check Lamp(RED) section.

ECU Fault List

DTC	Description	LAMP	TRQ	Limpome Mode	Engine STOP in 5minutes
P0402	EGR Air High Fault	ON	50%		
P0401	EGR Air Low Fault	ON	50%		
P0406	EGR Position Sensor High Fault	ON	50%		
P0407	EGR Position Sensor Low Fault	ON	50%		
P046D	EGR Position Sensor Noise Fault	ON	50%		
P0C17	EGR Close Position Learning Drift Fault	ON	50%		
P0C18	EGR Close Position Learning Range Fault	ON	50%		
P0088	Over Pressure IMV Fault	FLASH			O
P0089	Rail Pressure Control Stability Positive Fault	-	-		
P0089	Rail Pressure Control Stability Negative Fault	-	-		
P2267	Water In Fuel Sensor OC/SCB Fault	FLASH	80%		
P2266	Water In Fuel Sensor SCG Fault	FLASH	80%		
P2269	Water In Fuel Detected Fault	FLASH	80%		
P0524	Oil Pressure Low Fault	FLASH			O
P0523	Oil Pressure Sensor High Fault	ON	50%		
P0522	Oil Pressure Sensor Low Fault	ON	50%		
P0111	Intake Manifold Temperature Plausibility Fault	-	-		
P0113	Intake Manifold Temperature Sensor High Fault	ON	50%		
P0112	Intake Manifold Temperature Sensor Low Fault	ON	50%		
P0114	Intake Manifold Temperature Sensor Noise Fault	ON	50%		
P0108	Manifold Pressure Sensor High Fault	ON	50%		
P0107	Manifold Pressure Sensor Low Fault	ON	50%		
P2229	Atmospheric Sensor High Fault	ON	50%		
P2228	Atmospheric Sensor Low Fault	ON	50%		
P0116	Coolant Temperature Plausibility Fault	-	-		
P0118	Coolant Temperature Sensor High Fault	ON	80%		
P0117	Coolant Temperature Sensor Low Fault	ON	80%		
P00BD	MAF Plausibility High Fault	ON	50%		
P00BC	MAF Plausibility Low Fault	ON	50%		
P0103	MAF sensor High Fault	ON	50%		
P0102	MAF sensor Low Fault	ON	50%		

DTC	Description	LAMP	TRQ	Limphone Mode	Engine STOP in 5minutes
P0190	Rail Pressure Sensor Gradient Fault	FLASH			O
P0193	Rail Pressure Sensor High Fault	FLASH			O
P0192	Rail Pressure Sensor Low Fault	FLASH			O
P0087	Rail Pressure Build-up Fault	ON			
P0191	Rail Pressure Sensor Drift Fault	FLASH			O
P0002	Rail Pressure Control Fault (IMV only)	FLASH			O
P0089	Rail Pressure Control Fault (Rail Discharge)	FLASH			O
P0563	Battery Voltage High Fault	ON	50%		
P0562	Battery voltage Low Fault	ON	50%		
P0074	Inlet Air Temperature Gradient Fault	ON	50%		
P0073	Inlet Air Temperature Sensor High Fault	ON	50%		
P0072	Inlet Air Temperature Sensor Low Fault	ON	50%		
P2428	Exhaust Over Temperature Fault	ON	50%		
P0181	Fuel Temperature Gradient Fault	ON	50%		
P0183	Fuel Temperature Sensor High Fault	ON	50%		
P0182	Fuel Temperature Sensor Low Fault	ON	50%		
P0196	Oil Temperature Plausibility Fault	-	-		
P0195	Oil temperature Sensor Fault	ON	50%		
P060B	Analog To Digital Convertor Fault	-	-		
P0602	Injector Code Program Fault	ON		O	
P0603	ECU Memory Fault (Data / Cal Integrity)	FLASH	-		
P0604	ECU Memory Fault (RAM Integrity)	FLASH	-		
P0605	ECU Memory Fault (Code Integrity)	FLASH	-		
P062F	ECU Non-volatile Memory Fault	-	-		
P0371	Crank Signal Early Fault	-	-		
P0339	Crank Signal Gap Fault	ON	50%		
P0372	Crank Signal Missing Fault	ON	50%		
P0374	Crank Signal Lost Fault	ON	50%		
P0335	Crank Signal Over-speed Fault	-	-		
P0344	Cam Signal Missing Fault	ON	50%		
P0342	Cam Signal Lost Fault	ON	50%		
P0341	Cam Signal Drift Fault	-	-		
P0340	Cam Signal Learning Fault	-	-		
P0201	Injector Open Fault (Cylinder #1)	ON	50%		
P02EE	Injector Short Fault (Cylinder #1)	ON	50%		
P0262	Harness Resistance High Fault (Cylinder #1)	-	-		

DTC	Description	LAMP	TRQ	Limphone Mode	Engine STOP in 5minutes
P0261	Harness Resistance Low Fault (Cylinder #1)	-	-		
P029B	Injector Minimum Drive Pulse Drift Fault (Cylinder #1)	ON	-		
P0202	Injector Open Fault (Cylinder #2)	ON	50%		
P02EF	Injector Short Fault (Cylinder #2)	ON	50%		
P0265	Harness Resistance High Fault (Cylinder #2)	-	-		
P0264	Harness Resistance Low Fault (Cylinder #2)	-	-		
P029F	Injector Minimum Drive Pulse Drift Fault (Cylinder #2)	ON	-		
P0203	Injector Open Fault (Cylinder #3)	ON	50%		
P02F0	Injector Short Fault (Cylinder #3)	ON	50%		
P0268	Harness Resistance High Fault (Cylinder #3)	-	-		
P0267	Harness Resistance Low Fault (Cylinder #3)	-	-		
P02A3	Injector Minimum Drive Pulse Drift Fault (Cylinder #3)	ON	-		
P0204	Injector Open Fault (Cylinder #4)	ON	50%		
P02F1	Injector Short Fault (Cylinder #4)	ON	50%		
P0271	Harness Resistance High Fault (Cylinder #4)	-	-		
P0270	Harness Resistance Low Fault (Cylinder #4)	-	-		
P02A7	Injector Minimum Drive Pulse Drift Fault (Cylinder #4)	ON	-		
P0384	Glow Plug Relay SCB Fault	-	-		
P0383	Glow Plug Relay SCG Fault	-	-		
P0380	Glow Plug Relay OC Fault	-	-		
P0325	Accelerometer Sensor 0 Fault	-	-		
P0330	Accelerometer Sensor 1 Fault	-	-		
P0007	Rail Pressure Control Fault (Trim High)	FLASH			O
P0006	Rail Pressure Control Fault (Trim Low)	FLASH			O
P0004	IMV Current Feedback High Fault	FLASH			O
P0003	IMV Current Feedback Low Fault	ON	50%		
P0259	IMV Current Trim Drift High Fault (High Fuelling)	-	-		
P0254	IMV Current Trim Drift High Fault (Low Fuelling)	-	-		O
P0253	IMV Current Trim Drift Low Fault (High Fuelling)	-	-		
P0258	IMV Current Trim Drift Low Fault (Low Fuelling)	-	-		
P0252	IMV Rail Pressure Control PWM Fault	ON	50%		
P0251	IMV Rail Pressure Control Fault (Trim Drift)	ON	50%		
P2080	Turbo In Temperature Plausibility Fault	-	-		
P0546	Turbo In Temperature Sensor High Fault	ON	50%		

DTC	Description	LAMP	TRQ	Limphone Mode	Engine STOP in 5minutes
P0545	Turbo In Temperature Sensor Low Fault	ON	50%		
P2081	Turbo In Temperature Sensor Noise Fault	ON	50%		
P0685	Main Relay Stuck Fault	-	-		
P068A	Main Relay Drop Fault	ON	-		
P062D	Injector Bank 1 SCB Fault	FLASH	-		
P062D	Injector Bank 1 SCG Fault	FLASH	-		
P062D	Injector Bank 1 SPI Fault	FLASH	-		
P062E	Injector Bank 2 SCB Fault	FLASH	-		
P062E	Injector Bank 2 SCG Fault	FLASH	-		
P062E	Injector Bank 2 SPI Fault	FLASH	-		
P2145	EGR H-Bridge Driver SCB Fault	ON	50%		
P2144	EGR H-Bridge Driver SCG Fault	ON	50%		
P2143	EGR H-Bridge Driver OC Fault	ON	50%		
P0404	EGR Position Control Fault	ON	50%		
P0641	5V Sensor Supply #1 Fault	FLASH	50%		
P0651	5V Sensor Supply #2 Fault	FLASH	50%		
P0697	5V Auxiliary Sensor Supply Fault	FLASH	50%		
P025D	IMV Drive SCB Fault	FLASH			O
P025C	IMV Drive SCG Fault	FLASH	80%		
P025A	IMV Drive OC Fault	FLASH			O
P061B	ECU Safety Monitoring Fault	FLASH	special		
P0409	EGR actuator position feedback signal ADC fault	-	-		
P2264	Water in Fuel sensor electrical fault (ADC)	-	-		
P0110	TMAP Temperature Element sensor ADC fault	-	-		
P0105	Manifold Pressure sensor electrical ADC fault	-	-		
P2226	Barometric pressure sensor electrical ADC fault	-	-		
P0100	MAF sensor electrical ADC fault	-	-		
P0070	Inlet Air Temperature sensor ADC fault	-	-		
P0001	Rail pressure control feedback ADC fault	-	-		
P0544	Turbo in temperature sensor ADC fault	-	-		
P0101	Intake air path leakage, MAF sensor drift, damage of MAF sensor	-	-		
P1650	Check engine lamp fault	-	-		
P0115	Coolant temperature sensor mother fault	-	-		
P0403	OC/SC2G/SC2Vbatt was generated in EGR H-bridge driver	-	-		

DTC	Description	LAMP	TRQ	Limphone Mode	Engine STOP in 5minutes
P0381	Glow plug lamp fault	-	-		
P0711	Transmission oil temperature is out of range	ON	50%		
P2135	Pedal position sensor 1,2 voltage correlation	ON		O	
P060D	Pedal position performance out of range	ON		O	
P0120	Pedal position sensor 1 fault	ON	-	O	
P0220	Pedal position sensor 2 fault	ON	-		
P2544	Multi torque switch has ADC problem	-	-		
P2547	Multi torque switch is above than operation range	ON	-		
P2546	Multi torque switch is under than operation range	ON	-		
P0606	ECU Safety monitoring fault	-	-		
P0607	ECU Safety monitoring fault	-	-		
P060A	ECU Safety monitoring fault	-	-		
P060C	ECU Safety monitoring fault	-	-		
P25BC	DeSOx Switch SCB Fault	ON	-		
P25BB	DeSOx Switch SCG Fault	ON	-		
P25BA	DeSOx Switch Open/Stuck Fault	ON	-		
P0180	Fuel Temperature Sensor ADC Fault	-	-		
P01C3	Fuel filter pressure sensor or joint	FLASH	80%		
P01C4	Fuel filter pressure sensor value low: Fuel supply system needs to be checked.	FLASH	80%		
P0217	Coolant high temperature fault	ON	80%		
P0241	Boost error too low fault	ON	50%		
P0242	Boost error too high fault	ON	50%		
P025B	IMV Drive SC Fault	-	-		
P0400	EGR Air Plausibility fault				
P0421	DOC Exothermal Efficiency Fault	-	-		
P16XX	ECU Safety Monitoring Fault	ON	-		
P2120	Hand Pedal Position Sensor 1 Fault	ON			
P2121	Hand Pedal Performance Fault	ON	50%		
P2125	Hand Pedal Position Sensor 2 Fault	ON			
P2138	Hand Pedal Position Sensor Correlation Fault	ON	50%		
P242B	SCR in temperature sensor plausibility fault	FLASH	80%		
P2463	Service DeSOx Needed Fault	ON	50%		
P2BB1	SCR Inducement Fault - EGR block	-	-		
P2BB2	SCR Inducement Fault - Dosing fault	-	-		
P2BB4	SCR Inducement Fault - UREA(DEF) quality fault	-	-		
P2BB5	SCR Inducement Fault - Tampering	-	-		

DTC	Description	LAMP	TRQ	Limphone Mode	Engine STOP in 5minutes
P2BB6	SCR Inducement Fault - Repeat offense	-	-		
P2BC1	SCR Inducement Fault - UREA(DEF) tank warning	-	-		
P2BC2	SCR Inducement Fault - UREA(DEF) tank level very low (warning escalation)	-	-		
P2BC3	SCR Inducement Fault	-	-		
P2BC4	SCR Inducement Fault - UREA(DEF) tank level empty	-	-		
P2BD0	SCR Inducement Fault	FLASH	80%		
U0140	J1939 CAN Pedal Fault	FLASH	-		
U0140	Timeout of CM1 (Service DeSOx Switch)	FLASH	-		

DCU Fault List

An inducement is set to limit engine power and speed when the SCR system fails to regularly reduce nitrogen oxides. This is for the operator to stop work and take a measure.

DTC	Description	Inducement
P2530	Key Position Error	-
P0071	Environment Temperature Too High	Interruption of Dosing
P0071	Environment Temperature Too Low	Interruption of Dosing
P0073	Environment Temperature Sensor High	-
P0072	Environment Temperature Sensor Low	-
P1563	Battery Voltage High	-
P1562	Battery Voltage Low	-
P1561	DEF tank: poor DEF quality	When DEF quality is poor
P1566	Battery voltage abnormal	
U1544	SAE J1939 Error (Reference Torque, ECU)	-
U1401	UDS CAN ID Error	-
U110E	CAN A Bus-off	-
P203B	DEF Level Too High	-
P203B	DEF Level Too Low	-
P203F	DEF Level is Warning	DEF
P203F	DEF Level is Empty	DEF
P203A	DEF Level Signal Error	-
P203E	DEF Fill Level High	-
P203E	DEF Fill Level Low	-
P205B	DEF Temperature Too High	-
P205B	DEF Temperature Too Low	-
P205B	DEF Temperature Plausibility High	-
P205B	DEF Temperature Plausibility Low	-
P205E	DEF Overheating	-
P205A	DEF Temperature Sensor Error	-
P205A	DEF Temperature Signal Error	-
P2202	Inlet Nox Sensor Short Circuit	Tampering
P2203	Inlet Nox Sensor Open	Tampering
U1216	Inlet NOx Sensor SAE J1939 Error (Concentration)	-
P23C1	Inlet Nox O2 Plausibility (Full-Load)	-
P23A3	Inlet NOx Sensor SAE J1939 Error (Binary Lambda Max)	-
P23A5	Inlet NOx Sensor SAE J1939 Error (Binary Lambda Min)	-
U1217	SAE J1939 Error (inlet Nox Sensor)	-
P23C3	O2 Plausibility in overrun (Sensor 1)	-
P23C5	O2 Plausibility in part load (Sensor 1)	-

DTC	Description	Inducement
P23F0	Inlet NOx Delay (O2 Signal High)	-
U1223	Inlet NOx Sensor SAE J1939 Error (Power Signal)	-
P23E1	Inlet NOx Delay (O2 Signal Low)	-
U1219	Inlet NOx Sensor SAE J1939 Error (Temperature)	-
P23EE	Inlet NOx sensor Wire monitoring	-
P23EF	Outlet NOx sensor Wire monitoring	-
P23D1	Inlet NOx Dynamic Error (O2 Signal High)	-
P23D2	Outlet NOx Dynamic Error (O2 Signal High)	-
P23D3	Inlet NOx Dynamic Error (O2 Signal Low)	-
P23D4	Outlet NOx Dynamic Error (O2 Signal Low)	-
P23A7	Inlet NOx sensor SAE J1939 Error (Linear lambda Max)	-
P23A9	Inlet NOx sensor SAE J1939 Error (Linear lambda Min)	-
P23A1	Inlet NOx sensor signal readiness Error	Tampering
P2391	Inlet NOx Sensor offset max error	-
P2393	Inlet NOx Sensor offset min error	-
P2395	Inlet NOx Sensor SRC Max	-
P2397	Inlet NOx Sensor SRC Min	-
U1224	Inlet NOx Sensor SAE J1939 Error (Nox Signal)	-
P239E	Nox Undershoot Error (Sensor 1)	-
U1234	SAE J1939 Error (inlet Nox Sensor Signal)	-
P2215	Outlet NOx Sensor Short Circuit	Tampering
P2216	Outlet NOx Sensor Open	Tampering
U1226	Outlet NOx Sensor SAE J1939 Error (Concentration)	-
P23C2	Outlet NOx O2 Plausibility (Full-Load)	-
P23A4	Outlet NOx Sensor SAE J1939 Error (Binary Lambda Max)	-
P23A6	Outlet NOx Sensor SAE J1939 Error (Binary Lambda Min)	-
U1227	Outlet NOx Sensor SAE J1939 Error (Oxidation Factor)	-
P23C4	O2 Plausibility in overrun (Sensor 2)	-
P23C6	O2 Plausibility in part load (Sensor 2)	-
P23F1	Outlet NOx Delay (O2 Signal High)	-
U1233	Outlet NOx Sensor SAE J1939 Error (Power Signal)	-
P23E2	Outlet NOx Delay (O2 Signal Low)	-
U1229	Outlet NOx Sensor SAE J1939 Error (Temperature)	-
P23A8	Outlet NOx sensor SAE J1939 Error (Linear lambda Max)	-
P23AA	Outlet NOx sensor SAE J1939 Error (Linear lambda Min)	-
P23A2	Outlet NOx sensor signal readiness Error	Tampering
P2392	Outlet NOx Sensor offset max error	-
P2394	Outlet NOx Sensor offset min error	-

DTC	Description	Inducement
P2396	Outlet NOx Sensor SRC Max	-
P2398	Outlet NOx Sensor SRC Min	-
U1225	Outlet NOx Sensor SAE J1939 Error (Nox Signal)	-
P239F	Nox Undershoot Error (Sensor 2)	-
U1235	Outlet NOx Sensor SAE J1939 Error (O2 Signal)	-
P2047	Dosing Valve Short Circuit to Battery	Tampering
P2048	Dosing Valve Short Circuit to Ground	Tampering
P2049	Dosing Valve Short Circuit to Battery	Tampering
P202E	Dosing Valve Over Temperature	Tampering
P2064	Dosing Valve Short Circuit to Ground	-
P208E	Dosing Valve is blocked	-
P202C	DEF Tank Heater SCB	Interruption of Dosing
P202B	DEF Tank Heater SCG	Interruption of Dosing
P202A	DEF Tank Heater Open	Interruption of Dosing
P209F	DEF Tank Heater Over-temperature	Interruption of Dosing
P068A	DCU Main Relay (Early opening)	-
P2510	DCU Main Relay (Stuck)	-
P0659	DCU Actuator Relay 0 SCB	-
P0658	DCU Actuator Relay 0 SCG	-
P2671	DCU Actuator Relay 1 SCB	-
P2670	DCU Actuator Relay 1 SCG	-
P2686	DCU Actuator Relay 2 SCB	-
P2685	DCU Actuator Relay 2 SCG	-
P26E9	DCU Actuator Relay 3 SCB	-
P26E8	DCU Actuator Relay 3 SCG	-
P206B	DEF Quality Error	DEF Quality
P206B	DEF Quality Error	DEF Quality
P206D	DEF Quality Sensor Open	Tampering
P206C	DEF Quality Sensor SCG	Tampering
P206A	DEF Quality Sensor Fail	Tampering
P206A	DEF Quality Sensor Fail	Tampering
P203D	DEF Level Sensor Open	Tampering
P203C	DEF Level Sensor SCG	Tampering
P203A	DEF Level Signal Error	-
P27B3	Outlet NOx Peak Plausibility Error	-
P27B4	Outlet NOx Stuck Error	-
P20E8	DEF Pump Pressure Too Low	-
P204D	DEF Pump Pressure Max	Tampering

DTC	Description	Inducement
P204C	DEF Pump Pressure Min	Tampering
P204F	DEF Pump Pressure Signal Error	-
P23BB	DEF Pump Pressure Too High	-
P23BA	DEF Pump Pressure Too Low	-
P204E	Defective Pressure Reduction	-
P204D	DEF Pump Pressure Max	Tampering
P204C	DEF Pump Pressure Min	Tampering
P204B	Monitoring of Pressure Build-up	Tampering
P204D	DEF Pump Pressure Max	Tampering
P27F0	Nox Controller Reset Error	-
P20C8	DEF Line Heater SCB	Interruption of Dosing
P20BD	DEF Line Heater 3 SCG or Open	Interruption of Dosing
P20C2	General Backflow Line Plausibility Error	Interruption of Dosing
P20C1	DEF Line Heater 4 SCG or Open	Interruption of Dosing
P20C5	DEF Line Heater 5 SCG or Open	Interruption of Dosing
P21C4	DEF Heater Relay SCB	Interruption of Dosing
P21C3	DEF Heater Relay SCG	Interruption of Dosing
P21C2	DEF Heater Relay Open	Interruption of Dosing
P21C2	DEF Heater Relay Open	Interruption of Dosing
P20BE	Pressure Line Heater Plausibility Error	Interruption of Dosing
P20C0	Pressure Line Heater SCB	Interruption of Dosing
P20BF	Pressure Line Heater SCG	Interruption of Dosing
P20BD	DEF Line Heater 3 SCG or Open	Interruption of Dosing
P20BE	Pressure Line Heater Plausibility Error	Interruption of Dosing
P20BE	Pressure Line Heater Plausibility Error	Interruption of Dosing
P20C2	General Backflow Line Plausibility Error	Tampering
P20C4	Backflow Line Heater SCB	Interruption of Dosing
P20C3	Backflow Line Heater SCG	Interruption of Dosing
P20C1	DEF Line Heater 4 SCG or Open	Interruption of Dosing
P20C2	General Backflow Line Plausibility Error	Interruption of Dosing
P20C6	Suction Line Heater Plausibility Error	Interruption of Dosing
P20C8	DEF Line Heater SCB	Interruption of Dosing
P20C7	Suction Line Heater SCG	Interruption of Dosing
P20C5	DEF Line Heater 5 SCG or Open	Interruption of Dosing
P20C6	Suction Line Heater Plausibility Error	Interruption of Dosing
P0426	SCR Inlet Temperature Error	Interruption of Dosing
P0426	SCR Inlet Temperature Error	Interruption of Dosing
P0428	SCR Inlet Temperature Sensor Signal High	Tampering

DTC	Description	Inducement
P0427	SCR Inlet Temperature Sensor Signal Low	Tampering
P24F6	SCR Inlet Temperature Plausibility Max	-
P24F5	SCR Inlet Temperature Plausibility Min	-
P24F4	SCR Inlet Temperature Static Plausibility	-
P0426	SCR Inlet Temperature Error	Interruption of Dosing
P042B	SCR Outlet Temperature Error	Interruption of Dosing
P042B	SCR Outlet Temperature Error	Interruption of Dosing
P042D	SCR Outlet Temperature Sensor Signal High	-
P042C	SCR Outlet Temperature Sensor Signal Low	-
P24FA	SCR outlet Temperature Static Plausibility	-
P042B	SCR Outlet Temperature Error	Interruption of Dosing
P27B6	Inlet Nox Plausibility Max	-
P27B5	Inlet Nox Plausibility Min	-
P27B1	Long-term Adaption Factor Max	-
P27B0	Long-term Adaption Factor Min	-
P27C0	Average Efficiency Error (SCR System)	-
P27C1	Average Efficiency Error (SCR System)	-
P27C2	Average Efficiency Error (SCR System)	-
P27C3	Average Efficiency Error (SCR System)	-
P115D	DEF Temperature Sensor Open	Tampering
P115C	DEF Temperature Sensor SCG	Tampering
P115A	DEF Temperature Sensor Fail	Tampering
P2A8D	DEF Pump Motor Speed Duty High	Tampering
P2A8C	DEF Pump Motor Speed Duty Low	Tampering
P208B	DEF Pump Motor Over temperature	-
P201F	DEF Pump Motor Speed Deviation Error (permanent)	Tampering
P208D	DEF Pump Motor SCB	Tampering
P208C	DEF Pump Motor SCG	Tampering
P208A	DEF Pump Motor Open	Tampering
P208B	DEF Pump Motor Over temperature	-
P2B8D	DEF Pump Motor Internal Duty High	Tampering
P2B8C	DEF Pump Motor Internal Duty Low	Tampering
P20FD	DEF Backflow Pump SCB	Tampering
P20FC	DEF Backflow Pump SCG	Tampering
P20FA	DEF Backflow Pump Open	Tampering
P20FB	DEF Backflow Pump Over temperature	Tampering
P2081	DOC Inlet Temperature Error	-
P2081	DOC Inlet Temperature Error	-

DTC	Description	Inducement
P2080	DOC Inlet Temperature Sensor Signal Error	-
P2080	DOC Inlet Temperature Sensor Signal Error	-
U1024	CAN communications faulty: DOC Inlet NOx sensor	-
U1025	CAN communications faulty: DOC Inlet NOx sensor	-
U1026	CAN communications faulty: DOC Inlet NOx sensor	-
U1027	CAN communications faulty: DOC Inlet NOx sensor	-
U1028	CAN communications faulty: DOC Inlet NOx sensor	-
U1029	CAN communications faulty: DOC Inlet NOx sensor	-
U102A	CAN communications faulty: DOC Inlet NOx sensor	-
U102B	CAN communications faulty: DOC Outlet NOx sensor	-
U102C	CAN communications faulty: DOC Outlet NOx sensor	-
U102D	CAN communications faulty: DOC Outlet NOx sensor	-
U102E	CAN communications faulty: DOC Outlet NOx sensor	-
U102F	CAN communications faulty: DOC Outlet NOx sensor	-
U1030	CAN communications faulty: DOC Outlet NOx sensor	-
U1031	CAN communications faulty: DOC Outlet NOx sensor	-
P204B	Monitoring of Pressure Build-up	Tampering
P204A	General Pressure Check Error	Tampering
U140F	DEF Pump Motor Communication Fail (Supply Module)	Tampering
P23B2	Supply Module Heater Plausibility Error	-
P25E1	Supply Module Heater Duty High	Tampering
P25E0	Supply Module Heater Duty Low	Tampering
P23B3	Supply Module Heater Temperature Plausibility Error	-
P23B4	Supply Module Heater Temperature cold start Plausibility Error	-
P20BC	Supply Module Heater SCB	Interruption of Dosing
P20BB	Supply Module Heater SCG	-
P20B9	Supply Module Heater Open	Interruption of Dosing
P20BA	Supply Module Heater Over temperature	Interruption of Dosing
P25E3	Supply Module Temperature Duty High	Tampering
P25E2	Supply Module Temperature Duty Low	Tampering
P23B5	Supply Module Temperature Plausibility Error	-
P23B6	Supply Module Temperature cold start Plausibility Error	-
P06EB	Outlet NOx Sensor Self-Diagnosis	-
P06EB	Outlet NOx Sensor Self-Diagnosis	-
P06EB	Outlet NOx Sensor Self-Diagnosis	-
P06EA	Inlet NOx Sensor Self-Diagnosis	-
P06EA	Inlet NOx Sensor Self-Diagnosis	-

DTC	Description	Inducement
P06EA	Inlet NOx Sensor Self-Diagnosis	-
U1904	Timeout of NOxSensGlbReqTx (NOx sensor)	-
U1646	Timeout of DM1ECU BAM (ECU)	-
U1660	Timeout of DM1ECU Packet (ECU)	-
U1444	Timeout of EEC1 (ECU)	-
U111A	Timeout of AT1I1 (Inlet Nox sensor)	-
U116D	Timeout of AT1O1 (Outlet Nox sensor)	-
U1300	Variant Dataset Error	-
P062F	EEPROM Code Word Error	-
U116F	Timeout of AT1OGC2 (Outlet Nox sensor)	-
U116E	Timeout of AT1OGC1 (Outlet Nox sensor)	-
U111C	Timeout of AT1IGC2 (Inlet Nox sensor)	-
U111B	Timeout of AT1IGC1 (Inlet Nox sensor)	-
U1800	Timeout of A1DOC (DOC Inlet Temperature Sensor)	-
U121A	Timeout AT1T1I (DEF Tank)	-
U1916	Timeout of EEC7 (ECU)	-
U1923	Timeout of A1DEFI (DEF Tank)	-
U1126	Timeout of DM1ECU (ECU)	-
U1661	Timeout of DM1ECUSPN1 (ECU)	-
U1147	Timeout of EEC3 (ECU)	-
U1162	Timeout of ET1	-
U1169	Timeout of AMB	-
U1170	Timeout of IC1	-
U1196	Timeout of PROSCR1 (ECU)	-
U1200	Timeout of PROSCR3 (ECU)	-
P23B0	Leakage Detection	-
P23B1	Evaluate Filter Clog	-
P2381	Inlet NOx Sensor Heater Readiness Error	-
P2383	Inlet NOx Sensor Mounting Error	-
P2385	Inlet NOx Sensor Signal Validity Error	-
P237E	Heater No Availability (Sensor 1)	-
P2387	Inlet NOx Sensor Dynamic High Error	-
P2388	Inlet NOx Sensor Dynamic Low Error	-
P2382	Outlet NOx Sensor Heater Readiness Error	-
P2384	Outlet NOx Sensor Mounting Error	-
P2386	Outlet NOx Sensor Signal Validity Error	-
P237F	Heater No Availability (Sensor 2)	-
P160C	DCU Reset 0	-

DTC	Description	Inducement
P160D	DCU Reset 1	-
P160E	DCU Reset 2	-
P160C	DCU Reset 0	-
P160D	DCU Reset 1	-
P160E	DCU Reset 2	-
P160F	Peripheral Monitoring Error	-
P1602	Sensor Supply Error	-
P1220	DEF Temperature Plausibility High	
P1221	DEF Temperature Plausibility Low	
P1223	DEF Temperature Too High	
P1224	DEF Temperature Too Low	
P1227	DEF Temperature Sensor Error	
P1229	DEF Temperature Signal Error	
P1230	DEF Level Signal Error	
P1231	DEF Level Sensor Fail	
P123A	DEF Fill Level High	
P123B	DEF Fill Level Low	
P123C	DEF Level is Warning	
P123D	DEF Level is Empty	
P1332	Dosing Valve Tip Temperature Error at Cold condition	
P1337	Dosing Valve Tip Temperature Error	
P1343	Dosing Valve Short Circuit to Battery	
P1344	Dosing Valve Short Circuit Error	
P1350	DOC Inlet Temperature Too High	
P1351	DOC Inlet Temperature Too Low	
P1353	DOC Inlet Temperature Sensor Signal High	
P1354	DOC Inlet Temperature Sensor Signal Low	
P1360	SCR Inlet Temperature Too High	
P1361	SCR Inlet Temperature Too Low	
P1370	SCR Outlet Temperature Too High	
P1371	SCR Outlet Temperature Too Low	
P1443	DEF Pump Pressure Max	
P1444	DEF Pump Pressure Min	
P1450	Overpressure in Metering Control	
P1451	Underpressure in Metering Control	
P1452	Monitoring of Over Pressure	
P1453	Pressure Stabilization Error	
P1455	Monitoring of Pressure Build-up	





DTC	Description	Inducement
P1511	DEF Quality Sensor Fail	
P1531	DEF Quality Signal Error	
P1560	DEF Quality Too High	
P1630	DCU EEP Read Error	
P1631	DCU EEP Write Error	
P16C0	DCU Reset 0	
P16C1	DCU Monitoring Error (query-/response-communication)	
P16C2	DCU Reset 1	
P16C3	DCU Monitoring Error (SPI communication)	
P16C4	DCU Reset 2	
P16C5	DCU Monitoring Error (ROM-test)	
P1710	Environment Temperature Too High	
P1711	Environment Temperature Too Low	
P1880	DEF Line failure	
P1882	Pressure Line Heater Plausibility Error	
P1884	Pressure Line Heater Over-temperature	
P1885	Pressure Line Heater Open Load	
P1892	Backflow Line Heater SCB	
P1893	General Backflow Line Plausibility Error	
P1894	Backflow Line Heater Over-temperature	
P1895	Backflow Line Heater Open Load	
P18A2	Suction Line Heater Plausibility Error	
P18A3	Suction Line Heater SCB	
P18A4	Suction Line Heater Over-temperature	
P18A5	Suction Line Heater Open Load	
P18B0	DEF Line Heater SCB	
P18B2	DEF Heater Relay Over-temperature	
P18B5	DEF Heater Relay Open Load	
P1A32	Self-Diagnosis in Nox Sensor 2 (Outlet Nox sensor)	
P1A37	Self-Diagnosis abort in Nox Sensor 2 (Outlet Nox sensor)	
P1A39	Nox Sensor 2 timeout to self-Diagnosis ((Outlet Nox sensor)	
P1A42	Self-Diagnosis in Nox Sensor 1 (Inlet Nox Sensor)	
P1A47	Self-Diagnosis abort in Nox Sensor 1 (Inlet Nox Sensor)	
P1A49	Nox Sensor 1 timeout to self-Diagnosis (Inlet Nox Sensor)	
P20EE	SCR Efficiency Monitoring (Nox Sensor)	
P20FF	Dosing Valve Tip Temperature Error	*TRQ3
U0024	SAE J1939 Error (Inlet Nox sensor)	

DTC	Description	Inducement
U0025	SAE J1939 Error (Inlet Nox sensor)	
U0026	SAE J1939 Error (Inlet Nox sensor)	
U0027	SAE J1939 Error (Inlet Nox sensor)	
U0028	SAE J1939 Error (Inlet Nox sensor)	
U0029	SAE J1939 Error (Inlet Nox sensor)	
U002A	SAE J1939 Error (Inlet Nox sensor)	
U002B	SAE J1939 Error (outlet Nox sensor)	
U002C	SAE J1939 Error (outlet Nox sensor)	
U002D	SAE J1939 Error (outlet Nox sensor)	
U002E	SAE J1939 Error (outlet Nox sensor)	
U002F	SAE J1939 Error (outlet Nox sensor)	
U0030	SAE J1939 Error (outlet Nox sensor)	
U0031	SAE J1939 Error (outlet Nox sensor)	
U010E	CAN A Bus-off	
U011A	Timeout of AT1I1 (Inlet Nox sensor)	
U011B	Timeout of AT1IGC1 (Inlet Nox sensor)	
U011C	Timeout of AT1IGC2 (Inlet Nox sensor)	
U0147	Timeout of EEC3 (ECU)	
U0162	Timeout of ET1	
U0169	Timeout of AMB	
U016D	Timeout of AT1O1 (Outlet Nox sensor)	
U016E	Timeout of AT1OGC1 (Outlet Nox sensor)	
U016F	Timeout of AT1OGC2 (Outlet Nox sensor)	
U0170	Timeout of IC1	
U0196	Timeout of PROSCR1 (ECU)	
U0200	Timeout of PROSCR3 (ECU)	
U0216	SAE J1939 Error (inlet Nox sensor)	
U0219	SAE J1939 Error (inlet Nox sensor)	
U021A	Timeout AT1T1I (DEF Tank)	
U0223	SAE J1939 Error (inlet Nox sensor)	
U0224	SAE J1939 Error (inlet Nox sensor)	
U0225	SAE J1939 Error (outlet Nox sensor)	
U0226	SAE J1939 Error (outlet Nox sensor)	
U0227	SAE J1939 Error (outlet Nox sensor)	
U0229	SAE J1939 Error (outlet Nox sensor)	
U0233	SAE J1939 Error (outlet Nox sensor)	
U0235	SAE J1939 Error (outlet Nox sensor)	
U0300	Variant Dataset Error	

DTC	Description	Inducement
U0401	UDS CAN ID Error	
U040F	DEF Pump Motor Communication Fail (Supply Module)	Tampering
U0444	Timeout of EEC1 (ECU)	
U0646	Timeout of DM1ECU BAM (ECU)	
U0660	Timeout of DM1ECU Packet (ECU)	
U0661	Timeout of DM1ECUSPN1 (ECU)	
U0800	Timeout of A1DOC (DOC Inlet Temperature Sensor)	
U0904	Timeout of NOxSensGlbReqTx (NOX sensor)	
U0916	Timeout of EEC7 (ECU)	
U0923	Timeout of A1DEFI (DEF Tank)	

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
Level1	On	On	Reduced	Reduced	Continuous	ENGINE MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power Reduced!
Level2	Blinking	On	Limp home	Limp home	Continuous	ENGINE MALFUNCTION CALL DOOSAN SERVICE AGENT Engine is in Limp home Mode
Level3	Blinking	On	Engine Stop	Engine Stop	Continuous	FATAL ENGINE ERROR CALL DOOSAN SERVICE AGENT Engine Stop after 5min

DEF/Ad-Blue Level inducement for USA / Europe





There are several DEF/Ad-Blue level points at which the DEF level indicator lamp changes and the display shows a message to warn the shortage of DEF/Ad-Blue. The lower the point, the more the system limits the engine power and speed in order to prevent nitrogen oxide emissions from exceeding the acceptable level due to a lack of DEF/Ad-Blue. As shown in the table below, for your information, we provide correlation of DEF/Ad-Blue level inducement strategy and LCD display.



DEF/Ad-Blue Level Inducement for USA

Inducement Stage	Condition DEF volume [%]	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	25 ~ 100	NA	Green ON	Off	Off	Off	0%	NA
Level1	10 ~ 25	NA	Green ON	Off	Off	Off	0%	NA
Level2	5~10	NA	Yellow ON	Off	Off	At starting & Every 20min	25%	NA
Level3	2.5~5	NA	Red ON	Off	Off	Every 10min	50%	60% (about 1500rpm)
Level4	0~2.5%	NA	Red Blink	Off	Off	Every 5min	0%	Fix at Low Idle RPM

Inducement Stage	Condition DEF volume [%]	Repeat Offence (within 40hrs)	LCD Display	
			Method	Message on the Display
				
Normal	25 ~ 100	NA	NA	NA
Level1	10 ~ 25	NA	For 1min At starting & Every 20min	DEF LOW - REFILL Engine Power Will Be Reduced
Level2	5~10	NA	For 1min At starting & Every 20min	DEF VERY LOW - REFILL NOW Engine Power Reduced By 25%
Level3	2.5~5	NA	For 1min Every 10min	DEF VERY LOW - REFILL NOW Engine Power Reduced By 50%
Level4	0~2.5%	NA	Continuous	DEF EMPTY Engine can run LOW IDLE ONLY

DEF/Ad-Blue Level Inducement for Europe





Inducement Stage	Condition DEF volume [%]	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	25 ~ 100	NA	Green ON	Off	Off	Off	0%	NA
Level1	10 ~ 25	NA	Green ON	Off	Off	Off	0%	NA
Level2	5~10	NA	Yellow ON	Off	Off	At starting & Every 20min	25%	NA
Level3	0~5	NA	Red Blink	Off	Off	Every 10min	50%	60% (about 1500rpm)



Inducement Stage	Condition DEF volume [%]	Repeat Offence (within 40hrs)	LCD Display	
			Method	Message on the Display
				
Normal	25 ~ 100	NA	NA	NA
Level1	10 ~ 25	NA	For 1min At starting & Every 20min	DEF LOW - REFILL Engine Power Will Be Reduced
Level2	5~10	NA	For 1min Every 10min	DEF VERY LOW - REFILL NOW Engine Power Reduced By 25%
Level3	2.5~5	NA	Continuous	DEF VERY LOW - REFILL NOW Engine Power Reduced By 50%

DEF/Ad-Blue Quality Failure for USA / Europe





If you use a poor quality DEF/Ad-Blue type, engine power will decrease in order to prevent the SCR system from functional degradation and damage. Continued use of poor quality DEF/Ad-Blue may result in high replacement cost due to damage caused to the SCR system. As shown in the table below, for your information, we provide correlation of DEF/Ad-Blue quality inducement strategy and LCD display.



DEF/Ad-Blue Quality Failure for USA

Inducement Stage	Condition	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	NA	NA	Green ON	Off	Off	Off	0%	NA
Level1	Poor DEF quality was detected	NA	Green ON	On	Off	Off	0%	NA
Level2	0.5~2.5hrs	Immediately	Green ON	On	Off	At starting & Every 20min	25%	NA
Level3	2.5~3.5hrs	9~25min	Green ON	Blinking	On	Every 10min	50%	60% (about 1500rpm)
Level4	over 3.5hrs	over 25min	Green ON	Blinking	Blinking	Every 5min	0%	Fix at Low Idle RPM

Inducement Stage	Condition	Repeat Offence (within 40hrs)	LCD Display	
			Method	Message on the Display
				
Normal	25 ~ 100	NA	NA	NA
Level1	10 ~ 25	NA	For 1min At starting & Every 20min	DEF QUALITY POOR - CHANGE NOW Engine Power will be Reduced in 30min
Level2	5~10	NA	For 1min At starting & Every 20min	DEF QUALITY POOR - CHANGE NOW Engine Power Reduced By 25%
Level3	2.5~5	NA	For 1min Every 10min	DEF QUALITY POOR - CHANGE NOW Engine Power Reduced By 50%
Level4	0~2.5%	NA	Continuous	DEF QUALITY POOR - CHANGE NOW Engine can run LOW IDLE ONLY

DEF/Ad-Blue Quality Failure for Europe





Inducement Stage	Condition	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	NA	≥ 90% of counter value for severe inducement (20hr)	Green ON	Off	Off	Off	0%	NA
Level1	Poor DEF quality was detected		Green ON	On	Off	Off	0%	NA
Level2	10~20hrs		Green ON	On	On	At starting & Every 20min	25%	NA
Level3	over 20hrs		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	≥ 90% of counter value for severe inducement (20hr)	NA	NA
Level1	Poor DEF quality was detected		For 1min At starting & Every 20min	DEF QUALITY POOR - CHANGE NOW Engine Power will be Reduced
Level2	10~20hrs		For 1min At starting & Every 10min	DEF QUALITY POOR - CHANGE NOW Engine Power Reduced By 25%
Level3	over 20hrs		Continuous	DEF QUALITY POOR - CHANGE NOW Engine Power Reduced By 50%

SCR system tampering for USA / Europe





There are several tampering level points at which the DEF indicator lamp lights up or blinks and the display shows a message to warn that the DEF/Ad-Blue is not being consumed due to the malfunctioning of the SCR system, the installation of another device to the system, or the handling of related parts. 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 SCR tampering inducement strategy and LCD display.



SCR system Tampering for USA

Inducement Stage	Condition	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	NA	NA	Green ON	Off	Off	Off	0%	NA
Level1	Tampering was detected	NA	Green ON	On	Off	Off	0%	NA
Level2	0.5~2.5hrs	Immediately	Green ON	On	On	At starting & Every 20min	25%	NA
Level3	2.5~3.5hrs	9~25min	Green ON	Blinking	On	Every 10min	50%	60% (about 1500rpm)
Level4	over 3.5hrs	over 25min	Green ON	Blinking	Blinking	Every 5min	0%	Fix at Low Idle RPM

Inducement Stage	Condition	Repeat Offence (within 40hrs)	LCD Display	
			Method	Message on the Display
				
Normal	NA	NA	NA	NA
Level1	Tampering was detected	NA	At starting & Every 20min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power Reduced in 30min
Level2	0.5~2.5hrs	Immediately	At starting & Every 20min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 25%
Level3	2.5~3.5hrs	9~25min	Every 10min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 50%
Level4	over 3.5hrs	over 25min	Continuous	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine can run LOW IDLE ONLY

SCR system Tampering for Europe





Inducement Stage	Condition	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	NA	≥ 95% of counter value for severe inducement (100hrs)	Green ON	Off	Off	Off	0%	NA
Level1	Tampering was 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	Tampering was detected		At starting & Every 20min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power will be Reduced
Level2	36~100hrs		Every 10min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 25%
Level3	over 100hrs		Continuous	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 50%

Impeded EGR / Interruption of Dosing for Europe only





There are several interruption level points at which the DEF indicator and engine check lamps light up or blink and the display shows a message to warn that the DEF/Ad-Blue is not being consumed due to a fault on the engine EGR valve and SCR system. 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 Impeded EGR / Interruption of Dosing inducement strategy and LCD display.



Impeded EGR for Europe

Inducement Stage	Condition	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	NA	≥ 95% of counter value for severe inducement (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	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power will be Reduced
Level2	36~100hrs		Every 10min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 25%
Level3	over 100hrs		Continuous	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 50%

Interruption of Dosing for Europe

Inducement Stage	Condition	Repeat Offence (within 40hrs)	Inducement Strategy					
			DEF Level Indicator	DEF Indicator	Engine Check Lamp	Buzzer	Torque Reduction	RPM Limit
								
Normal	NA	≥ 90% of counter value for severe inducement (20hrs)	Green ON	Off	Off	Off	0%	NA
Level1	Dosing Interruption detected		Green ON	On	Off	Off	0%	NA
Level2	10~20hrs		Green ON	On	On	At starting & Every 20min	25%	NA
Level3	over 20hrs		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	≥ 90% of counter value for severe inducement (20hrs)	NA	NA
Level1	Dosing Interruption detected		At starting & Every 20min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power will be Reduced
Level2	10~20hrs		Every 10min	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 25%
Level3	over 20hrs		Continuous	SCR SYSTEM MALFUNCTION CALL DOOSAN SERVICE AGENT Engine Power is Reduced By 50%

Electronic Controlled Spark-Ignition Engines

PSI 4.3L LP Engine

The primary components of the fuel system are the fuel supply, direct electronic pressure regulator (DEPR), fuel mixer, electronic throttle control (ETC) device, 2-Stage convertor, engine control module (ECM), and a catalytic converter. The system operates on a slightly positive fuel pressure. Primary fuel pressure can be measured at the LD 2-Stage convertor. Secondary fuel pressure command and actual fuel pressure is monitored by the ECM.

To obtain maximum effect from the catalyst and accurate control of the air fuel ratio, the emission certified engine is equipped with an onboard computer or Engine Control Module (ECM). The ECM is a 32 bit controller which receives input data from sensors mounted to the engine and fuel system and then outputs various signals to control engine operation.

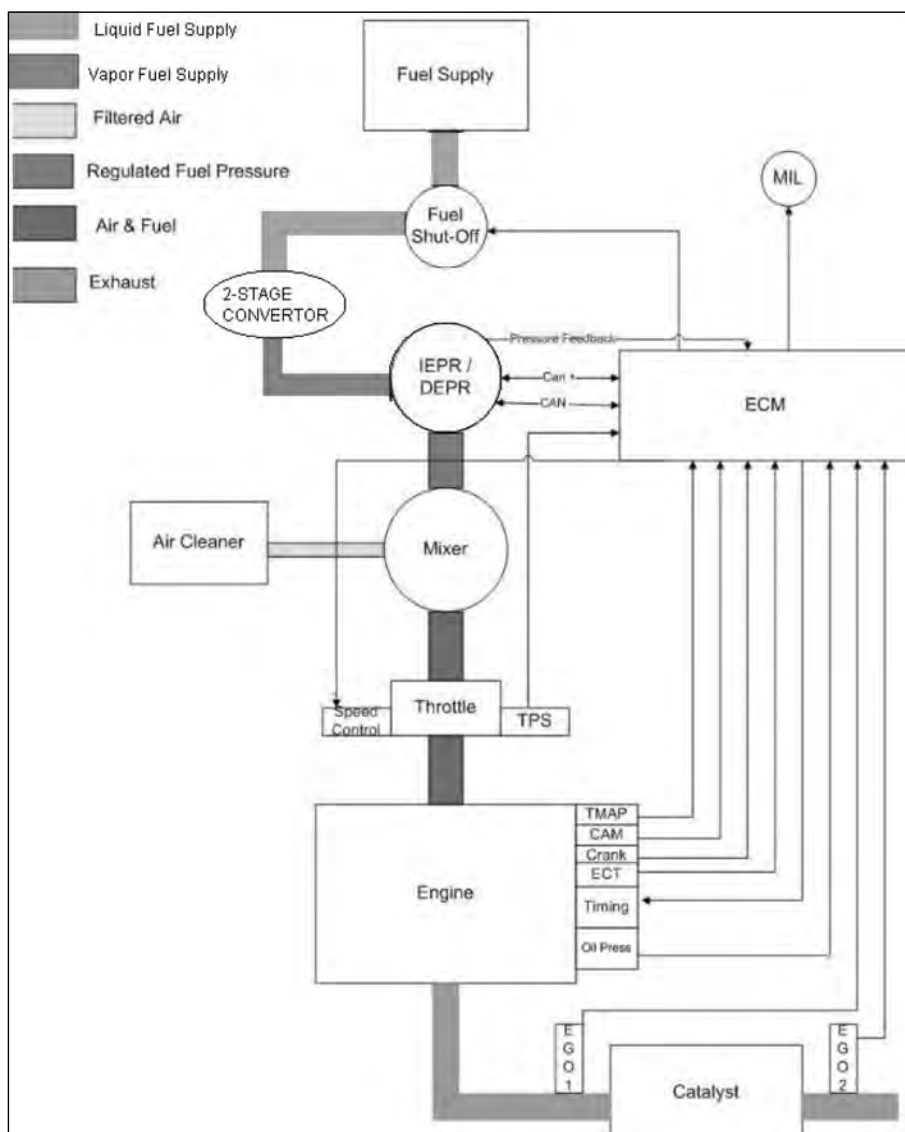
One specific function of the controller is to maintain a closed loop fuel control which is accomplished by use of the Heated Exhaust Gas Oxygen sensor (HEGO) mounted in the exhaust system. The HEGO sensor sends a voltage signal to the controller which then outputs signals to the EPR to change the amount of fuel being delivered from the regulator or mixer to the engine.

The controller also performs diagnostic functions on the fuel system and notifies the operator of engine malfunctions by turning on a Malfunction Indicator Light (MIL) mounted in the dash. Malfunctions in the system are identified by a Diagnostic Trouble Code (DTC) number. In addition to notifying the operator of the malfunction in the system, the controller also stores the information about the malfunction in its memory. A technician can then utilize a computerized diagnostic scan tool to retrieve the stored diagnostic code and by using the diagnostic charts in this manual to determine the cause of the malfunction. In the event a technician does not have the computerized diagnostic tool, the MIL light can be used to identify the diagnostic code to activate the "blink" feature and count the number of blinks to determine the diagnostic code number to locate the fault in the system.

The primary components of the Gasoline Multi Point Fuel Injection (MPFI) fuel system are the gasoline fuel tank, electric fuel pump, fuel pressure and temperature sensor manifold, fuel filter and fuel rail.

This engine is equipped with a fuel injector rail that does not have a pressure regulator or a return circuit to the fuel tank. Fuel pressure for this engine is regulated by the engine's ECM. The ECM receives fuel pressure and temperature feedback from the gasoline fuel sensor manifold and uses this information to control the ground side of the fuel pump. Fuel pressure is regulated by the ECM pulse width modulating (PWM) the fuel pump. The fuel pressure and temperature sensor manifold has a return or "bleed" circuit that connects back to the equipment fuel tank. This circuit is used to bleed off any vapor that develops in the line and returns a small amount of fuel to the tank. The fuel comes from the fuel tank and passes through the fuel pump. Fuel exits the fuel pump, passes through the filter and then enters the fuel pressure and temperature manifold assembly. Fuel flows through the feed circuit and is delivered to the fuel injector rail. Fuel that enters the bleed circuits through the by-pass valve in the manifold is returned to the fuel tank.

EMS schematic of PSI 4.3L LP engine



Basic Troubleshooting(LP)

The PSI 4.3L fuel systems are equipped with built-in fault diagnostics. Detected system faults can be displayed by the Malfunction Indicator Lamp (MIL) and are covered in the Advanced Diagnostics section. Items such as fuel level, plugged fuel lines, clogged fuel filters and malfunctioning pressure regulators may not set a fault code by the Engine Control Module (ECM).

Below are basic checks that should be made before referring to the Advanced Diagnostics section, if engine or drivability problems are encountered.

Locating a problem in a propane engine is done exactly the same way as with a gasoline engine.

Consider all parts of the ignition and mechanical systems as well as the fuel system.

FUEL SYSTEM SYMPTOM DIAGNOSTICS

Checks	Action
Before Using This Section	<p>Before using this section, you should have performed On Board Diagnostic (OBD) Check and determined that:</p> <ol style="list-style-type: none">1. The ECM and MIL are operating correctly.2. There are no Diagnostic Trouble Codes (DTCs) stored, or a DTC exists but without a MIL. <p>Several of the following symptom procedures call for a careful visual and physical check. These checks are very important as they can lead to prompt diagnosis and correction of a problem.</p>
Fuel System Check	<ol style="list-style-type: none">1. Verify the customer complaint.2. Locate the correct symptom table.3. Check the items indicated under that symptom.4. Operate the equipment under the conditions the symptom occurs. Verify HEGO switching between lean and rich. <p>IMPORTANT! Normal HEGO switching indicates the fuel system is in closed loop and operating correctly at that time.</p> <ol style="list-style-type: none">5. Take a data snapshot using the DST under the condition that the symptom occurs to review at a later time.
Visual and Physical Checks	<ul style="list-style-type: none">• Check all ECM system fuses and circuit breakers.• Check the ECM ground for being clean, tight and in its proper location.• Check the vacuum hoses for splits, kinks and proper connections.• Check thoroughly for any type of leak or restriction.• Check for air leaks at all the mounting areas of the intake manifold sealing surfaces.• Check for proper installation of the mixer assembly.• Check for air leaks at the mixer assembly. <p>Check the ignition wires for the following conditions:</p> <ul style="list-style-type: none">• Cracking• Hardening• Proper routing• Carbon tracking. <p>Check the wiring for the following items: proper connections, pinches or cuts.</p> <p>The following symptom tables contain groups of possible causes for each symptom. The order of these procedures is not important. If the DST readings do not indicate a problem, then proceed in a logical order, easiest to check or most likely to cause the problem.</p>

INTERMITTENT

Checks	Action
DEFINITION: <i>The problem may or may not turn ON the (MIL) or store a Diagnostic Trouble Code (DTC).</i>	
Preliminary Checks	Do not use the DTC tables. If a fault is an intermittent, the use of the DTC tables with this condition may result in the replacement of good parts.
Faulty Electrical Connections or Wiring	<p>Faulty electrical connections or wiring can cause most intermittent problems. Check the suspected circuit for the following conditions:</p> <ul style="list-style-type: none"> • Faulty fuse or circuit breaker, connectors poorly mated, terminals not fully seated in the connector (backed out). Terminals not properly formed or damaged. • Wire terminals poorly connected. • Terminal tension is insufficient. • Carefully remove all the connector terminals in the problem circuit in order to ensure the proper contact tension. • If necessary, replace all the connector terminals in the problem circuit in order to ensure the proper contact tension (except those noted as "Not Serviceable"). See section <i>Wiring Schematics</i>. • Checking for poor terminal to wire connections requires removing the terminal from the connector body.
Operational Test	If a visual and physical check does not locate the cause of the problem, operate the vehicle with the DST connected. When the problem occurs, an abnormal voltage or scan reading indicates a problem circuit.
Intermittent MIL Illumination	<p>The following components can cause intermittent MIL and no DTC(s):</p> <ul style="list-style-type: none"> • A defective relay. • Switch that can cause electrical system interference. Normally, the problem will occur when the faulty component is operating. • The improper installation of add on electrical devices, such as lights, 2-way radios, electric motors, etc. • The ignition secondary voltage shorted to a ground. • The MIL circuit or the Diagnostic Test Terminal intermittently shorted to ground. • The MIL wire grounds.
Loss of DTC Memory	<p>To check for the loss of the DTC Memory:</p> <ol style="list-style-type: none"> 1. Disconnect the TMAP sensor. 2. Idle the engine until the MIL illuminates. 3. The ECM should store a TMAP DTC which should remain in the memory when the ignition is turned OFF. If the TMAP DTC does not store and remain, the ECM is faulty.

NO START

Checks	Action
DEFINITION: <i>The engine cranks OK but does not start.</i>	
Preliminary Checks	None
ECM Checks	<p>Use the DST to:</p> <ul style="list-style-type: none"> • Check for proper communication with both the ECM • Check all system fuses engine fuse holder. Refer to <i>Engine Controls Schematics</i>. • Check battery power, ignition power and ground circuits to the ECM. Refer to <i>Engine Control Schematics</i>. Verify voltage and/or continuity for each.
Sensor Checks	<ul style="list-style-type: none"> • Check the TMAP sensor. • Check the cam angle sensor for output (RPM).
Fuel System Checks	<p>Important: A closed LPG manual fuel shut off valve will create a no start condition.</p> <ul style="list-style-type: none"> • Check for air intake system leakage between the mixer and the throttle body. Verify proper operation of the low pressure lock-off solenoids. • Verify proper operation of the fuel control solenoids. • Check the fuel system pressures. • Refer to the <i>LPG Fuel System Diagnosis</i>. • Check for proper mixer air valve operation.
Ignition System Checks	<p>Note: LPG being a gaseous fuel requires higher secondary ignition system voltages for the equivalent gasoline operating conditions.</p> <ol style="list-style-type: none"> 1. Check for the proper ignition voltage output with <i>J 26792</i> or the equivalent. 2. Verify that the spark plugs are correct for use with LPG. <p>Check the spark plugs for the following conditions:</p> <ul style="list-style-type: none"> • Wet plugs. • Cracks. • Wear. • Improper gap. • Burned electrodes. • Heavy deposits. • Check for bare or shorted ignition wires. • Check for loose ignition coil connections at the coil.

NO START

Checks	Action
Engine Mechanical Checks	<p>Important: The LPG Fuel system is more sensitive to intake manifold leakage than the gasoline fuel system.</p> <p>Check for the following:</p> <ul style="list-style-type: none">• Vacuum leaks.• Improper valve timing.• Low compression.• Improper valve clearance.• Worn rocker arms.• Broken or weak valve springs. <p>Worn camshaft lobes.</p>
Exhaust System Checks	<p>Check the exhaust system for a possible restriction:</p> <ul style="list-style-type: none">• Inspect the exhaust system for damaged or collapsed pipes:• Inspect the muffler for signs of heat distress or for possible internal failure.• Check for possible plugged catalytic converter. Refer to <i>Restricted Exhaust System Diagnosis</i>.

HARD START

Checks	Action
DEFINITION: The engine cranks OK, but does not start for a long time. The engine does eventually run, or may start but immediately dies.	
Preliminary Checks	Make sure the vehicle's operator is using the correct starting procedure.
Sensor Checks	<ul style="list-style-type: none"> • Check the Engine Coolant Temperature sensor with the DST. Compare the engine coolant temperature with the ambient air temperature on a cold engine. If the coolant temperature reading is more than 10 degrees greater or less than the ambient air temperature on a cold engine, check for high resistance in the coolant sensor circuit. Check the cam angle sensor. • Check the Throttle Position (TPS) and Foot Pedal Position (FPP) sensor connections.
Fuel System Checks	<p>Important: A closed LPG manual fuel shut off valve will create an extended crank OR no start condition.</p> <ul style="list-style-type: none"> • Verify the excess flow valve is not tripped or that the manual shut-off valve is not closed. <p>Check mixer assembly for proper installation and leakage.</p> <ul style="list-style-type: none"> • Verify proper operation of the low pressure lock-off solenoid. • Verify proper operation of the EPR. • Check for air intake system leakage between the mixer and the throttle body. Check the fuel system pressures. Refer to the <i>Fuel System Diagnosis</i>.
Ignition System Checks	<p>Note: LPG being a gaseous fuel requires higher secondary ignition system voltages for the equivalent gasoline operating conditions.</p> <ul style="list-style-type: none"> • Check for the proper ignition voltage output with <i>J 26792</i> or the equivalent. • Verify that the spark plugs are the correct type and properly gapped. <p>Check the spark plugs for the following conditions:</p> <ul style="list-style-type: none"> • Wet plugs. • Cracks. • Wear. • Burned electrodes. • Heavy deposits • Check for bare or shorted ignition wires. • Check for moisture in the distributor cap. • Check for loose ignition coil connections. <p>Important:</p> <ol style="list-style-type: none"> 1. If the engine starts but then immediately stalls, check the cam angle sensor. 2. Check for improper gap, debris or faulty connections.

HARD START

Checks	Action
Engine Mechanical Checks	<p>Important: The LPG Fuel system is more sensitive to intake manifold leakage than the gasoline fuel supply system.</p> <p>Check for the following:</p> <ul style="list-style-type: none"> • Vacuum leaks • Improper valve timing • Low compression • Improper valve clearance. • Worn rocker arms • Broken or weak valve springs • Worn camshaft lobes. <p>Check the intake and exhaust manifolds for casting ash.</p>
Exhaust System Checks	<p>Check the exhaust system for a possible restriction:</p> <ul style="list-style-type: none"> • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for signs of heat distress or for possible internal failure. <p>Check for possible plugged catalytic converter. Refer to <i>Restricted Exhaust System Diagnosis</i>.</p>

CUTS OUT, MISSES

Checks	Action
DEFINITION: A surging or jerking that follows engine speed, usually more pronounced as the engine load increases, but normally felt below 1500 RPM. The exhaust has a steady spitting sound at idle, low speed, or hard acceleration for the fuel starvation that can cause the engine to cut-out.	
Preliminary Checks	None
Ignition System Checks	<ol style="list-style-type: none"> 1. Start the engine. 2. Check for proper ignition output voltage with spark tester J 26792. 3. Check for a cylinder misfire. 4. Verify that the spark plugs are the correct type and properly gapped. <p>Remove the spark plugs and check for the following conditions:</p> <ul style="list-style-type: none"> • Insulation cracks. • Wear. • Improper gap. • Burned electrodes. • Heavy deposits. <p>Visually/Physically inspect the secondary ignition for the following:</p> <ul style="list-style-type: none"> • Ignition wires for arcing and proper routing. • Cross- ring. • Ignition coils for cracks or carbon tracking
Engine Mechanical Checks	<p>Perform a cylinder compression check. Check the engine for the following:</p> <ul style="list-style-type: none"> • Improper valve timing. • Improper valve clearance. • Worn rocker arms. • Worn camshaft lobes. • Broken or weak valve springs. • Check the intake and exhaust manifold passages for casting ash.
Fuel System Checks	<p>Check the fuel system:</p> <ul style="list-style-type: none"> • Plugged fuel filter. • Low fuel pressure, etc. Refer to <i>LPG Fuel System Diagnosis</i>. • Check the condition of the wiring to the low pressure lock-off solenoid.
Additional Check	<p>Check for Electromagnetic Interference (EMI), which may cause a misfire condition. Using the DST, monitor the engine RPM and note sudden increases in rpms displayed on the scan tool but with little change in the actual engine rpm. If this condition exists, EMI may be present. Check the routing of the secondary wires and the ground circuit.</p>

HESITATION, SAG, STUMBLE

Checks	Action
<p>DEFINITION: The engine has a momentary lack of response when putting it under load. The condition can occur at any engine speed. The condition may cause the engine to stall if it's severe enough.</p>	
Preliminary Checks	None
Fuel System Checks	<ul style="list-style-type: none"> • Check the fuel pressure. Refer to <i>LPG Fuel System Diagnosis</i>. • Check for low fuel pressure during a moderate or full throttle acceleration. If the fuel pressure drops below specification, there is possibly a faulty low pressure regulator or a restriction in the fuel system. • Check the TMAP sensor response and accuracy. • Check Shut-Off electrical connection. • Check the mixer air valve for sticking or binding. • Check the mixer assembly for proper installation and leakage. Check the EPR.
Ignition System Checks	<p>Note: LPG being a gaseous fuel requires higher secondary ignition system voltages for the equivalent gasoline operating conditions. If a problem is reported on LPG and not gasoline, do not discount the possibility of a LPG only ignition system failure and test the system accordingly.</p> <ul style="list-style-type: none"> • Check for the proper ignition voltage output with J 26792 or the equivalent. Verify that the spark plugs are the correct type and properly gapped. • Check for faulty spark plug wires. • Check for fouled spark plugs.
Additional Check	<ul style="list-style-type: none"> • Check for manifold vacuum or air induction system leaks. • Check the alternator output voltage.

BACKFIRE

Checks	Action
DEFINITION: The fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.	
Preliminary Checks	None
Ignition System Checks	<p>Important! LPG, being a gaseous fuel, requires higher secondary ignition system voltages for the equivalent gasoline operating conditions. The ignition system must be maintained in peak condition to prevent backfire.</p> <ul style="list-style-type: none"> • Check for the proper ignition coil output voltage using the spark tester J26792 or the equivalent. • Check the spark plug wires by connecting an ohmmeter to the ends of each wire in question. If the meter reads over 30,000 ohms, replace the wires. • Check the connection at ignition coil. • Check for deteriorated spark plug wire insulation. <p>Remove the plugs and inspect them for the following conditions:</p> <ul style="list-style-type: none"> • Wet plugs. • Cracks. • Wear. • Improper gap. • Burned electrodes. • Heavy deposits.
Engine Mechanical Check	<p>Important! The LPG Fuel system is more sensitive to intake manifold leakage than a gasoline fuel supply system.</p> <p>Check the engine for the following:</p> <ul style="list-style-type: none"> • Improper valve timing. • Engine compression. • Manifold vacuum leaks. • Intake manifold gaskets. • Sticking or leaking valves. • Exhaust system leakage. • Check the intake and exhaust system for casting flash or other restrictions.
Fuel System Checks	Perform a fuel system diagnosis. Refer to <i>LPG Fuel System Diagnosis</i> .

LACK OF POWER, SLUGGISHNESS, OR SPONGINESS

Checks	Action
DEFINITION: <i>The engine delivers less than expected power.</i>	
Preliminary Checks	<ul style="list-style-type: none"> • Refer to the <i>LPG Fuel system OBD System Check</i>. • Compare the customer's vehicle with a similar unit to verify customer has an actual problem. <i>Do not compare the power output of the vehicle operating on LPG to a vehicle operating on gasoline as the fuels do have different drive feel characteristics.</i> • Remove the air filter and check for dirt or restriction. • Check the vehicle transmission. • Refer to the OEM transmission diagnostics.
Fuel System Checks	<ul style="list-style-type: none"> • Check for a restricted fuel filter, contaminated fuel, or improper fuel pressure. Refer to <i>LPG Fuel System Diagnosis</i>. • Check for the proper ignition output voltage with the spark tester J 26792 or the equivalent. • Check for proper installation of the mixer assembly. Check all air inlet ducts for condition and proper installation. • Check for fuel leaks between the EPR and the mixer. • Verify that the LPG tank manual shut-off valve is fully open. • Verify that liquid fuel (not vapor) is being delivered to the EPR.
Sensor Checks	<ul style="list-style-type: none"> • Check the Heated Exhaust Gas Oxygen Sensors (HEGO) for contamination and performance. Check for proper operation of the TMAP sensor. • Check for proper operation of the TPS and FPP sensors.
Exhaust System Checks	<p>Check the exhaust system for a possible restriction:</p> <ul style="list-style-type: none"> • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for signs of heat distress or for possible internal failure. • Check for possible plugged catalytic converter.
Engine Mechanical Check	<p>Check the engine for the following:</p> <ul style="list-style-type: none"> • Engine compression. • Valve timing. • Improper or worn camshaft. • Refer to <i>Engine Mechanical</i> in the Service Manual.
Additional Check	<ul style="list-style-type: none"> • Check the ECM grounds for being clean, tight, and in their proper locations. • Check the alternator output voltage. <p>If all procedures have been completed and no malfunction has been found, review and inspect the following items:</p> <ul style="list-style-type: none"> • Visually and physically, inspect all electrical connections within the suspected circuit and/or systems. • Check the DST data.

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Checks	Action
DEFINITION: <i>The engine runs unevenly at idle. If severe enough, the engine may shake.</i>	
Preliminary Checks	None.
Sensor Checks	<p>Check the Heated Exhaust Gas Oxygen Sensors (HEGO) performance:</p> <ul style="list-style-type: none"> • Check for silicone contamination from fuel or improperly used sealant. If contaminated, the sensor may have a white powdery coating result in a high but false signal voltage (rich exhaust indication). The ECM will reduce the amount of fuel delivered to the engine causing a severe driveability problem. <p>Check the Temperature Manifold Absolute Pressure (TMAP) sensor response and accuracy.</p>
Fuel System Checks	<ul style="list-style-type: none"> • Check for rich or lean symptom that causes the condition. • Drive the vehicle at the speed of the complaint. • Monitoring the oxygen sensors will help identify the problem. • Check for a sticking mixer air valve. • Verify proper operation of the EPR. • Perform a cylinder compression test. Refer to <i>Engine Mechanical</i> in the Service Manual. • Check the EPR fuel pressure. Refer to the <i>LPG Fuel System Diagnosis</i>. • Check mixer assembly for proper installation and connection.
Ignition System Checks	<ul style="list-style-type: none"> • Check for the proper ignition output voltage using the spark tester J26792 or the equivalent. • Verify that the spark plugs are the correct type and properly gapped. <p>Remove the plugs and inspect them for the following conditions:</p> <ul style="list-style-type: none"> • Wet plugs. • Cracks. • Wear. • Improper gap. • Burned electrodes. • Blistered insulators. • Heavy deposits. <p>Check the spark plug wires by connecting an ohmmeter to the ends of each wire in question. If the meter reads over 30,000 ohms, replace the wires.</p>
Additional Checks	<p>Important: The LPG Fuel system is more sensitive to intake manifold leakage than the gasoline fuel supply system.</p> <ul style="list-style-type: none"> • Check for vacuum leaks. Vacuum leaks can cause a higher than normal idle and low throttle angle control command. • Check the ECM grounds for being clean, tight, and in their proper locations. Check the battery cables and ground straps. They should be clean and secure. Erratic voltage may cause all sensor readings to be skewed resulting in poor idle quality.

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Checks	Action
Engine Mechanical Check	<p>Check the engine for:</p> <ul style="list-style-type: none"> • Broken motor mounts. • Improper valve timing. • Low compression. • Improper valve clearance. • Worn rocker arms. • Broken or weak valve springs. • Worn camshaft lobes.

Advanced Diagnostics

The Fuel system has built-in diagnostics for system trouble shooting. The system has a dash mounted malfunction indicator lamp (MIL) that provides indications of engine or fuel system related problem. Most engine control system related problems that affect emissions or driveability of the vehicle will set a (DTC) diagnostic trouble code and illuminate the MIL.

The MIL serves as notification to the operator of a problem related to the emission control system so the driver can arrange for service as soon as possible. It will also display DTCs that have been stored due to a system malfunction.

The MIL should illuminate when the key is in the ON position and the engine is not running. This feature verifies that the lamp is in proper working order. If the MIL does not illuminate with the vehicle key ON/engine OFF, repair it as soon as possible. Once the engine is in start or run mode, the MIL should turn off. If the lamp remains on while the engine is in the start or run mode a diagnostic trouble code may be set.

The MIL will be turned OFF after three (3) consecutive run cycles or by clearing the active code with the Diagnostic Scan Tool (DST).

Diagnostic Trouble Codes are set when the GCP (Electronic Control Module) runs a diagnostic self test and the test fails. When a DTC is set, the ECM will illuminate the MIL on the instrument panel and also save the DTC in memory. The ECM will continue to run the self test. If the system continues to fail the test, the lamp will stay illuminated and the DTC is stored as an active DTC. If the self test runs and passes, the DTC will be stored as historic DTC. All DTCs are stored as historic faults until they are cleared. Most DTCs will automatically clear from memory if the DTC does not reset within 50 to 100 consecutive engine run cycles.

While a Diagnostic Trouble Code is current for a sensor, the ECM may assign a default "limp home" value and use that value in its control algorithms. All of the system diagnostic self-tests run continuously during normal vehicle operation.

The Diagnostic Trouble Codes can be read by using either the MIL lamp or a laptop computer. Diagnostic Trouble Codes can be cleared from memory with a laptop computer, or by turning the ignition key to the OFF position and removing the ECM power fuse or battery cable for at least 15 seconds.

If more than one DTC is detected, start the diagnostic repair with the lowest DTC number set. Diagnose each problem to correction unless directed to do otherwise by the diagnostic chart. The DTCs are numbered in order of importance. Both DTC 112 and DTC122 pertain to the oxygen sensor, so it is possible that a repair that corrects DTC 112 may also correct the problem causing the DTC 122.

Diagnostic test charts contained in this manual refer to the DST to be connected and in the "System Data Mode." This simply means that the DST is connected and communicating with the PC. In some instances the chart will call out a special test mode. An example of this would be instructions for the DST to be connected and in the DBW (drive by wire) mode. Always be sure to follow the special instructions to avoid a false diagnosis of fuel system components.

Blink Code Function

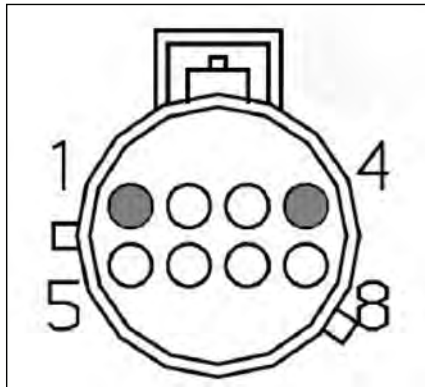
Although the DST is considered a required tool to access the DTC codes, codes may be retrieved without a laptop computer using the blink code function. To enable this function follow the steps below:

- Jump pins 1 and 4 at the DLC connector (see illustration below)
- Turn the ignition key to the on position
- The system will now enter the self diagnostic blink code mode. Be ready with pen and paper to write down any codes that may be stored.
- The ECM will flash the MIL indicator with a pause between represented numbers that represent DTC codes. The sequence starts with code 1654. Code 1654 confirms the system has entered the blink code mode. The ECM will flash code 1654 (3) times before displaying the actual DTC code that may be set.

Example:

One short blink (pause) six short blinks (pause) five short blinks (pause) four short blinks.

- If no DTC codes are found, the ECM will continue to flash 1654 only. This means no stored DTC codes were found.
- If one of the numbers in the DTC code is zero (0), no flash will occur to represent the zero value—it will be represented as a short pause.



Malfunction Indicator Lamp (MIL) Operation

How does my MIL work?

The emissions control system utilizes a MIL to warn the operator or technician of a possible issue with the engine or emissions control system. The system will keep the MIL illuminated for the entire key cycle in which the trouble code was set. It will keep the MIL illuminated for three additional engine run cycles under the following two circumstances: (1) The fault caused the engine to shut down or (2) the fault is related to the exhaust gas oxygen (EGO) sensors. This function is called MIL persistence.

How does MIL persistence work?

In the event the DTC is related to either an engine shutdown fault OR an oxygen sensor fault the following statement applies: If the vehicle is not serviced by a technician and the condition causing the MIL illumination (DTC) no longer exists, the MIL will remain illuminated for the 3 additional start cycles. The MIL will go out on the 4th start cycle if the condition does not reoccur.

In the event the DTC is not related to an engine shut down or an oxygen sensor fault and the condition causing the MIL illumination (DTC) no longer exists, the MIL will go out at the next run cycle.

If the condition is serviced by a technician and the DTC is cleared using a Diagnostic Service Tool (DST), the MIL will go out immediately.

Diagnostic Trouble Codes (DTC) are permanently retained in the historic DTC section until cleared with a DST or the auto clear requirements are met. The auto clear feature will clear out historic faults after 40 run cycles.

What are the requirements for a run cycle?

A run cycle is when the engine speed is above the "run speed" set point for 1.5 seconds or longer. The "run speed" is the transition point when the ECM recognizes the engine is going from the cranking parameters to the engine running parameters. The run speed is typically set at 450 rpm.

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY DTC # (1 of 4)

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 11: Intake cam / distributor position error	520800	7	DTC 268: Injector 3 coil shorted	653	6
DTC 16: Crank and/or cam could not synchronize during start	636	8	DTC 270: Injector 4 open or short to ground	654	5
DTC 24: Exhaust cam position error	520801	7	DTC 271: Injector 4 coil shorted	654	6
DTC 87 Fuel pressure lower than expected	94	1	DTC 273: Injector 5 open or short to ground	655	5
DTC 88 Fuel pressure higher than expected	94	0	DTC 274: Injector 5 coil shorted	655	6
DTC 91: FP low voltage	94	4	DTC 276: Injector 6 open or short to ground	656	5
DTC 92: FP high voltage	94	3	DTC 277: Injector 6 coil shorted	656	6
DTC 107: MAP voltage low	106	4	DTC 279: Injector 7 open or short to ground	657	5
DTC 108: MAP pressure high	106	16	DTC 280: Injector 7 coil shorted	657	6
DTC 111: IAT higher than expected stage 1	105	15	DTC 282: Injector 8 open or short to ground	658	5
DTC 112: IAT voltage low	105	4	DTC 283: Injector 8 coil shorted	658	6
DTC 113: IAT voltage high	105	3	DTC 285: Injector 9 open or short to ground	659	5
DTC 116: ECT higher than expected stage 1	110	15	DTC 286: Injector 9 coil shorted	659	6
DTC 117: ECT voltage low	110	4	DTC 288: Injector 10 open or short to ground	660	5
DTC 118: ECT voltage high	110	3	DTC 289: Injector 10 coil shorted	660	6
DTC 121: TPS1-2 lower than expected	51	1	DTC 1631: PWM1-Gauge1 open / ground short	697	5
DTC 122: TPS1 voltage low	51	4	DTC 299: Boost control underboost failure	1692	1
DTC 123: TPS1 voltage high	51	3	DTC 301: Cylinder 1 emissions/catalyst damaging misfire	1323	31
DTC 127: IAT higher than expected stage 2	105	0	DTC 302: Cylinder 2 emissions/catalyst damaging misfire	1324	31
DTC 129: BP pressure low	108	1	DTC 303: Cylinder 3 emissions/catalyst damaging misfire	1325	31
DTC 134: EGO1 open / lazy	724	10	DTC 304: Cylinder 4 emissions/catalyst damaging misfire	1326	31
DTC 140: EGO3 open / lazy	520209	10	DTC 305: Cylinder 5 emissions/catalyst damaging misfire	1327	31
DTC 154: EGO2 open / lazy	520208	10	DTC 306: Cylinder 6 emissions/catalyst damaging misfire	1328	31
DTC 160: EGO4 open / lazy	520210	10	DTC 307: Cylinder 7 emissions/catalyst damaging misfire	1329	31
DTC 171: Adaptive-learn gasoline bank1 high	520200	0	DTC 308: Cylinder 8 emissions/catalyst damaging misfire	1330	31

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 172: Adaptive-learn gasoline bank1 low	520200	1	DTC 326: Knock1 excessive or erratic signal	731	2
DTC 174: Adaptive-learn gasoline bank2 high	520201	0	DTC 327: Knock1 sensor open or not present	731	4
DTC 175: Adaptive-learn gasoline bank2 low	520201	1	DTC 331: Knock2 excessive or erratic signal	520241	2
DTC 182: FT low voltage	174	4	DTC 332: Knock2 sensor open or not present	520241	4
DTC 183: FT high voltage	174	3	DTC 336: CRANK input signal noise	636	2
DTC 187: Gaseous fuel temperature sender low voltage	520240	4	DTC 337: Crank signal loss	636	4
DTC 188: Gaseous fuel temperature sender high voltage	520240	3	DTC 341: CAM input signal noise	723	2
DTC 217: ECT higher than expected stage 2	110	0	DTC 342: Loss of CAM input signal	723	4
DTC 219: RPM higher than max allowed govern speed	515	15	DTC 359: Fuel run-out longer than expected	1239	7
DTC 221: TPS1-2 higher than expected	51	0	DTC 420: Catalyst inactive on gasoline (Bank 1)	520211	10
DTC 222: TPS2 voltage low	520251	4	DTC 430: Catalyst inactive on gasoline (Bank 2)	520212	10
DTC 223: TPS2 voltage high	520251	3	DTC 502: Roadspeed input loss of signal	84	1
DTC 234: Boost control overboost failure	1692	0	DTC 508: IAC ground short	520252	6
DTC 236: TIP active	1692	2	DTC 509: IAC coil open/short	520252	5
DTC 237: TIP low voltage	1127	4	DTC 520: Oil pressure sender low pressure stage 1	100	18
DTC 238: TIP high voltage	1127	3	DTC 521: Oil pressure sender high pressure	100	0
DTC 261: Injector 1 open or short to ground	651	5	DTC 522: Oil pressure sender low voltage	100	4
DTC 262: Injector 1 coil shorted	651	6	DTC 523: Oil pressure sender high voltage	100	3
DTC 264: Injector 2 open or short to ground	652	5	DTC 524: Oil pressure low	100	1
DTC 265: Injector 2 coil shorted	652	6	DTC 562: Vbat voltage low	168	17
DTC 267: Injector 3 open or short to ground	653	5	DTC 563: Vbat voltage high	168	15

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY DTC # (2 of 4)

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 601: Microprocessor failure - FLASH	628	13	DTC 1175: MegaJector voltage supply low	520260	4
DTC 604: Microprocessor failure - RAM	630	12	DTC 1176: MegaJector internal actuator fault detection	520260	12
DTC 606: Microprocessor failure - COP	629	31	DTC 1177: MegaJector internal circuitry fault detection	520260	12
DTC 615: Start relay coil open	1321	5	DTC 1178: MegaJector internal comm fault detection	520260	12
DTC 616: Start relay ground short	1321	4	DTC 1182: Fuel impurity level high	520401	0
DTC 617: Start relay coil short to power	1321	3	DTC 1183: MegaJector autozero / lockoff failure	520803	31
DTC 627: Fuel pump relay coil open	1348	5	DTC 1311: Cylinder 1 misfire detected	1323	11
DTC 628: Fuel-pump high-side open or short to ground	1347	5	DTC 1312: Cylinder 2 misfire detected	1324	11
DTC 628: Fuel pump relay control ground short	1348	4	DTC 1313: Cylinder 3 misfire detected	1325	11
DTC 629: Fuel-pump high-side short to power	1347	6	DTC 1314: Cylinder 4 misfire detected	1326	11
DTC 629: Fuel pump relay coil short to power	1348	3	DTC 1315: Cylinder 5 misfire detected	1327	11
DTC 642: Sensor supply voltage 1 low	1079	4	DTC 1316: Cylinder 6 misfire detected	1328	11
DTC 643: Sensor supply voltage 1 high	1079	3	DTC 1317: Cylinder 7 misfire detected	1329	11
DTC 650: MIL open	1213	5	DTC 1318: Cylinder 8 misfire detected	1330	11
DTC 652: Sensor supply voltage 2 low	1080	4	DTC 1411: EMWT1 voltage high	441	3
DTC 653: Sensor supply voltage 2 high	1080	3	DTC 1412: EMWT2 voltage high	442	3
DTC 685: Power relay coil open	1485	5	DTC 1413: EMWT1 voltage low	441	4
DTC 686: Power relay ground short	1485	4	DTC 1414: EMWT2 voltage low	442	4
DTC 687: Power relay coil short to power	1485	3	DTC 1415: EMWT1 higher than expected stage 1	441	15
DTC 916: Shift actuator feedback out-of-range	520226	3	DTC 1416: EMWT2 higher than expected stage 1	442	15
DTC 919: Shift unable to reach desired gear	520226	7	DTC 1417: EMWT1 higher than expected stage 2	441	0
DTC 920: Shift actuator or drive circuit failed	520226	31	DTC 1418: EMWT2 higher than expected stage 2	442	0
DTC 1111: RPM above fuel rev limit level	515	16	DTC 1419: ERWT1 voltage high	443	3
DTC 1112: RPM above spark rev limit level	515	0	DTC 1420: ERWT2 voltage high	444	3
DTC 1121: FPP1/2 simultaneous voltages out-of-range (redundancy lo)	91	31	DTC 1421: ERWT1 voltage low	443	4

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 1122: FPP1/2 do not match each other or IVS (redundancy lo)	520250	31	DTC 1422: ERWT2 voltage low	444	4
DTC 1131: WGP voltage high	1192	3	DTC 1423: ERWT1 higher than expected stage 1	443	15
DTC 1132: WGP voltage low	1192	4	DTC 1424: ERWT2 higher than expected stage 1	444	15
DTC 1151: Closed-loop LPG high	520206	0	DTC 1425: ERWT1 higher than expected stage 2	443	0
DTC 1152: Closed-loop LPG low	520206	1	DTC 1426: ERWT2 higher than expected stage 2	444	0
DTC 1153: Closed-loop NG high	520207	0	DTC 1511: AUX analog Pull-Up 1 high voltage	520216	3
DTC 1154: Closed-loop NG low	520207	1	DTC 1512: AUX analog Pull-Up 1 low voltage	520216	4
DTC 1155: Closed-loop gasoline bank1 high	520204	0	DTC 1513: AUX analog Pull-Up 2 high voltage	520217	3
DTC 1156: Closed-loop gasoline bank1 low	520204	1	DTC 1514: AUX analog Pull-Up 2 low voltage	520217	4
DTC 1157: Closed-loop gasoline bank2 high	520205	0	DTC 1515: AUX analog Pull-Down 1 high voltage	520215	3
DTC 1158: Closed-loop gasoline bank2 low	520205	1	DTC 1516: AUX analog Pull-Down 1 low voltage	520215	4
DTC 1161: Adaptive-learn LPG high	520202	0	DTC 1517: AUX analog Pull-Up 3 high voltage	520218	3
DTC 1162: Adaptive-learn LPG low	520202	1	DTC 1518: AUX analog Pull-Up 3 low voltage	520218	4
DTC 1163: Adaptive-learn NG high	520203	0	DTC 1521: CHT higher than expected stage 1	110	16
DTC 1164: Adaptive-learn NG low	520203	1	DTC 1522: CHT higher than expected stage 2	110	0
DTC 1165: Catalyst inactive on LPG	520213	10	DTC 1531: Gov1/2/3 interlock failure	520270	31
DTC 1166: Catalyst inactive on NG	520214	10	DTC 1541: AUX analog Pull-Up/Down 1 high voltage	520219	3
DTC 1171: MegaJector delivery pressure higher than expected	520260	0	DTC 1542: AUX analog Pull-Up/Down 1 low voltage	520219	4
DTC 1172: MegaJector delivery pressure lower than expected	520260	1	DTC 1543: AUX analog Pull-Up/Down 2 high voltage	520220	3
DTC 1173: MegaJector comm lost	520260	31	DTC 1544: AUX analog Pull-Up/Down 2 low voltage	520220	4
DTC 1174: MegaJector voltage supply high	520260	3	DTC 1545: AUX analog Pull-Up/Down 3 high voltage	520221	3

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY DTC # (3 of 4)

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 1546: AUX analog Pull-Up/Down 3 low voltage	520221	4	DTC 1662: PWM6 short to power	925	3
DTC 1547: AUX analog Pull-Up/Down 4 high voltage	713	3	DTC 1663: PWM7 open / ground short	926	5
DTC 1548: AUX analog Pull-Up/Down 4 low voltage	713	4	DTC 1664: PWM7 short to power	926	3
DTC 1551: AUX digital 1 high voltage	520222	3	DTC 1665: PWM8 open / ground short	2646	5
DTC 1552: AUX digital 1 low voltage	520222	4	DTC 1666: PWM8 short to power	2646	3
DTC 1553: AUX digital 2 high voltage	520223	3	DTC 1669: PWM9 open / ground short	2647	5
DTC 1554: AUX digital 2 low voltage	520223	4	DTC 1670: PWM9 short to power	2647	3
DTC 1555: AUX digital 3 high voltage	520224	3	DTC 2111: Unable to reach lower TPS	51	7
DTC 1555: Water Intrusion Detection	520224	3	DTC 2112: Unable to reach higher TPS	51	7
DTC 1556: AUX digital 3 low voltage	520224	4	DTC 2115: FPP1 higher than IVS	91	0
DTC 1561: AUX analog Pull-Down 2 high voltage	0	3	DTC 2116: FPP2 higher than IVS	29	0
DTC 1561: AUX analog Pull-Down 3 high voltage	0	3	DTC 2120: FPP1 invalid voltage and FPP2 disagrees with IVS	520250	31
DTC 1561: AUX analog Pull-Down 2 low voltage	0	4	DTC 2121: FPP1-2 lower than expected	91	18
DTC 1561: AUX analog Pull-Down 3 low voltage	0	4	DTC 2122: FPP1 voltage high	91	3
DTC 1611: Sensor supply voltage 1 and 2 out-of-range	1079	31	DTC 2123: FPP1 voltage low	91	4
DTC 1612: Microprocessor failure - RTI 1	629	31	DTC 2125: FPP2 invalid voltage and FPP1 disagrees with IVS	520250	31
DTC 1613: Microprocessor failure - RTI 2	629	31	DTC 2126: FPP1-2 higher than expected	91	16
DTC 1614: Microprocessor failure - RTI 3	629	31	DTC 2127: FPP2 voltage low	29	4
DTC 1615: Microprocessor failure - A/D	629	31	DTC 2128: FPP2 voltage high	29	3
DTC 1616: Microprocessor failure - Interrupt	629	31	DTC 2130: IVS stuck at-idle, FPP1/2 match	558	5
DTC 1621: RS-485 Rx inactive	0	31	DTC 2131: IVS stuck off-idle, FPP1/2 match	558	6
DTC 1622: RS-485 Rx noise	0	31	DTC 2135: TPS1/2 simultaneous voltages out-of-range	51	31
DTC 1623: RS-485 Rx bad packet format	0	31	DTC 2139: FPP1 lower than IVS	91	1
DTC 1624: RS-485 remote shutdown request	0	31	DTC 2140: FPP2 lower than IVS	29	1
DTC 1625: J1939 shutdown request	1384	31	DTC 2229: BP pressure high	108	0
DTC 1626: CAN-J1939 Tx fault	639	12	DTC 2300: Spark coil 1 primary open or short to ground	1268	5
DTC 1627: CAN-J1939 Rx fault	639	12	DTC 2301: Spark coil 1 primary shorted	1268	6

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 1628: J1939 CAN address / engine-number conflict	639	13	DTC 2303: Spark coil 2 primary open or short to ground	1269	5
DTC 1629: J1939 TSC1 message receipt loss	639	9	DTC 2304: Spark coil 2 primary shorted	1269	6
DTC 1630: J1939 ETC message receipt loss	91	2	DTC 2306: Spark coil 3 primary open or short to ground	1270	5
DTC 1632: PWM1-Gauge1 short to power	697	6	DTC 2307: Spark coil 3 primary shorted	1270	6
DTC 1633: PWM2-Gauge2 open / ground short	698	5	DTC 2309: Spark coil 4 primary open or short to ground	1271	5
DTC 1634: PWM2-Gauge2 short to power	698	6	DTC 2310: Spark coil 4 primary shorted	1271	6
DTC 1635: PWM3-Gauge3 open / ground short	699	5	DTC 2312: Spark coil 5 primary open or short to ground	1272	5
DTC 1636: PWM3-Gauge3 short to power	699	6	DTC 2313: Spark coil 5 primary shorted	1272	6
DTC 1637: PWM4 open / ground short	700	5	DTC 2315: Spark coil 6 primary open or short to ground	1273	5
DTC 1638: PWM4 short to power	700	6	DTC 2316: Spark coil 6 primary shorted	1273	6
DTC 1639: PWM5 open / ground short	520230	5	DTC 2318: Spark coil 7 primary open or short to ground	1274	5
DTC 1640: PWM5 short to power	520230	6	DTC 2319: Spark coil 7 primary shorted	1274	6
DTC 1641: Buzzer control ground short	920	4	DTC 2321: Spark coil 8 primary open or short to ground	1275	5
DTC 1642: Buzzer open	920	5	DTC 2322: Spark coil 8 primary shorted	1275	6
DTC 1643: Buzzer control short to power	920	3	DTC 2324: Spark coil 9 primary open or short to ground	1276	5
DTC 1644: MIL control ground short	1213	4	DTC 2325: Spark coil 9 primary shorted	1276	6
DTC 1645: MIL control short to power	1213	3	DTC 2327: Spark coil 10 primary open or short to ground	1277	5
DTC 1651: J1939 ETC message receipt loss while in-gear	91	9	DTC 2328: Spark coil 10 primary shorted	1277	6
DTC 1661: PWM6 open / ground short	925	5	DTC 2428: EGT temperature high	173	0

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY DTC # (4 of 4)

Description	DTC Set 2	
	SPN-2	FMI-2
DTC 2618: Tach output ground short	645	4
DTC 2619: Tach output short to power	645	3
DTC 8901: UEGO microprocessor internal fault	3221	31
DTC 8902: UEGO heater supply high voltage	3222	3
DTC 8903: UEGO heater supply low voltage	3222	4
DTC 8904: UEGO cal resistor voltage high	3221	3
DTC 8905: UEGO cal resistor voltage low	3221	4
DTC 8906: UEGO return voltage shorted high	3056	3
DTC 8907: UEGO return voltage shorted low	3056	4
DTC 8908: UEGO pump voltage shorted high	3218	3
DTC 8909: UEGO pump voltage shorted low	3218	4
DTC 8910: UEGO sense cell voltage high	3217	3
DTC 8911: UEGO sense cell voltage low	3217	4
DTC 8912: UEGO pump voltage at high drive limit	3225	3
DTC 8913: UEGO pump voltage at low drive limit	3225	4
DTC 8914: UEGO sense cell slow to warm up	3222	10
DTC 8915: UEGO pump cell slow to warm up	3225	10
DTC 8916: UEGO sense cell impedance high	3222	0
DTC 8917: UEGO pump cell impedance high	3225	0
DTC 8918: UEGO pump cell impedance low	3225	1

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY SPN:FMI (1 of 4)

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 1561: AUX analog Pull-Down 2 high voltage	0	3	DTC 107: MAP voltage low	106	4
DTC 1561: AUX analog Pull-Down 3 high voltage	0	3	DTC 108: MAP pressure high	106	16
DTC 1561: AUX analog Pull-Down 2 low voltage	0	4	DTC 2229: BP pressure high	108	0
DTC 1561: AUX analog Pull-Down 3 low voltage	0	4	DTC 129: BP pressure low	108	1
DTC 1621: RS-485 Rx inactive	0	31	DTC 1522: CHT higher than expected stage 2	110	0
DTC 1622: RS-485 Rx noise	0	31	DTC 217: ECT higher than expected stage 2	110	0
DTC 1623: RS-485 Rx bad packet format	0	31	DTC 118: ECT voltage high	110	3
DTC 1624: RS-485 remote shutdown request	0	31	DTC 117: ECT voltage low	110	4
Undefined DTC - Index 10297	0	31	DTC 116: ECT higher than expected stage 1	110	15
Undefined DTC - Index 10298	0	31	DTC 1521: CHT higher than expected stage 1	110	16
Undefined DTC - Index 10299	0	31	DTC 563: Vbat voltage high	168	15
DTC 2116: FPP2 higher than IVS	29	0	DTC 562: Vbat voltage low	168	17
DTC 2140: FPP2 lower than IVS	29	1	DTC 2428: EGT temperature high	173	0
DTC 2128: FPP2 voltage high	29	3	DTC 183: FT high voltage	174	3
DTC 2127: FPP2 voltage low	29	4	DTC 182: FT low voltage	174	4
DTC 221: TPS1-2 higher than expected	51	0	DTC 1417: EMWT1 higher than expected stage 2	441	0
DTC 121: TPS1-2 lower than expected	51	1	DTC 1411: EMWT1 voltage high	441	3
DTC 123: TPS1 voltage high	51	3	DTC 1413: EMWT1 voltage low	441	4
DTC 122: TPS1 voltage low	51	4	DTC 1415: EMWT1 higher than expected stage 1	441	15
DTC 2112: Unable to reach higher TPS	51	7	DTC 1418: EMWT2 higher than expected stage 2	442	0
DTC 2111: Unable to reach lower TPS	51	7	DTC 1412: EMWT2 voltage high	442	3
DTC 2135: TPS1/2 simultaneous voltages out-of-ran	51	31	DTC 1414: EMWT2 voltage low	442	4
DTC 502: Roadspeed input loss of signal	84	1	DTC 1416: EMWT2 higher than expected stage 1	442	15
DTC 2115: FPP1 higher than IVS	91	0	DTC 1425: ERWT1 higher than expected stage 2	443	0
DTC 2139: FPP1 lower than IVS	91	1	DTC 1419: ERWT1 voltage high	443	3
DTC 1630: J1939 ETC message receipt loss	91	2	DTC 1421: ERWT1 voltage low	443	4
DTC 2122: FPP1 voltage high	91	3	DTC 1423: ERWT1 higher than expected stage 1	443	15

DTC 2123: FPP1 voltage low	91	4	DTC 1426: ERWT2 higher than expected stage 2	444	0
DTC 1651: J1939 ETC message receipt loss while in	91	9	DTC 1420: ERWT2 voltage high	444	3
DTC 2126: FPP1-2 higher than expected	91	16	DTC 1422: ERWT2 voltage low	444	4
DTC 2121: FPP1-2 lower than expected	91	18	DTC 1424: ERWT2 higher than expected stage 1	444	15
DTC 1121: FPP1/2 simultaneous voltages out-of-ran	91	31	DTC 1112: RPM above spark rev limit level	515	0
DTC 88 Fuel pressure higher than expected	94	0	DTC 219: RPM higher than max allowed govern speed	515	15
DTC 87 Fuel pressure lower than expected	94	1	DTC 1111: RPM above fuel rev limit level	515	16
DTC 92: FP high voltage	94	3	DTC 2130: IVS stuck at-idle, FPP1/2 match	558	5
DTC 91: FP low voltage	94	4	DTC 2131: IVS stuck off-idle, FPP1/2 match	558	6
DTC 521: Oil pressure sender high pressure	100	0	DTC 601: Microprocessor failure - FLASH	628	13
DTC 524: Oil pressure low	100	1	DTC 606: Microprocessor failure - COP	629	31
DTC 524: Oil pressure sender low pressure	100	1	DTC 1612: Microprocessor failure - RTI 1	629	31
DTC 523: Oil pressure sender high voltage	100	3	DTC 1613: Microprocessor failure - RTI 2	629	31
DTC 522: Oil pressure sender low voltage	100	4	DTC 1614: Microprocessor failure - RTI 3	629	31
DTC 520: Oil pressure sender low pressure stage 1	100	18	DTC 1615: Microprocessor failure - A/D	629	31
DTC 127: IAT higher than expected stage 2	105	0	DTC 1616: Microprocessor failure - Interrupt	629	31
DTC 113: IAT voltage high	105	3	DTC 604: Microprocessor failure - RAM	630	12
DTC 112: IAT voltage low	105	4	DTC 336: CRANK input signal noise	636	2
DTC 111: IAT higher than expected stage 1	105	15	DTC 337: Crank signal loss	636	4

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY SPN:FMI (2 of 4)

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 16: Crank and/or cam could not synchronize du	636	8	DTC 1661: PWM6 open / ground short	925	5
DTC 1629: J1939 TSC1 message receipt loss	639	9	DTC 1664: PWM7 short to power	926	3
DTC 1626: CAN-J1939 Tx fault	639	12	DTC 1663: PWM7 open / ground short	926	5
DTC 1627: CAN-J1939 Rx fault	639	12	DTC 643: Sensor supply voltage 1 high	1079	3
DTC 1628: J1939 CAN address / engine-number con	639	13	DTC 642: Sensor supply voltage 1 low	1079	4
DTC 2619: Tach output short to power	645	3	DTC 1611: Sensor supply voltage 1 and 2 out-of-range	1079	31
DTC 2618: Tach output ground short	645	4	DTC 653: Sensor supply voltage 2 high	1080	3
DTC 261: Injector 1 open or short to ground	651	5	DTC 652: Sensor supply voltage 2 low	1080	4
DTC 262: Injector 1 coil shorted	651	6	DTC 238: TIP high voltage	1127	3
DTC 264: Injector 2 open or short to ground	652	5	DTC 237: TIP low voltage	1127	4
DTC 265: Injector 2 coil shorted	652	6	DTC 1131: WGP voltage high	1192	3
DTC 267: Injector 3 open or short to ground	653	5	DTC 1132: WGP voltage low	1192	4
DTC 268: Injector 3 coil shorted	653	6	DTC 1645: MIL control short to power	1213	3
DTC 270: Injector 4 open or short to ground	654	5	DTC 1644: MIL control ground short	1213	4
DTC 271: Injector 4 coil shorted	654	6	DTC 650: MIL open	1213	5
DTC 273: Injector 5 open or short to ground	655	5	DTC 359: Fuel run-out longer than expected	1239	7
DTC 274: Injector 5 coil shorted	655	6	DTC 2300: Spark coil 1 primary open or short to ground	1268	5
DTC 276: Injector 6 open or short to ground	656	5	DTC 2301: Spark coil 1 primary shorted	1268	6
DTC 277: Injector 6 coil shorted	656	6	DTC 2303: Spark coil 2 primary open or short to ground	1269	5
DTC 279: Injector 7 open or short to ground	657	5	DTC 2304: Spark coil 2 primary shorted	1269	6
DTC 280: Injector 7 coil shorted	657	6	DTC 2306: Spark coil 3 primary open or short to ground	1270	5
DTC 282: Injector 8 open or short to ground	658	5	DTC 2307: Spark coil 3 primary shorted	1270	6
DTC 283: Injector 8 coil shorted	658	6	DTC 2309: Spark coil 4 primary open or short to ground	1271	5
DTC 285: Injector 9 open or short to ground	659	5	DTC 2310: Spark coil 4 primary shorted	1271	6

DTC 286: Injector 9 coil shorted	659	6	DTC 2312: Spark coil 5 primary open or short to ground	1272	5
DTC 288: Injector 10 open or short to ground	660	5	DTC 2313: Spark coil 5 primary shorted	1272	6
DTC 289: Injector 10 coil shorted	660	6	DTC 2315: Spark coil 6 primary open or short to ground	1273	5
DTC 1631: PWM1-Gauge1 open / ground short	697	5	DTC 2316: Spark coil 6 primary shorted	1273	6
DTC 1632: PWM1-Gauge1 short to power	697	6	DTC 2318: Spark coil 7 primary open or short to ground	1274	5
DTC 1633: PWM2-Gauge2 open / ground short	698	5	DTC 2319: Spark coil 7 primary shorted	1274	6
DTC 1634: PWM2-Gauge2 short to power	698	6	DTC 2321: Spark coil 8 primary open or short to ground	1275	5
DTC 1635: PWM3-Gauge3 open / ground short	699	5	DTC 2322: Spark coil 8 primary shorted	1275	6
DTC 1636: PWM3-Gauge3 short to power	699	6	DTC 2324: Spark coil 9 primary open or short to ground	1276	5
DTC 1637: PWM4 open / ground short	700	5	DTC 2325: Spark coil 9 primary shorted	1276	6
DTC 1638: PWM4 short to power	700	6	DTC 2327: Spark coil 10 primary open or short to ground	1277	5
DTC 1547: AUX analog Pull-Up/Down 4 high voltage	713	3	DTC 2328: Spark coil 10 primary shorted	1277	6
DTC 1548: AUX analog Pull-Up/Down 4 low voltage	713	4	DTC 617: Start relay coil short to power	1321	3
DTC 341: CAM input signal noise	723	2	DTC 616: Start relay ground short	1321	4
DTC 342: Loss of CAM input signal	723	4	DTC 615: Start relay coil open	1321	5
DTC 134: EGO1 open / lazy	724	10	DTC 1311: Cylinder 1 misfire detected	1323	11
DTC 326: Knock1 excessive or erratic signal	731	2	DTC 301: Cylinder 1 emissions/catalyst damaging misfire	1323	31
DTC 327: Knock1 sensor open or not present	731	4	DTC 1312: Cylinder 2 misfire detected	1324	11
DTC 1643: Buzzer control short to power	920	3	DTC 302: Cylinder 2 emissions/catalyst damaging misfire	1324	31
DTC 1641: Buzzer control ground short	920	4	DTC 1313: Cylinder 3 misfire detected	1325	11
DTC 1642: Buzzer open	920	5	DTC 303: Cylinder 3 emissions/catalyst damaging misfire	1325	31
DTC 1662: PWM6 short to power	925	3	DTC 1314: Cylinder 4 misfire detected	1326	11

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY SPN:FMI (3 of 4)

Description	DTC Set 2		Description	DTC Set 2	
	SPN-2	FMI-2		SPN-2	FMI-2
DTC 304: Cylinder 4 emissions/catalyst damaging m	1326	31	DTC 175: Adaptive-learn gasoline bank2 low	520201	1
DTC 1315: Cylinder 5 misfire detected	1327	11	DTC 1161: Adaptive-learn LPG high	520202	0
DTC 305: Cylinder 5 emissions/catalyst damaging m	1327	31	DTC 1162: Adaptive-learn LPG low	520202	1
DTC 1316: Cylinder 6 misfire detected	1328	11	DTC 1163: Adaptive-learn NG high	520203	0
DTC 306: Cylinder 6 emissions/catalyst damaging m	1328	31	DTC 1164: Adaptive-learn NG low	520203	1
DTC 1317: Cylinder 7 misfire detected	1329	11	DTC 1155: Closed-loop gasoline bank1 high	520204	0
DTC 307: Cylinder 7 emissions/catalyst damaging m	1329	31	DTC 1156: Closed-loop gasoline bank1 low	520204	1
DTC 1318: Cylinder 8 misfire detected	1330	11	DTC 1157: Closed-loop gasoline bank2 high	520205	0
DTC 308: Cylinder 8 emissions/catalyst damaging m	1330	31	DTC 1158: Closed-loop gasoline bank2 low	520205	1
DTC 628: Fuel-pump high-side open or short to grou	1347	5	DTC 1151: Closed-loop LPG high	520206	0
DTC 629: Fuel-pump high-side short to power	1347	6	DTC 1152: Closed-loop LPG low	520206	1
DTC 629: Fuel pump relay coil short to power	1348	3	DTC 1153: Closed-loop NG high	520207	0
DTC 628: Fuel pump relay control ground short	1348	4	DTC 1154: Closed-loop NG low	520207	1
DTC 627: Fuel pump relay coil open	1348	5	DTC 154: EGO2 open / lazy	520208	10
DTC 1625: J1939 shutdown request	1384	31	DTC 140: EGO3 open / lazy	520209	10
DTC 687: Power relay coil short to power	1485	3	DTC 160: EGO4 open / lazy	520210	10
DTC 686: Power relay ground short	1485	4	DTC 420: Catalyst inactive on gasoline (Bank 1)	520211	10
DTC 685: Power relay coil open	1485	5	DTC 430: Catalyst inactive on gasoline (Bank 2)	520212	10
DTC 234: Boost control overboost failure	1692	0	DTC 1165: Catalyst inactive on LPG	520213	10
DTC 299: Boost control underboost failure	1692	1	DTC 1166: Catalyst inactive on NG	520214	10
DTC 236: TIP active	1692	2	DTC 1515: AUX analog Pull-Down 1 high voltage	520215	3
DTC 1666: PWM8 short to power	2646	3	DTC 1516: AUX analog Pull-Down 1 low voltage	520215	4
DTC 1665: PWM8 open / ground short	2646	5	DTC 1511: AUX analog Pull-Up 1 high voltage	520216	3
DTC 1670: PWM9 short to power	2647	3	DTC 1512: AUX analog Pull-Up 1 low voltage	520216	4
DTC 1669: PWM9 open / ground short	2647	5	DTC 1513: AUX analog Pull-Up 2 high voltage	520217	3
DTC 8906: UEGO return voltage shorted high	3056	3	DTC 1514: AUX analog Pull-Up 2 low voltage	520217	4

DTC 8907: UEGO return voltage shorted low	3056	4	DTC 1517: AUX analog Pull-Up 3 high voltage	520218	3
DTC 8910: UEGO sense cell voltage high	3217	3	DTC 1518: AUX analog Pull-Up 3 low voltage	520218	4
DTC 8911: UEGO sense cell voltage low	3217	4	DTC 1541: AUX analog Pull-Up/Down 1 high voltage	520219	3
DTC 8908: UEGO pump voltage shorted high	3218	3	DTC 1542: AUX analog Pull-Up/Down 1 low voltage	520219	4
DTC 8909: UEGO pump voltage shorted low	3218	4	DTC 1543: AUX analog Pull-Up/Down 2 high voltage	520220	3
DTC 8904: UEGO cal resistor voltage high	3221	3	DTC 1544: AUX analog Pull-Up/Down 2 low voltage	520220	4
DTC 8905: UEGO cal resistor voltage low	3221	4	DTC 1545: AUX analog Pull-Up/Down 3 high voltage	520221	3
DTC 8901: UEGO microprocessor internal fault	3221	31	DTC 1546: AUX analog Pull-Up/Down 3 low voltage	520221	4
DTC 8916: UEGO sense cell impedance high	3222	0	DTC 1551: AUX digital 1 high voltage	520222	3
DTC 8902: UEGO heater supply high voltage	3222	3	DTC 1552: AUX digital 1 low voltage	520222	4
DTC 8903: UEGO heater supply low voltage	3222	4	DTC 1553: AUX digital 2 high voltage	520223	3
DTC 8914: UEGO sense cell slow to warm up	3222	10	DTC 1554: AUX digital 2 low voltage	520223	4
DTC 8917: UEGO pump cell impedance high	3225	0	DTC 1555: AUX digital 3 high voltage	520224	3
DTC 8918: UEGO pump cell impedance low	3225	1	DTC 1555: Water Intrusion Detection	520224	3
DTC 8912: UEGO pump voltage at high drive limit	3225	3	DTC 1556: AUX digital 3 low voltage	520224	4
DTC 8913: UEGO pump voltage at low drive limit	3225	4	DTC 916: Shift actuator feedback out-of-range	520226	3
DTC 8915: UEGO pump cell slow to warm up	3225	10	DTC 919: Shift unable to reach desired gear	520226	7
DTC 171: Adaptive-learn gasoline bank1 high	520200	0	DTC 920: Shift actuator or drive circuit failed	520226	31
DTC 172: Adaptive-learn gasoline bank1 low	520200	1	DTC 1639: PWM5 open / ground short	520230	5
DTC 174: Adaptive-learn gasoline bank2 high	520201	0	DTC 1640: PWM5 short to power	520230	6

DIAGNOSTIC TROUBLE CODE (DTC) CHART – SORTED BY SPN:FMI (4 of 4)

Description	DTC Set 2	
	SPN-2	FMI-2
DTC 188: Gaseous fuel temperature sender high voltage	520240	3
DTC 187: Gaseous fuel temperature sender low voltage	520240	4
DTC 331: Knock2 excessive or erratic signal	520241	2
DTC 332: Knock2 sensor open or not present	520241	4
DTC 2120: FPP1 invalid voltage and FPP2 disagrees	520250	31
DTC 2125: FPP2 invalid voltage and FPP1 disagrees	520250	31
DTC 1122: FPP1/2 do not match each other or IVS (520250	31
DTC 223: TPS2 voltage high	520251	3
DTC 222: TPS2 voltage low	520251	4
DTC 509: IAC coil open/short	520252	5
DTC 508: IAC ground short	520252	6
DTC 1171: MegaJector delivery pressure higher than	520260	0
DTC 1172: MegaJector delivery pressure lower than	520260	1
DTC 1174: MegaJector voltage supply high	520260	3
DTC 1175: MegaJector voltage supply low	520260	4
DTC 1176: MegaJector internal actuator fault detection	520260	12
DTC 1177: MegaJector internal circuitry fault detection	520260	12
DTC 1178: MegaJector internal comm fault detection	520260	12
DTC 1173: MegaJector comm lost	520260	31
DTC 1531: Gov1/2/3 interlock failure	520270	31
DTC 1182: Fuel impurity level high	520401	0
DTC 11: Intake cam / distributor position error	520800	7
DTC 24: Exhaust cam position error	520801	7
DTC 1183: MegaJector autozero / lockoff failure	520803	31
DTC 57: EGOH 4 Open / Ground Short	3271	4

Lift Truck Operation

Power Shift Transmission / Drive Axle

1. Start the engine. See item "Starting the Engine"



Typical Example

2. PUSH DOWN on the service foot brake pedal to hold the lift truck until ready to move it.
3. RELEASE the parking brake.



Typical Example

4. Select the direction of travel by PUSHING the directional lever FORWARD for forward direction or PULLING the lever BACK for reverse direction.
5. Rotate the speed range control to first (low) speed range.

NOTE: From a stopped position, move the lift truck in first (low) range ONLY.

WARNING

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

This could result in personal injury.

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

6. RELEASE the service foot brake.
7. PUSH DOWN on the accelerator pedal to obtain the desired travel speed. RELEASE the pedal to decrease travel speed.
8. Transmission speed changes to second and third speed range can be made on the go, without deceleration or braking. When faster travel speed is needed.

NOTICE

Come to a complete stop before changing direction of travel.

WARNING

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

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

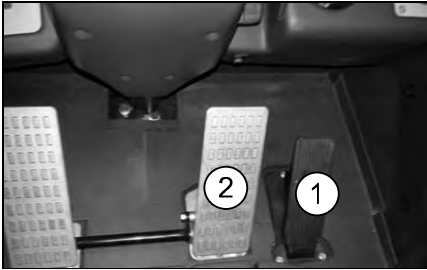
Failure to comply could result in personal injury.

9. To change the lift truck direction of travel, RELEASE the accelerator pedal.
10. PUSH DOWN on the service foot brake pedal to bring the lift truck to a complete stop.
11. SHIFT the directional lever to the desired direction of travel. Rotate the speed selector lever to first (low) speed range, if it is not already in this position.
12. RELEASE the service foot brake. PUSH DOWN on the accelerator pedal to obtain the desired travel speed.

WARNING

Watch the road carefully for any obstacle when driving the truck. Do not go fast over bumps, pot holes or other rough grounds, otherwise the engine might go OFF by a severe impact.

In case of engine going OFF, press the brake pedal at one time as hard as possible in order to stop the truck. Pressing the brake pedal several times has a risk that the brake would not work.



Typical Example

13. To stop the lift truck when travelling in either direction, RELEASE accelerator pedal (1).
14. PUSH DOWN on service foot brake pedal (2) 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.



Typical Example

1. To inch (creep) in either direction, slowly push down on the inching pedal. This will start to apply the service foot brakes and allow the transmission clutch discs to slip.
2. Vary the position of 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.

Auto Shift Controller ASC-208 (If Equipped)

Product Description

The Autoshift controller is an electrical control system, specially designed for use on forklift trucks with internal combustion engines.

Its primary purpose is to prevent the operator from operating the truck outside of the design parameters, e.g. selecting the reverse gear when travelling in excess of 5 km/h (3.11 mph) in a forward direction, and vice versa.

The Autoshift controller is mounted on a convenient position away from excessive heat sources and retrofits into the truck's electrical system. An inductive speed sensor is mounted on the transmission case where it will pick up a pulse from a gear tooth pattern. This pulse is used to monitor the truck in motion and its travel speed. To enable the system to change gears smoothly, the shift points for offset speed are adjustable.

An operator no longer has to change gears with his hands, therefore he can be more productive.

The Autoshift controller prevents strain and abuse to the transmission by changing gears up and down automatically. It also prevents damage to the half shaft, excessive tire wear and heat to the transmission.

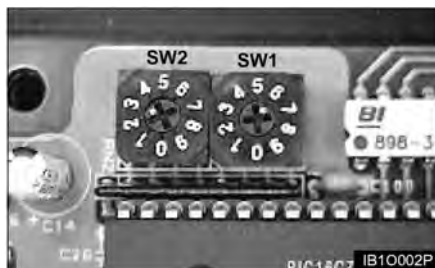
Features

Product	Adaptable To
ASC-208	D(G)60/70S-7 (2 Speed)

- 1) 2 - speed auto shift control
- 2) Prevent downshifting at high speed
- 3) Inhibit selecting direction at high speed outside of the design parameters.



Adjustments



Adjustment Switch

• Low-High Shift Point (SW1)

ASC-208 allows you to set the 2 speed Auto Gear Shift Point, the maximum travel speed at which the Auto Shift Controller up-shift or down-shift the transmission automatically according to the vehicle speed. For adjustment of 2 speed Auto Gear Shift speed, the SW1 switch is used on the printed circuit board.

• Direction Inhibit Point (SW2)

Auto Shift allows you to set the Direction Inhibit Speed, the maximum travel speed at which the transmission can be reversed. For adjustment of direction inhibit speed, the SW2 switch is used on the printed circuit board.

Using a philips screwdriver, turn the SW1 adjustment until the white dot is next to the notch corresponding to the selected vehicle speed. You may reset Inhibit Speed to one of ten settings between a minimum of 3.3km/h(2.05mph) and a maximum of 6.0km/h(3.75mph) travel speed.

Adjustment data		
Notch	Vehicle Speed	
	SW2(F<->R Shift)	SW1(L->H Shift)
0	3.3km/h	5.57km/h
1	3.6km/h	
2	3.9km/h	
3	4.2km/h	
4	4.5km/h	
5	4.8km/h	6.17km/h
6	5.1km/h	6.78km/h
7	5.4km/h	7.29km/h
8	5.7km/h	7.89km/h
9	6.0km/h	8.40km/h

NOTICE

The transmission of your lift truck may be reversed under full power up to a travel of 6.0 km/h (3.73 mph). But the Inhibit Speed of Auto Shift is set by the factory at 4~5 km/h (2.5~3.2 mph) because reversing the transmission at lower travel speeds prolongs the life of the transmission, axle shafts and tires.

Diagnostics Features



ASC-208 has internal indicator on the right side of the controller for displaying the selected gear and the abnormal condition.

⚠ WARNING

Do not diagnose or repair Auto Shift Controller Faults unless trained and authorized to do so. Improper performance of maintenance procedures is dangerous and could result in personal injury or death.

Below is a description applicable for many ASC-208 implementations.

• Display for Operator

Display	Description	Remark
A	Automatic operation	
H	High speed	At 2nd shift gear
L	Low speed	At 1st shift gear
PT/M	Speed sensor open	Flashing
E	E/G Speed sensor open	Flashing
F	Controller fault	Flashing
5	H/L Sol. Short	Flashing
6	Forward Sol. Short	Flashing
7	Reverse Sol. Short	Flashing

This information is given during normal operating when something special happens. For example, on ASC-208's with the speed sensor, one of the indicators is used to indicate a sensor problem.

• Display for Troubleshooting

Display	Description	Remark
A	Automatic operation	
2	High speed s/w input	Lever input test
3	Forward s/w input	Lever input test
4	Reverse s/w input	Lever input test

This information is input for signal diagnostics.
This test is used to verify operation of direction control lever.

Operation

This system can be basically operated in two preselected modes, automatic mode and manual mode.

Automatic mode

Direction Inhibit

1. Start the engine with the direction control lever in NEUTRAL and the parking brake engaged.
2. Press down on the service brake pedal, disengage the parking brake and move the direction control lever to FORWARD.

Release the parking brake before using the directional control lever.

3. Observe the LED on the Auto Shift Controller. The LED should indicate "A" while the direction control lever is in FORWARD, NEUTRAL and REVERSE. Report Auto Shift as faulty if the LED indicates anything other than "A".
4. Keep the service brake pushed down until ready to move the truck.
5. To change directions of a traveling lift truck when the Auto Shift Controller LED displays "A", shift the direction control lever to the opposite direction and wait for the lift truck to change direction.
6. If however, your travel speed is higher than the pre-selected direction change speed as direction inhibit point in the controller, Auto Shift will shift the transmission to NEUTRAL until the lift truck's travel speed slows to the pre-selected direction change speed, and then shift the transmission to the direction selected.
7. You should be prepared to help slow the lift truck to the pre-selected direction change speed by pressing down on the service brake pedal.

WARNING

When you want to change the travel direction, you must press down on the service brake pedal to reduce the travel speed. Be cautious that the lift truck's stopping distance may be longer than in manual mode because the lift truck continues to travel forward regardless of the selection of reverse with the direction control lever until the vehicle speed is sufficiently reduced.

8. The direction of travel will change automatically when the vehicle speed is reduced as much as the pre-selected speed in the controller.

⚠ WARNING

**Bring the loaded lift truck to a complete stop before changing travel direction.
Changing travel direction while traveling may cause the lift truck to lose the load or tip over.**

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

NOTICE

The transmission of your lift truck may be reversed under full power up to a travel of 6.0 km/h (3.73 mph). But the Inhibit Speed of Auto Shift is set by the factory at 4~5 km/h (2.5~3.2 mph) because reversing the transmission at lower travel speeds prolongs the life of the transmission, axle shafts and tires.

Two-Speed Auto Shift Control

While traveling forward with the high speed gear, that is, 2nd gear selected, the ASC-208 can upshift or down-shift the transmission automatically according to the vehicle speed by its own speed ratio control so that the appropriate gear may be engaged in every situation.

NOTICE

Two-Speed Auto Shift Control function can be accomplished only when the direction control lever is placed in the high speed (2nd gear) position.

Manual Mode (Fail-Safe mode)

In case that the controller is broken down or you don't want to use the functions of the Auto Shift Controller, you can select Manual Mode. In Manual Mode, you can operate your lift truck in the same manner as any lift truck without Auto Shift Controller. You can select the Manual mode or the Automatic mode by doing following procedures.

⚠ WARNING

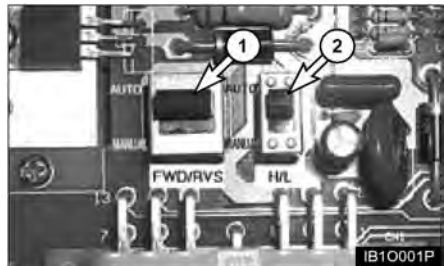
In the manual mode, direction inhibition function can not be operated normally. The sudden reversal of a loaded lift truck traveling forward can cause the load to fall or the lift truck to tip over.

The operator can operate the truck manually by selecting the Manual mode with the Fail-Safe mode switches on the PCB (Printed Circuit Board).

With the switch (1) in "MANUAL" position, direction inhibition function is disable.

If an operator moves the switch (2) from "AUTO" position to "MANUAL" position, then 2-speed auto shift function will become disabled.

Move the switches as indicated, up for Automatic (AUTO) operation or down for Manual (MANUAL) operation.

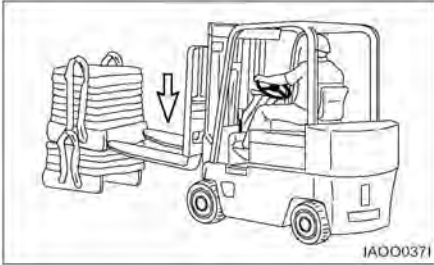


Typical Example of ASC-208

NOTE: After operating the truck manually by selecting the Manual Mode switch on PCB (Printed Circuit Board), the position of mode must be checked before operating the truck automatically.

Operating Techniques

Inching into Loads



Typical Example

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

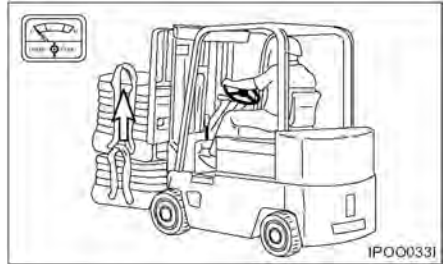


Typical Example

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

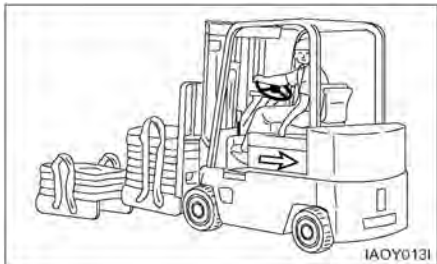
NOTICE

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



Typical Example

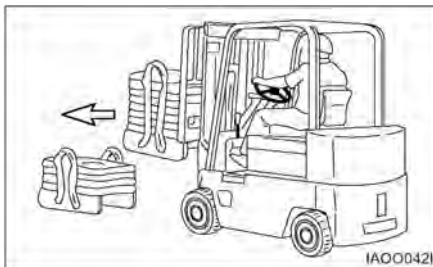
1. Carry the load as low as possible but maintain clearance.
2. On grades, always travel with the load on the UPHILL side, as shown above.



Typical Example

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

Unloading



Typical Example

1. Move the lift truck into the unloading position.

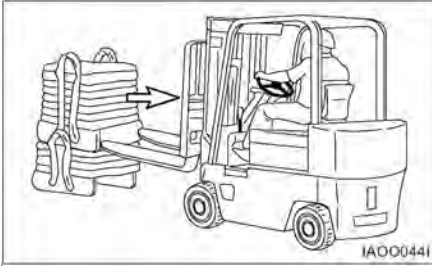


Typical Example

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

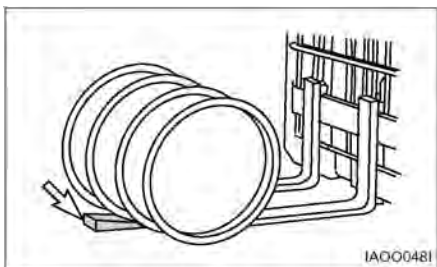


1. When turning sharp corners, keep close to the inside corner. Begin the turn when the inside drive wheel meets the corner.

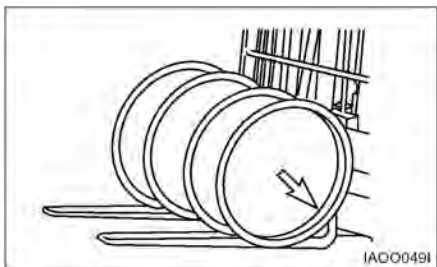


2. In narrow aisles, keep away from the stockpile when turning into the aisle. Allow for counterweight swing.

Lifting Drums or Round Objects



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



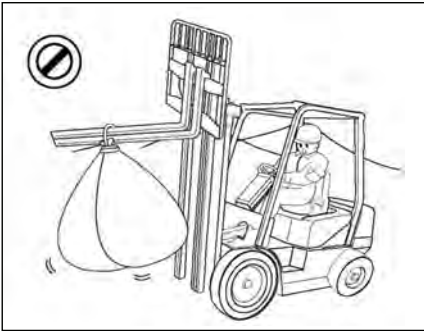
2. Before lifting, tilt the mast BACK slightly until the load is cradled on the forks.

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 the overheating. Clean them out regularly with a blast of compressed air. Also, check the 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 shut off the engine.

Safety instructions for attachments when transporting suspended load



WARNING

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

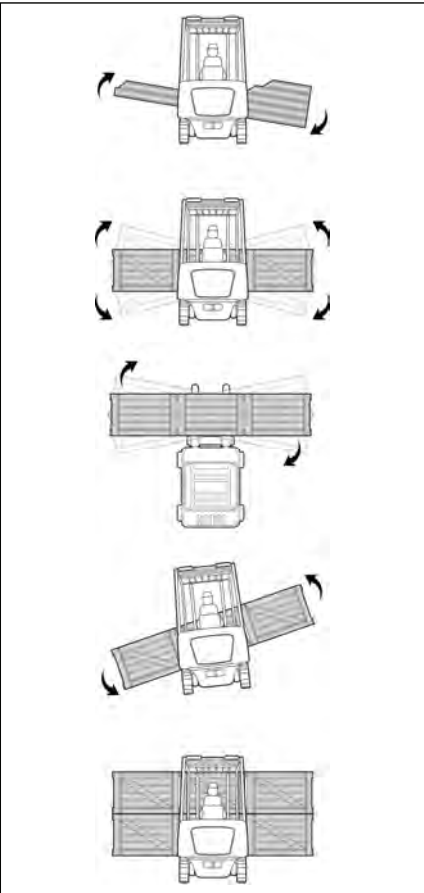
Adapt the travel speed to the load, less than walking pace.

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 offcenter 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



Typical Example

Park the lift truck level, with the forks lowered and the mast tilted forward until the fork tips touch the floor.

Block the drive wheels when parking on an incline.

1. Park in authorized area only. Do not block traffic.



Typical Example

2. Place the transmission controls in NEUTRAL.
3. Engage the parking brake.



Typical Example

4. Lower the forks to the ground.

WARNING

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

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



NOTE: If a LP equipped lift truck is stopped or parked for an indefinite or prolonged period of time, close the fuel shutoff valve on the LP tank. Run the engine until fuel in the line runs out and the engine stops. Turn off the ignition switch and disconnect switch (if equipped).

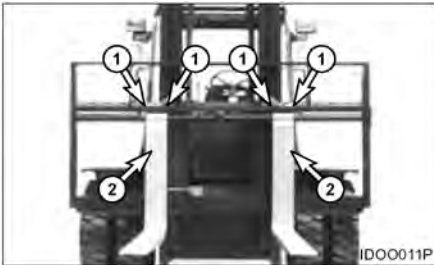
6. Turn the disconnect switch to OFF (if equipped). Do not operate the disconnecting switch after 30 seconds from start key-off. Otherwise Engine Control Unit (ECU) can be damaged.
7. Actuate each loading lever several times to remove the residual pressure in the respective cylinders and hoses.
8. Block the drive wheels if parking on an incline.

Lift Fork Adjustment

WARNING

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

For load stability, always adjust the forks as wide as possible. Position the load evenly on both forks.

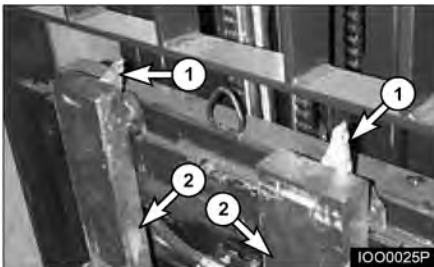


Typical Example of Shaft type Fork

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.



Typical Example of Hook-on type Fork

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

Storage Information

Before Storage

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

1. Wipe away grease, oil, etc. adhering to the body of the truck with waste cloth, and use water, if needed.
2. 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.
3. Fill the fuel tank with fuel specified.
4. Check for leakage of hydraulic oil, engine oil, fuel, or coolant, etc.
5. Apply grease, where needed.
6. Check for looseness of nuts and bolts, especially hub nuts.
7. Check mast rollers to see that they rotate smoothly.
8. Prime the oil into the lift cylinders by actuating the lift lever all the way several times.
9. Drain off coolant completely in cold weather, if antifreeze is not used.
10. Drain off DEF/Ad-Blue completely for long term storage. (If not the purity of DEF/Ad-Blue would be changed to lower quality.)

Long Time Storage

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

1. Taking the rainy season into consideration, park the machine on higher and hard ground.
2. Avoid parking on soft grounds such as an asphalt ground in summer.
3. 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.
4. Apply antirust to the exposed parts which tend to rust.

5. Cover components such as the breather and air cleaner which may be caught with humidity.
6. 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

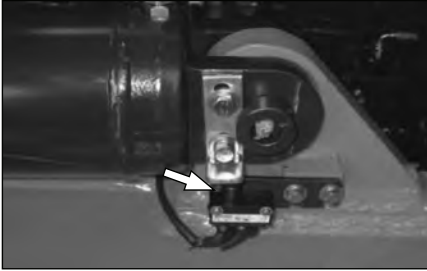
1. Remove covers and antirust from each of the components and exposed parts.
2. Drain the engine crankcase, transmission (clutch type machine), differential and final reduction gear, clean the inside of them and add new oil.
3. Drain off foreign matter and water from the hydraulic oil tank and fuel tank.
4. Remove the head cover from the engine cylinder. Oil valves and rocker shaft and check each valve for proper operation.
5. Add cooling water to the specified level.
6. Charge the battery and mount it on the machine. Connect the cables.
7. Perform pre - operational checks carefully. (Refer to "Before Starting the Engine")
8. Warm up the machine.
9. If deteriorated DEF/Ad-Blue warning lamp turns on and message appears, drain the fluid in the DEF/Ad-Blue tank thoroughly and refill with new DEF/Ad-Blue.
10. Check level of DEF/Ad-Blue and if necessary refill DEF/Ad-Blue (refer page.77)

Method and Caution for Cabin Tilting (Optional)

Cabin Tilting

Cabin Tilting Limit Switch

Do not remove the switch on the left tilting cylinder. The switch protects the front glazing during cabin tilting. The mast must be at a forward angle of at least 6 degrees for tilting operation.



WARNING

If the cabin tilting limit switch is not active, the cabin will be tilted when the mast is inclined backwards. This may damage cabin chassis or cabin front glazing.

Do not tilt the cabin when the mast is tilted backwards. If the cabin tilting limit switch is damaged or incorrectly adjusted, the cabin may be tilted and the cabin may be damaged.

Cabin Door

Check that the cabin door is closed before tilting the cabin.

WARNING

If the cabin door is open when tilting, the cabin door may touch the frame and damaged.

Cabin Tilting (power type)

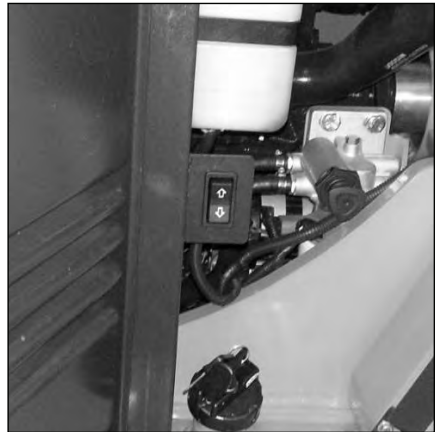
WARNING

Make sure that there is sufficient space before tilting the cabin.

WARNING

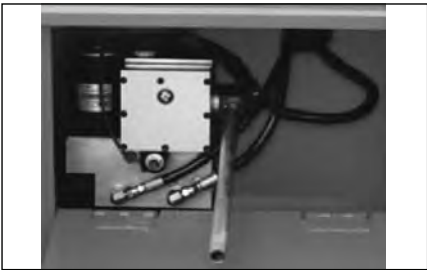
If the pin is locked, the cabin structure can be damaged in tilting operation.

Press the tilting switch on top of the left hood to tilt the cabin. Press the upper or lower arrow switches to open or close the cabin, respectively.



Cabin Tilting (manual)

1. For manual cabin tilting, open the cover under the left step equipped with power-pack. Support the power-pack with a lever and move the lever up and down.



2. To adjust cabin tilting position in manual tilting operation, change the direction with the Manual Override Position shown below.

- NORMAL POSITION: keep pressing the button, rotate the button counterclockwise by 180 degrees and release the button.
- SHIFTED POSITION: keep pressing the button, rotate the button clockwise by 180 degrees and release the button.



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.

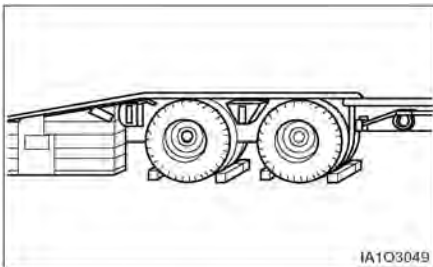
To prevent the lift truck from slipping while loading, or shifting in transit, remove ice, snow or other slippery material from the loading dock and the truck bed before loading.

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.



Typical Example

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.

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

If LP equipped, remove the LP fuel tank.

Block the wheels and secure lift truck with tie downs.

Machine Lifting and Tie down Information

NOTICE

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

1. Weight is given on the serial plate.
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 tie down locations provided for lift truck tie down.

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.

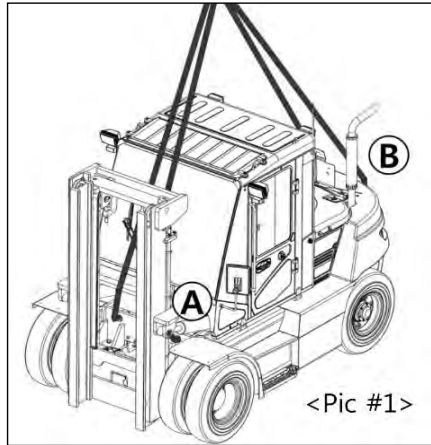
Lifting a Forklift Using a Crane

WARNING

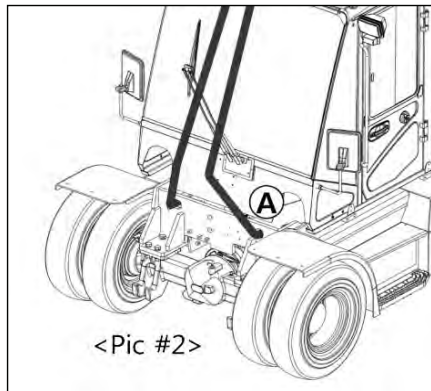
1. If lifting rope/cable breaks, serious injury/damage would occur.
2. The lifting wire rope and stay must be long enough to avoid contact with the forklift. Short rope/stay can damage the vehicle. If it's too long, it may cause interference.

Cover the rope/chain with rubber sheet or cloth to prevent damage to the vehicle, as necessary.

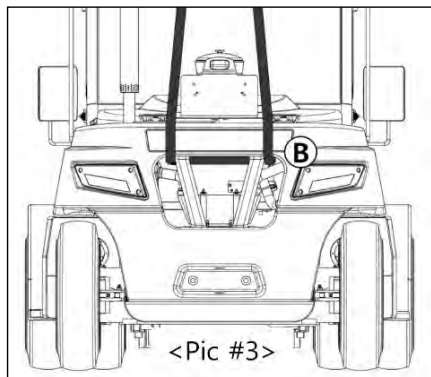
3. Rope/chain and other lifting tools must have sufficient strength, and free of any defect or wear.
4. Avoid impact load to the lifting devices/tools.
5. Apply only for OVHG Type truck. Not for Cabin type truck.

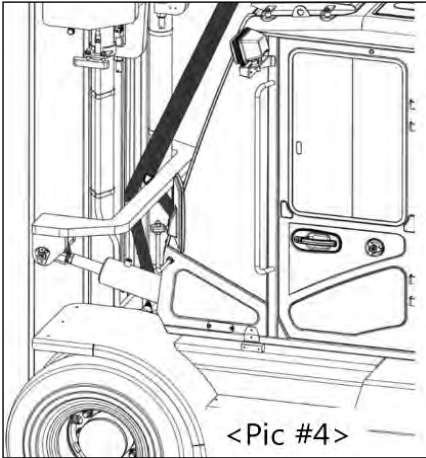


1. Check the weight, length, width and height of the vehicle before lifting.
2. Park the crane at an appropriate position.
3. Connect the rope/chain to the points A and B of the figure below (Pic#1, 2, 3). Front 2 rope/chains should be tied through middle stay of the mast (refer Pic#4).
4. If the wire rope/chain contacts the vehicle, insert a rubber plate between the rope/chain and the vehicle to protect the vehicle.



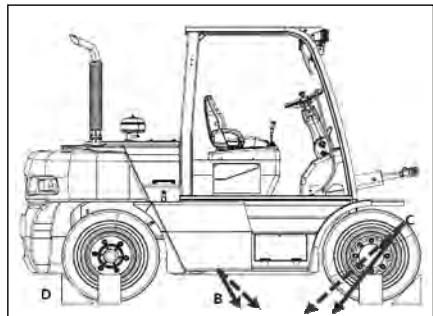
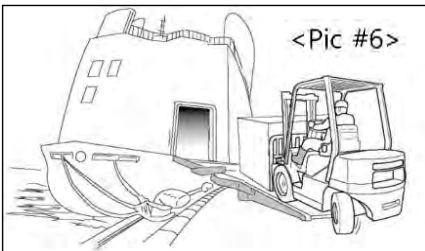
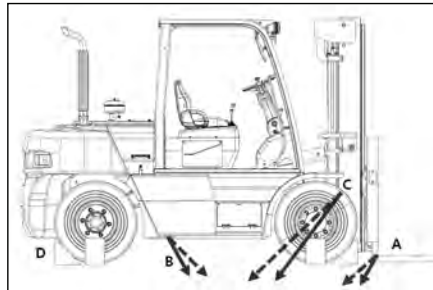
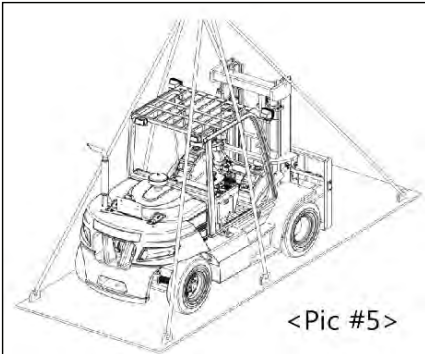
5. Lift up the vehicle extremely slowly
6. Strongly recommend to use moving basement or stay to move equipment at safety status, or use temporary bridge. (refer Pic#5, 6)
7. While transport, assign supervisor and warn people around enough.
8. Assist rope/cable can be helpful to move safety and stably.





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 (D).
6. If the vehicle has a mast, connect fixing rope/chain to the fork (A) and fix the vehicle using the reinforcing bar (B) of the lower frame. If without mast, fix with the drive axle wheel (C).



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 transport 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 Truck dealer for towing a disabled lift truck.

Mechanical Parking Brake (If Installed)



Typical Example

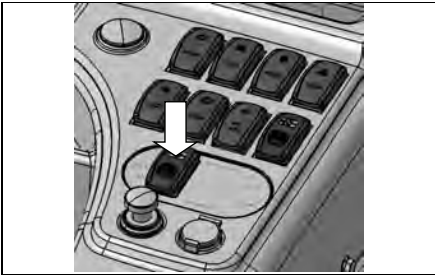
1. Release the parking brake.

NOTICE

Release the parking brake to prevent excessive wear and damage to the parking foot brake system.

2. Secure the wheels with blocks.
3. Direction control lever is in neutral.
4. Release the parking brake.
5. Release the service brake pedal.
6. Key switch is in the OFF position.
7. Direction control lever is in neutral.
8. Fasten the tow bar to the lift truck.
9. Remove the wheel blocks. Tow the lift truck slowly. Do not tow any faster than 2 km/h (1.2 mph).

Electronic Parking Brake (If Installed)



NOTICE

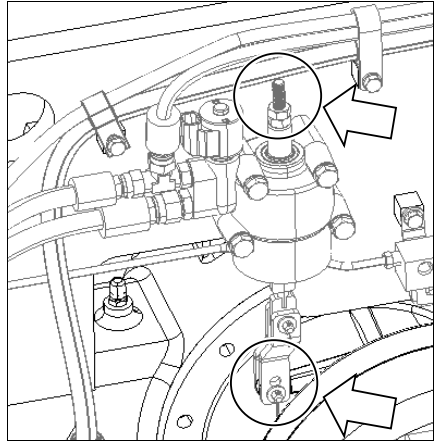
In the case of the electronic parking brake, it always stays engaged when the ignition is off, regardless of where the parking switch is positioned. Before towing the vehicle, therefore, you should release the parking brake by force to prevent excessive wear and damage on the park brake system.

1. Secure the wheels with blocks.
2. Direction control lever is in neutral.
3. Release the service brake pedal.
4. Turn the key switch off.
5. Direction control lever is in neutral.
6. Release the parking brake by force.

Step 1. Tilt the cabin open.

Step 2. Completely loosen two nuts (1) of the hydraulic actuator located at the fore part of the vehicle.

Step 3. Check that the parking brake lever is completely put down to the horizontal position.



⚠ 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.

After a repair of a vehicle equipped with an electronic parking brake, make sure to readjust the parking brake before you operate the vehicle. For how to make adjustment, refer to the Maintenance Section.

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 24 inch 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 is 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 12 month 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

Tires 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.

Always remove (deflate) all air from a single tire and from both tires on a dual assembly before changing them.

NOTICE

When changing tires, change them in sets, even if only one of the tires is damaged. If new and used tires are used on the same axle, tilting of the mast and rapid tire wear will result.

The mounting faces of the hub, wheel nuts and wheels must be free of any foreign material and lubricants of any kind. Tighten wheel nuts again after 24 hours of operation.

Do not re-inflate a tire that has been driven on while flat or underinflated, without first checking to be sure the locking ring on the wheel is not damaged and in position.

Always deflate tires before changing them.

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
8.25 x 15	14PR	790	115
8.25 x 15	16PR	880	128
9.00 x 20	14PR	790	115

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 \pm 35 kPa (5 psi). Tires can be filled with nitrogen.

Tire Inflation Pressures Adjustment

A 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 - This lift truck is almost totally metric design. Specifications are given in metric and U.S. Customary measurement.

Metric hardware must be replaced with metric hardware. Check parts books for proper replacement.

NOTE: Use only metric tools on most hardware for proper fit. Other tools could slip and possibly cause injury.

Torques for Standard Hose Clamps - Worm Drive Band Type

NOTICE

The following chart 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

¹1 Newton meter (N·m) is approximately the same as 0.1 kg·m.

Torques for Standard Bolts, Nuts and Taper lock Studs

NOTICE

The following charts give general torques for bolts, nuts and taper lock studs or 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

¹1 Newton meter (N·m) is approximately the same as 0.1 kg·m.

Torques for Taper lock Studs

Thread Size Inch	Standard Taper lock 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 1/8	500 ± 700	370 ± 50
1 1/4	650 ± 80	480 ± 60
3/8	750 ± 90	550 ± 65
1/2	870 ± 100	640 ± 75

¹1 Newton meter (N·m) is approximately the same as 0.1 kg·m.

Torques 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.). The following 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 for proper replacement.

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

¹1 Newton meter (1 N·m) is approximately the same as 0.1 kg·m.

²ISO - 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.

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.

NOTICE

DOOSAN recommends that the coolant mixture contain a minimum of 30% antifreeze or equivalent.

Never add coolant to an overheated engine, engine damage can result. Allow the engine to cool first.

All water is corrosive at engine operating temperature. The cooling system should be protected with a 3 to 6% concentration of liquid supplemental coolant additive at all times, regardless of the concentration of antifreeze.

Excessive supplemental coolant additive greater than the recommended 6%, together with concentrations of antifreeze greater than 65% can cause deposits to form and can result in radiator tube blockage, overheating, and/or water pump seal damage.

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.

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 de-ionized 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	80 mg/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 an 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°C (-10°F).

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 undisclosed 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

Specifications of Fuel and DEF/Ad-Blue

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.

- DO NOT USE Fuels that have sulfur content greater than 0.0015 % (15 ppm).
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service. (SAE J313 JUN87)
- These engines utilize Tier 4 standards, the use of Ultra Low Sulfur Diesel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S15 diesel fuel as an alternative to
- No.2-D, and use No.1-D S15 diesel fuel as an alternative to No.1-D for ambient temperature below 10 °C (14 °F).
 - a) No.1-D or No.2-D, S15: Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt.%

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 Specifications

These engines utilize Tier 4 standards, the use of Ultra Low Sulfur Diesel (ULSD) is mandatory for these engines.

Diesel Fuel Specification	Location
ASTM D975 No.1D/2D S15	USA
EN590:96	EU
ISO 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

- Cetane Rating: The minimum recommended Fuel Cetane Rating is 45. A cetane rating greater than 50 is preferred, especially for ambient temperatures below 20 °C (4 °F) or elevations above 1500m.
- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.

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 5% (by volume) of FAME with 95% (by volume) of approved mineral oil derived diesel fuel. Such bio-diesel fuels are known in the marketplace as B5 diesel fuels.

These 95 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. 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.

General DEF/Ad-Blue Information

DEF/Ad-Blue Information

Diesel Exhaust Fluid (DEF), commonly referred to as AdBlue in Europe, is an emissions control liquid required by modern diesel engines. It is injected into the exhaust stream. DEF/Ad-Blue is never added to diesel fuel. It is a non-hazardous solution of 32.5% urea in 67.5% de-ionized water. DEF/Ad-Blue is clear and colorless, and looks exactly like water. It has a slight smell of ammonia, similar to some home cleaning agents. DEF/Ad-Blue is used in by Selective Catalytic Reduction (SCR) technology to remove harmful NOx emissions from diesel engines.

The 32.5% urea concentration is the ideal solution as it provides the lowest freeze point. Also, SCR systems will be calibrated to the 32.5%, so that optimum NOx will be reduced during operation.

DEF/Ad-Blue should comply with the following specifications. The table lists several worldwide specifications for diesel fuels.

DEF/Ad-Blue Specification	Region
ISO 22241-1	International
DIN 70700	Germany
KS R ISI 22241-1	South Korea
Certification of API	USA

A 32.5% solution of DEF/Ad-Blue will begin to crystallize and freeze at 12 deg F (-11 deg C). At 32.5%, both the urea and water will freeze at the same rate, ensuring that as it thaws, the fluid does not become diluted, or over concentrated. The freezing and thawing of DEF/Ad-Blue will not cause degradation of the product.

CAUTION

- Make sure to wear personal protective equipment and observe precautions when handling DEF/Ad-Blue.
- Lack of DEF/Ad-Blue will reduce engine power. Check the DEF/Ad-Blue level frequently.
- Use genuine DEF/Ad-Blue that meets quality standards.
- Take care not to refill diesel fuel when replacing the DEF/Ad-Blue.
- Do not add any additives, antifreeze in particular, to prevent the DEF/Ad-Blue from freezing.
- Before operating a vehicle which has been stored for a six month period or longer, replace the DEF/Ad-Blue.

Storage

Between 4°C/40°F and 26°C/80°F is recommended to maintain shelf life.

Above -10°C/12° F is recommended to avoid freezing, which starts at -11°C/11° F.

Below 30°C/86° F is recommended, which cause hydrolysis to occur, with the consequent formation of ammonia and pressure rise, and will reduce shelf life.

Storage Temperature		Shelf life at constant Temperature
°C	°F	Months
16	60	36
27	80	12
38	100	3
49	120	1.5

Specification

ISO 22241-1/DIN20200

	Min	Max	
Urea Content	31.8	33.2	% by weight
Density at 20°C	1.087	1.093	g/cm ³
Refracting Index at 20°C	1.3814	1.3843	
Alkalinity as NH ₃		0.2	%
Biuret		0.3	%
Aldehyde		5	mg/kg
Insolubles		20	mg/kg
Phosphate (PO ₄)		0.5	mg/kg
Calcium		0.5	mg/kg
Iron		0.5	mg/kg
Copper		0.2	mg/kg
Zinc		0.2	mg/kg
Chromium		0.2	mg/kg
Nickel		0.2	mg/kg
Aluminum		0.5	mg/kg
Magnesium		0.5	mg/kg
Sodium		0.5	mg/kg
Potassium		0.5	mg/kg

Precautions for Handling

1. Read manufacturer's user manual and/or precautions carefully before using DEF/Ad-Blue.
2. Wash hands thoroughly after handling DEF/Ad-Blue.
3. Wear appropriate personal protective equipment, including safety gloves, appropriate clothes, goggles, and face shield.
4. Wash skin with plenty of water if exposed.
5. Take medical treatment if a large volume is swallowed.
6. Consult a doctor for any skin irritation.
7. Wash contaminated clothes before reusing.
If the eyes are exposed, carefully wash with flowing water for several minutes.
8. Remove contact lenses if possible.
9. Seek medical advice if eye irritation continues.
10. Seek medical advice for any risk of exposure or contact.
11. The product and the container must be disposed of according to a safe procedure provided by the manufacturer.

LP Specifications

LP is "liquefied petroleum gas". The exact composition of LP varies slightly between different parts of the country and different refineries. HD5 is recommended for DOOSAN forklift trucks. Remember LP is heavier than air and will sink to the lowest spot possible. Avoid areas near floor drains or lubrication pits where escaped fuel may collect.

Composition of HD5	
Propane (C ₃ H ₈)	90.0 %
Propylene	up to 5 %
Butane (C ₄ H ₁₀)	2.0 %
iso-Butane	1.5 %
Methane (CH ₄)	1.5 %
Total	100 %

Lubricant Specifications

Lubricant Information

Some classifications and abbreviations we use in this section follow S.A.E. (Society of Automotive Engineers) J754 nomenclature and others follow S.A.E. J183.

All MIL specifications are U.S.A. Military.

Recommended oil viscosities are given in the "Lubricant Viscosities" chart later in this section of the manual.

Greases are classified according to the National Lubricating Grease Institute (NLGI) based on ASTM D217-68 worked Penetration characteristics which give a defined consistency number.

Engine Oil (DEO and EO)

The following oil specifications provide guidelines for the selection of commercial products:

- D34 Tier4 Final Engine
- : API CJ4, ACEA E9 or higher

NOTICE

Failure to follow the oil recommendations can cause shortened engine life due to carbon deposits or excessive wear. Especially for D34 Tier4 Final engine, API CJ4 (ACEA E9) engine oil should be used, because of EGR & SCR 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. 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 blowby, 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 anti-wear, antifoam, antirust and antioxidation additives for heavy duty use as stated by the oil supplier. ISO viscosity grade of 32 would normally be selected.

Transmission Oil (TDTO)

NOTICE

These oils are formulated for transmissions and drive trains only, and should not be used in engines. Shortened engine life will result.

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.

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.

Select Oil that meets below specifications.

- ZF 3WG94
D50/60/70/80/90S-7(3 Speed)
- ZF TE-ML03
- PT50
D(G)50/60/70S-7(2 Speed)
- GM DEXRON III
FORD MERCON V

Drive Axle Oil

NOTE: Failure to follow the recommendation will cause shortened life due to excessive gear wear.

• **Oil Cooled Disc Brake (OCDB)**

Select oil that meets below specifications.
: Universal Transmission Tractor Oil (UTTO)

The following UTTO products of API GL4 class are authorized for use

Supplier	Product Name
MOBIL	MOBIL FLUID 424
GS Caltex	Textran TDH Premium

Lubricating Grease

NOTICE

Use MPGM for heavily loaded bearings and joints where an extreme pressure grease will maximize the life of DOOSAN equipment. This NLGI No. 2 grade is suitable for most temperatures. If MPGM is not available, use a type of multipurpose grease which contains 3 to 5% molybdenum.

This NLGI no. 2 grade is recommended for light duty automotive type applications where a high temperature [up to 175°C (350°F)] is required. This grease offers excellent mechanical stability, high resistance to oxidation, good rust protection and excellent breakaway torque.

If this grease is not available, use a similar type of multipurpose grease.

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 CJ4, ACEA E9	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
Engine Crankcase (LP) and Lift Chains API SJ	SAE 5W30	-30	+30	-22	+86
Auto Shift Transmission API GL4	UTTO (API GL4)	-20	+50	-4	+122
Power Shift Transmission DEXRON III	DEXRON III	-20	+50	-4	+122
Hydraulic and Power Steering System ISO 6743/4 HM	ISO VG32	-20	+30	-4	+86
	ISO VG46	-10	+40	+14	+104
	ISO VG68	0	+50	+32	+122
Drive Axle Housing Disc Brake (OCDB) API GL4	UTTO (API GL4)	-20	+50	-4	+122

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)		D5/6/7 TON 3speed	D8/9 TON 3speed	G5/6/7 TON 2speed
Compartment or System		Liters		
Engine Crankcase w/Filter	D34P D34NAP	12.6		4.3
Cooling System w/Coolant Reservoir tank	D34P D34NAP	12.7		19.0
Fuel Tank - Diesel		137	250	-
DEF / Ad-Blue Tank	D34P	15	30	-
Auto Shift Trans mission	ZF 3WG94	21		-
Power Shift Trans mission	PT50	13		13
Hydraulic Power Steering System		117 Proper quantity		117 Proper quantity
Drive Axle	Disc Brake	14		14

NOTE: The refill volume varies by the residual oil volume. Check the level gauge and refer to the related instruction on the oil replacement.

NOTE: Dieseling may occur, causing damage to the engine if oil is refilled excessively. Refill the oil half way between MIN and MAX using the dipstick.

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. Make sure to have only authorized personnel dispose waste oil

When Required

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Inspecting Engine Fuel Supply System	203
Separating Water from Fuel.....	203
Priming the Fuel System (Diesel Engine Only)	204
Test Fuel System for Leaks (LP Engine Only)	205
Fuel Tank Filter Cap & Screen - Clean	205
Seat - Check, Lubricate.....	206
Battery Terminal - Clean, Inspect.....	206
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Tires and Wheels - Inspect, Check	211
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Carriage Roller Extrusion - Adjust	213
Mast, Carriage, Lift Chains & Attachments - Inspect, Lubricate.....	214
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Every 10 Service Hours or Daily

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Hydraulic Oil Level - Check	220
Transmission Oil Level - Check	221
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Parking Brake - Test, Adjust.....	230
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Horn and Lights(If Equipped) - Check	231
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Fuel Trim Valve (FTV) Inspection (LP Engine only)	232
Inspect Electrical System (LP Engine only)	232
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Steering Mechanism - Check, Lubricate	234
Steering Axle Support - Check, Oiling.....	234
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Every 1000 Service Hours or 6 Months

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Carburetor (LP - Gas Engine Only) - Adjust, Clean	237
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Inspect Mixer Assembly (LP Engine Only).....	238
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Lift Chains - Test, Check, Adjust.....	240
Transmission Oil (2 Speed Only) – Change.....	242

Every 1500 Service Hours or 9 Months

Transmission Oil & Oil Filter – Change (3 Speed, ZF 3WG94)243

Inspect Ignition System (LP Engine Only)243

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Steer Wheel Bearings - Reassemble.....246

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Inspect Battery System250

Checking the TMAP Sensor (LP Engine Only)250

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Replace Oxygen Sensor (LP Engine Only)251

Every 3000 Service Hours or 36 Months

DEF/Ad-Blue Supply module filter replacement (D34P Engine Only)252

Environment Protection

Environment Protection.....253

Quick Reference to Maintenance Schedule				FIRST	EVERY							
ITEMS	SERVICES	PAGE	When Required	First 50-100 Service Hours or a Week	Every 10 Service Hours or Daily	Every 500 Service Hours or 3 Months	Every 1000 Service Hours or 6 Months	Every 1500 Service Hours or 9 Months	Every 2000 Service Hours or Yearly	Every 2500 Service Hours or 15 Months	Every 3000 Service Hours or 36 Months	
Air Cleaner Indicator	Check	217			O							
Air Intake System	Change	237					O					
Air Intake System	Check, Clean	234				O						
Battery Terminal	Clean, Inspect	206	O									
Belts (Diesel E/G Only)	Check, Adjust	229				O						
Carburetor (LP-Gas Engine Only)	Adjust, Clean	237					O					
Carriage Roller Extrusion	Adjust	213	O									
Checking the TMAP Sensor (LP Engine Only)		250								O		
Coolant Level	Check	216			O							
Cooling System	Clean, Change	247							O			
Crosshead Rollers	Inspect	230				O						
DEF/Ad-Blue Fluid Level	Check	220			O							
DEF/Ad-Blue Supply module filter replacement (D34P Engine Only)		252									O	
Drive Axle Oil	Change	225	O									
Drive Axle Oil (OCDB)	Change	230				O						
Drive Axle Oil Level	Check	221			O							
Engine Oil & Filter (Diesel Engine Only)	Change	232				O						
Engine Oil & Oil Filter	Change	222	O									
Engine Oil Level	Check	216			O							
Engine Valve Lash (Diesel E/G Only)	Check, Adjust	203	O									
Fork	Inspect	248							O			
Fuel Filter	Check, Clean, Change	233				O						
Fuel Lines & Fittings	Check	238					O					
Fuel Tank Filter Cap & Screen	Clean	205	O									
Fuel Trim Valve (FTV) Inspection (LP Engine only)		232				O						
Fuses, Bulbs & Circuit Breaker	Change, Reset	214	O									
Horn and Lights(If Equipped)	Check	231				O						
Hydraulic Oil Level	Check	221			O							
Hydraulic Oil, Return Filter, Strainer & Breather	Check, Clean, Change	239					O					
Inspect Battery System		250								O		
Inspect Coolant Hoses (LP Engines Only)		238					O					
Inspect Electrical System (LP Engine only)		232				O						
Inspect Engine for Exhaust Leaks		219			O							
Inspect for Intake Leaks (LP Engine Only)		251								O		
Inspect Ignition System (LP Engine Only)		243						O				
Inspect Mixer Assembly (LP Engine Only)		238					O					

Quick Reference to Maintenance Schedule				FIRST	EVERY						
ITEMS	SERVICES	PAGE	When Required	First 50-100 Service Hours or a Week	Every 10 Service Hours or Daily	Every 500 Service Hours or 3 Months	Every 1000 Service Hours or 6 Months	Every 1500 Service Hours or 9 Months	Every 2000 Service Hours or Yearly	Every 2500 Service Hours or 15 Months	Every 3000 Service Hours or 36 Months
Inspect Throttle Assembly (LP Engine Only)		238					O				
Inspect Vacuum Lines and Fittings (LP Engine only)		232				O					
Inspecting Engine Fuel Supply System		203	O								
Inspection Engine for Fluid Leaks		216			O						
Lift Chains	Test, Check, Adjust	240					O				
LP Regulator/Converter Inspection (LP Engine Only)		238					O				
Mast Channels	Lubricate	220			O						
Mast Hinge Pins	Lubricate	229				O					
Mast, Carriage, Lift Chains & Attachments	Inspect, Lubricate	214	O								
Overhead Guard (If Equipped)	Inspect	231				O					
Parking Brake	Test, Adjust	226, 230		O		O					
Priming the Fuel System (Diesel Engine Only)		204	O								
Radiator Cap	Clean, Change	213	O								
Replace LP Fuel Filter Element (LP Engine Only)		244						O			
Replace Oxygen Sensor (LP Engine Only)		251								O	
Replace PCV Valve and breather element	Change (LP Engine Only)	251								O	
Replace Spark Plugs (LP Engine Only)		243						O			
SCR Cleaning	DeSOx (Diesel)	207	O								
Seat	Check, Lubricate	206	O								
Separating Water from Fuel		203	O								
Steer Suspension	Inspect	231				O					
Steer Wheel Bearings	Reassemble	246							O		
Steering Axle Support	Check, Oiling	234				O					
Steering Mechanism	Check, Lubricate	234				O					
Steering Mechanism(Link Bearing)	Check, Lubricate	215	O								
Test Fuel System for Leaks (LP Engine Only)		205	O								
Testing Fuel Lock-off Operation (LP Engine Only)		245						O			
Thermostat Valve (optional)	Check	218			O						
Tilt Cylinders	Check, Adjust, Lubricate	230				O					
Tires and Wheels	Inspect, Check	211	O								

Quick Reference to Maintenance Schedule			FIRST		EVERY						
ITEMS	SERVICES	PAGE	When Required	First 50-100 Service Hours or a Week	Every 10 Service Hours or Daily	Every 500 Service Hours or 3 Months	Every 1000 Service Hours or 6 Months	Every 1500 Service Hours or 9 Months	Every 2000 Service Hours or Yearly	Every 2500 Service Hours or 15 Months	Every 3000 Service Hours or 36 Months
Transmission Oil & Oil Filter	Change	223		O							
Transmission Oil & Oil Filter	Change (3 Speed, ZF 3WG94)	243						O			
Transmission Oil (2 Speed Only)	Change	242					O				
Transmission Oil Level	Check	221			O						
Universal Joint	Inspect, Lubricate	231				O					
Walk-Around Inspection	Inspect	219			O						
Wheel Bolts & Nuts	Inspect	233				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.

Engine Valve Lash (Diesel E/G Only) - Check, Adjust

NOTICE

The valve clearances are to be adjusted at the times of the following situations.

- When the engine is overhauled and the cylinder heads are disassembled.
- When severe noise comes from valve train.
- When the engine is not normally operated even though there is no trouble in the fuel system.

⚠ WARNING

To prevent possible injury when adjusting diesel engines, do not use the starter motor to turn the flywheel.

Hot engine components can cause burns. Allow additional time for the engine to cool before measuring valve clearance.

NOTICE

Measure the valve lash with the engine stopped. To obtain an accurate measurement, allow at least 20 minutes for the engine cylinder head and block to cool.

Set the clearance to the nominal appropriate clearance given in the "Valve Clearance Setting" chart shown below.

Valve Clearances		
Engine	Valve	Clearance
D34P D34NAP	Exhaust Valves	.45 mm (.18 in)
	Intake Valves	.40 mm (.16 in)

Refer to the "Service Manual" for the complete valve adjustment procedure.

NOTE: In case of LP Engine, no valve adjustment is necessary.

Inspecting Engine Fuel Supply System

⚠ WARNING

Once a lot of foreign substances or water are detected in the fuel supply line, the warning function is activated. Failure to check the fuel supply line in response to the warning may cause a serious fault or damage in the engine.

Separating Water from Fuel

Once water is detected in the fuel, the water-in-fuel warning function is triggered to set off the warning buzzer, light up the warning lamp, and derate the engine. If a water-in-fuel warning occurs, check the fuel supply line as follows:

1. Turn off the engine and put a drip pan on the floor to catch drained fuel.
2. Remove the plug at the bottom of the fuel filter and wait until all fuel and water drain out of the filter.
3. Once they drain out, mount the plug and remove air according to the fuel system priming procedure.
4. Start up the engine and check if the warning has been cleared and the vehicle operates normally.



Getting Rid of Foreign Substances from Fuel Supply System

Once foreign substances are detected in the fuel, the pressure sensor warning function is activated. With this warning triggered, all or either of the following measures are taken depending on the vehicle settings: setting off the warning buzzer, lighting up the warning lamp, and derating the engine. If a pressure sensor warning occurs, check the system as follows:

1. Take out the fuel tank cover and remove the fuel tank filter.
2. Wipe foreign substances off the filter with a clean cloth or blowing them off using an air compressor.



3. Reinstall the filter and cover on the fuel tank.
4. Start the ignition and check if the warning has been cleared and the vehicle operates normally.
5. If the pressure sensor warning persists, replace the fuel filter cartridge. This replacement is one of the items described in the subsection of "Every 500 Service Hours or 3 Months."

NOTICE

Be careful not to damage the fuel tank filter when cleaning it. A damaged fuel tank filter may cause the contamination of the fuel filter with foreign substances and consequently a serious trouble in the engine.

WARNING

Before you perform service or maintenance, test the fuel system for leaks.

Priming the Fuel System (Diesel Engine Only)

Bleeding the Fuel System

After changing the fuel filter, or after having serviced any part of the fuel system, make sure that the air is bled from the system.



D34P

1. Operate priming pump for five minutes.
2. Make sure to check leakage of injection pump and filter after operating feed pump many times.

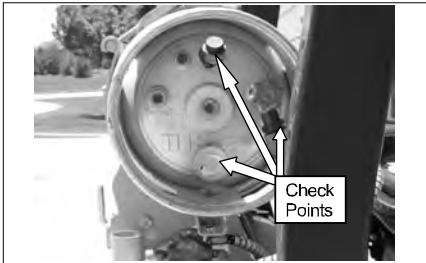
Draining Water from Fuel Filter

Applicable to diesel engines only

1. Turn the wing nut counterclockwise on the fuel filter's lower part to open the drain valve on the bottom of the filter.

Drain the fuel (including water) from the filter until clean fuel appears.

Test Fuel System for Leaks (LP Engine Only)



- Obtain a leak check squirt bottle or pump spray bottle.
- Fill the bottle with an approved leak check solution.
- Spray a generous amount of the solution on the fuel system fuel lines and connections, starting at the storage container.
- Wait approximately 15-60 seconds then perform a visual inspection of the fuel system. Leaks will cause the solution to bubble.
- Repair any leaks before continuing.
- Crank the engine through several revolutions. This will energize the fuel lock-off and allow fuel to flow to the pressure regulator/converter. Apply additional leak check solution to the regulator/converter fuel connections and housing. Repeat leak inspection as listed above.
- Repair any fuel leaks before continuing.

WARNING

Prior to any service or maintenance activity, Test Fuel System for Leaks.

Fuel Tank Filter Cap & Screen - Clean

Park the lift truck with the forks lowered, parking brake applied, transmission in neutral and the engine stopped.



Typical Example

1. Raise the left side cover.
2. Remove the filter cap assembly. Separate the cap from the screen. Clean both in clean, nonflammable solvent.
3. Dry and assemble cap and screen.
4. Install cap assembly.

WARNING

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

5. Drain moisture and sediment from fuel tank as required by prevailing conditions.

Seat - Check, Lubricate



Typical Example

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.

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.



Typical Example

Diesel Engine Truck

1. Clean the top of the battery and terminals.
2. Check terminals for corrosion. Coat terminals with heavy grease.

SCR Cleaning – DeSOx (Diesel)

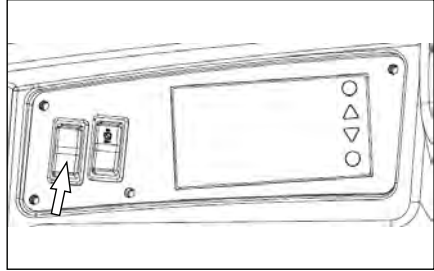
SCR Cleaning - DeSOx Display Pop-up

In order that the SCR system may maintain its exhaust cleaning efficiency at a proper level, it should be periodically initialized—"SCR cleaning."

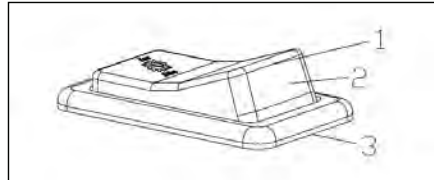
NOTICE

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 SCR cleaning function.
- Be careful of the high temperature of the exhaust tube or other parts during SCR cleaning.
- Do not operate the vehicle (e.g. pushing the accelerator pedal) during SCR cleaning.
- Do not switch off the ignition during SCR cleaning. The SCR system might be damaged.



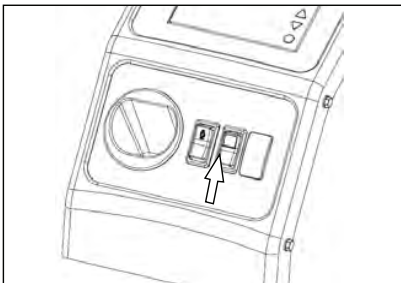
Cabin



SCR Cleaning switch



DOC & SCR Position



Overhead Guard

Automatic SCR Cleaning

The ECU attempts to start SCR cleaning during working—"automatic SCR cleaning"—at a proper moment after determining the moment. Once automatic SCR cleaning 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 SCR cleaning

If automatic SCR cleaning 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 SCR cleaning is fully completed. While automatic SCR cleaning is being carried out, exhaust emissions above 500 °C may cause fires or burns.

Setting this switch to position "3" prohibits automatic SCR Cleaning 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".



SCR Cleaning inhibited

If automatic SCR cleaning is failed, you should carry it out a while after the vehicle starts working.

- 1) A pop-up on the SCR Display warns the operator to perform SCR Cleaning. (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 SCR cleaning is not used; you will be violating the exhaust regulations if you do not.

To carry out SCR cleaning safely, observe the following steps:

1. Park the vehicle at a safe place. White smoke can be emitted during SCR Cleaning.
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 SCR cleaning is not possible in cold condition.

5. After holding down the switch at the "3" position for three seconds, check that SCR cleaning has started.

6. Once SCR cleaning 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





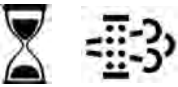


Proceeding



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 SCR Cleaning		-	Recommend SCR Cleaning in 10hr Need Engine Warm up
2			ON	Should Do SCR Cleaning in 5hr Need Engine Warm up
3			Blink	Must Do SCR Cleaning Immediately Need Engine Warm up
4	Progressing Passive SCR Cleaning Progressing Service SCR Cleaning		ON	Hot Exhaust Gas
5	Service SCR Cleaning Preparation Lamp		ON	Warming up for SCR Cleaning
6	Under Cleaning SCR		ON	Cleaning SCR DO NOT STOP ENGINE
7	SCR Cleaning Finish		-	SCR Cleaning completed
8	SCR Cleaning inhibit switch ON		ON	SCR Cleaning is inhibited

Fuses, Bulbs & Circuit Breaker - Change, Reset

Fuses

NOTE: If a fuse filament separates, use only the same type and size fuses for replacement. 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.

Remove the front cover of fuse box. The fuses are located under the cover.



Fuse - Protects an electrical circuit from an overload. Opens (filament separates) if an overload occurs.



Typical Example

Check the fuses. Use a flashlight, if necessary. Fuses are identified as follows:

HORN	TOU POWER	COMBI LAMP	WORKING LAMP	FRONT WIPER	MAIN POWER (SET SW-BATT)	CABIN POWER (AUDIO, REAR WIPER)
15A	15A	15A	15A	30A	30A	30A
START RELAY	OSR CONTROLLER (IGN) PARKING BRAKE CONTROLLER	LCD DISPLAY TCU F/R LEVER	HAZARD LAMP CABIN RELAY	CLUSTER LAMP ENGINE OVER LAMP CHARGE LAMP PRESENT LAMP		
10A	10A	10A	10A	10A		

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ECU POWER	AIRCON/HEATER	OSR CONTROLLER (BATT)	OPTION (BATT)	POWER PACK	DOU POWER	FUEL HEATER
30A	30A	10A	15A	30A	30A	30A
OSCAR LAMP WIPER TIMER	ECU RET POWER FUEL HEATER RELAY	ISO 9861 VALVE TCU AUTO NEUTRAL PARKING	CAMERA OPTION (ACC)	STOP LAMP AIRCON/HEATER RELAY CD PLAYER		
30A	10A	15A	15A	15A		

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Diesel

HORN	TOU POWER	COMBI LAMP	WORKING LAMP	FRONT WIPER	MAIN POWER (SET SW-BATT)	CABIN POWER (AUDIO, REAR WIPER)
15A	15A	15A	15A	30A	30A	30A
START RELAY	OSR CONTROLLER (IGN) PARKING BRAKE CONTROLLER	LCD DISPLAY TCU F/R LEVER	HAZARD LAMP CABIN RELAY	CLUSTER LAMP ENGINE OVER LAMP CHARGE LAMP PRESENT LAMP		
10A	10A	10A	10A	10A		

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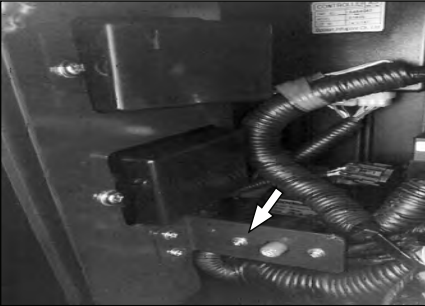
ECU POWER	AIRCON/HEATER	OSR CONTROLLER (BATT)	OPTION (BATT)	POWER PACK	DOU POWER	FUEL HEATER
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30A	10A	15A	15A	15A		

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LPG PSI4.3L

Circuit Breaker

1. Operation the pilot box.



Typical Example

Diesel Engine Truck

2. The main circuit breaker is located on the rear of the support for the controls.

NOTE: To reset circuit breakers push 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?

Bulbs

Bulbs are identified as follows

[Diesel Engine]

1. Bulb-head lamp halogen(24V-70/75W)
2. Bulb-rear(24V-55W)
3. Bulb-turn signal(Front, 24V-25/10W)
4. Bulb-turn signal(Rear, 24V-25W)
5. Bulb-stop & tail(24V-25/10W)
6. Bulb-back up(24V-10W)
7. LED head lamp
8. LED tail light
9. LED turn signal light (front)
10. LED turn signal light (rear)
11. LED stoplight, tail light
12. LED backup lamp
13. Strobe light

[LP Engine]

1. Bulb-head lamp halogen(12V-60/55W)
2. Bulb-rear(12V-55W)
3. Bulb-turn signal(Front, 12V-23/8W)
4. Bulb-turn signal(Rear, 12V-23W)
5. Bulb-stop & tail(12V, 23/8W)
6. Bulb-back up(12V-10W)

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. Deflate tire before removing wheel nuts from the truck.

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 inline valve and gauge.

Always stand behind the tread of the tire. NOT in front of the rim.



Typical Example

Do not re-inflate a tire that has been run while flat or underinflated, without first checking to make sure 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.

Radiator Cap - Clean, Change

Clean Pressure Cap

WARNING

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



1. Remove the radiator cap slowly to relieve pressure.
2. Inspect the cap for damage, deposits or foreign material. Clean the cap with a clean cloth or change the cap as necessary.
3. Install the cap.

Clean Outside of Radiator Core

WARNING

Pressure air can cause personal injury.

When using pressure air for cleaning, wear a protective face shield, protective clothing and protective shoes.

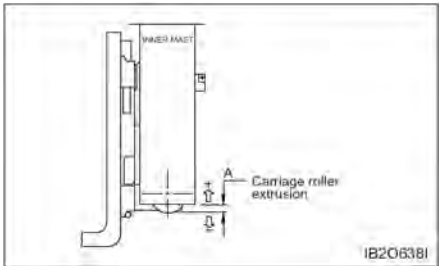
The maximum air pressure must be below 205 kPa (30 psi) for cleaning purposes.

Compressed air, high pressure water or steam can be used to remove dust, leaves and general debris from a radiator. Clean as required by condition of radiator.

The use of compressed air is preferred.

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.

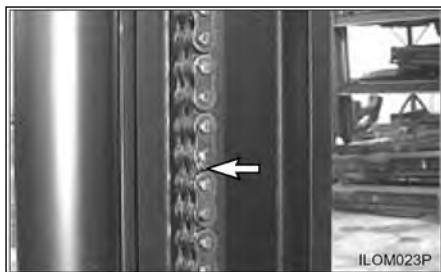


4. Measure the distance from the bottom of the inner upright to the bottom of carriage bearing.
5. The measurement (A) must be as follows in Chart below.

Height of carriage roller extrusion (A)		
STD mast	FF mast	FFT mast
D60/70S-7 (3 Speed)		
23	-	26
D80/90S-7 (3 Speed)		
42	-	42

Mast, Carriage, Lift Chains & Attachments - Inspect, Lubricate

1. Operate the lift, tilt and attachment controls. Listen for unusual noises. These may indicate a need for repair.
2. Check for loose bolts and nuts on the carriage. Remove any debris from the carriage and mast.
3. Check the forks and attachments for free operation and damage. Have repairs made if necessary.



Typical Example

4. Brush a film of oil on all links of the chain.
5. 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.

6. Check the air cleaner housing for loose latches.

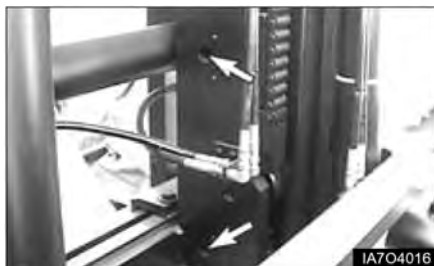
Lubricate Mast Side Rollers



Typical Example

1. Lubricate the 2 fittings on the inner mast.

Lubricate Carriage Side Rollers



Typical Example

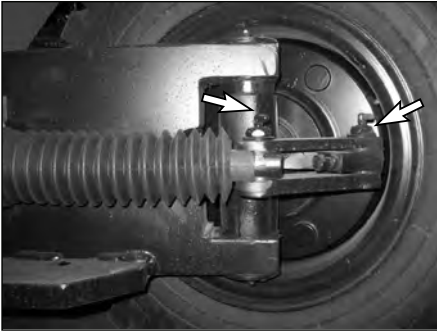
1. Lubricate the 4 fittings for the carriage side rollers, two on each side of the carriage side rollers.



Typical Example

2. Lubricate the 2 fittings for the carriage middle rollers, one on each side of the carriage middle rollers.

Steering Mechanism (Link Bearing) - Check, Lubricate



Typical Example

1. Lubricate the steering link bearings, total of four fittings. Two on the right side and two on the left side
2. Check for any worn or loose components of the steering mechanism. Remove any debris or trash as required.

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.

Inspection Engine for Fluid Leaks

1. Start the engine and allow it to reach operating temperatures.
2. Turn the engine off.
3. Inspect the entire engine for oil and/or coolant leaks.
4. Repair as necessary before continuing.

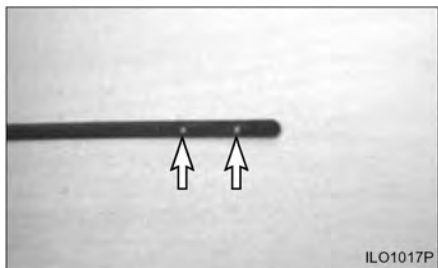
Engine Oil Level - Check

1. 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.

Excessive refill volume of engine oil can cause dieseling phenomenon resulting in severe engine, damage. Keep appropriate engine oil level.



Typical Example

2. The oil level should be close as possible to upper point of the oil dip stick. Do not refill more than upper point.

Coolant Level - Check

WARNING

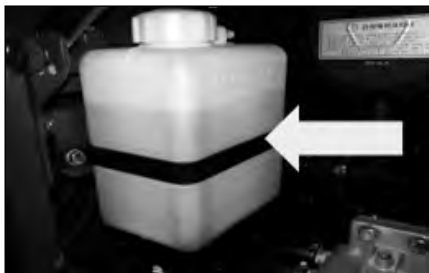
At operating temperature, the engine coolant is hot and under pressure.

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 injury.



Typical Example

1. Observe the coolant level with engine cold. 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.
2. Remove the radiator cap. Fill radiator to the top of the filter neck. Inspect radiator cap. Replace if damaged. Install the radiator cap.



Typical Example

3. 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.
4. Stop the engine.
5. Inspect the cooling system for leaks, hose cracks or loose connections.

⚠ WARNING

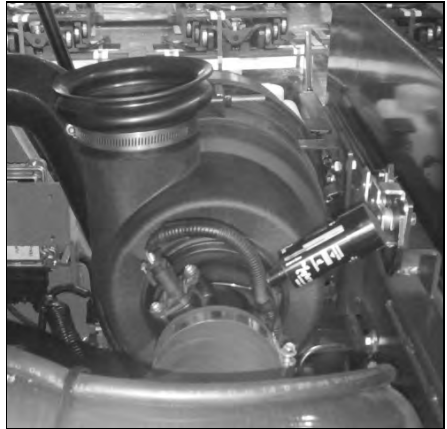
Pressure air can cause personal injury.

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.

6. Blow any dust and lint from the radiator fins.

Air Cleaner Indicator - Check Service Indicator



Typical Example

Diesel Engine Truck

1. Observe the air cleaner service indicator.
2. Service the air cleaner when the RED band in the service indicator, locks in the visible position. See topic, "Air Intake System - Check, Clean" in "Every 500 Service Hours or 3 Months".

NOTE: Service the element more frequently, as required, in severe dust or lint conditions. Also, service it more frequently where the operator is required to wear a respirator.

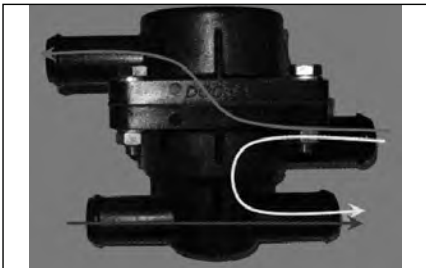
3. Close hood and seat assembly.

Thermostat Valve (optional) - Check

Thermostat Valve Function

A thermostat valve is provided in the transmission oil cooling line to shorten the oil warming-up time in cold weather.

The valve installation of shall be in accordance with the picture below.



CAUTION

Incorrect assembly of the Thermostat Valve can result in oil leak and/or overheating of the transmission.

Failure detected by a defective thermostat valve part:

- 1) Fault occurred with the internal thermostat closed: in the initial operation, the transmission oil gauge exceeds red line and B7 error code appears on the transmission display.
- 2) Fault occurred with the internal thermostat open: same as without a thermostat valve. It takes long to preheat the transmission oil but no further impact on the vehicle.

Inspect Engine for Exhaust Leaks

1. Start the engine and allow it to reach operating temperatures.
2. Perform visual inspection of exhaust system. 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.



Typical Example

1. Inspect the tires and wheels for cuts, gouges, foreign objects, inflation pressure and loose or missing bolts.
2. Inspect the mast and lift chains for wear, broken links, pins and loose rollers.
3. Inspect the hydraulic system for leaks, worn hoses or damaged lines.
4. Look for transmission and drive axle leaks on the lift truck and on the ground.



Typical Example

5. Inspect the operator's compartment for loose items and cleanliness.
6. Inspect the instrument panel for broken gauges and indicator lights.
7. Test the horn and other safety devices for proper operation.
8. Inspect engine compartment for oil, coolant and fuel leaks.
9. Inspect the cooling system for leaks, worn hoses and debris buildup.
10. Inspect the carriages, forks or attachments for wear, damage, and loose or missing bolts.
 - 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



Typical Example

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.

DEF/Ad-Blue Fluid Level - Check

1. Start the engine and check DEF/Ad-Blue level at the LCD.
2. If DEF/Ad-Blue level is less than 20%, must refill DEF/ Ad-Blue in the DEF/ Ad-Blue tank.

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.

1. 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.
2. Raise the hood and seat assembly. Make sure the air lift cylinder securely holds the hood open.



Typical Example

3. Check the oil level.
4. Maintain the oil level to the FULL mark on the dip stick/filter cap assembly.
5. Install the dip stick/filter cap assembly.

Transmission 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 transmission reaches normal operating temperature (about 80°C).
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 transmission into NEUTRAL. Engage the parking brake.
5. Loosen the oil dipstick counter-clockwise, remove and clear it. Insert the oil dipstick slowly into the oil level tube until contact is obtained, and pull the dipstick out again.
6. When the oil temperature is around 40°C, the marking on the oil dipstick must be lying above the cold start mark, "COLD". When the oil temperature is around 80°C, the oil level must be lying in the zone "HOT".
7. Install the oil dipstick again and tighten it clockwise.
8. Check for oil leaks at the filter and drain plug.
9. Stop the engine.

Drive Axle Oil Level - Check

WARNING

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

Oil Cooled Disc Brake (OCDB) Type

Park the lift truck on a level surface. Apply the parking brake. The engine is at the low idle. Place the directional control lever in NEUTRAL.

1. Remove the dip stick/filter cap. Observe the oil level.
2. Maintain the oil level between lower mark and upper mark on the dip stick/filter cap.
3. Install the dip stick/filter cap.



Typical Example

D60/70/80/90S-7 (3 Speed)



Typical Example

D(G)60/70S-7 (2 Speed)

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 & Oil Filter - Change

The percentage of sulfur in the fuel will affect the engine oil recommendations. If the fuel has over 0.5% sulfur content, the engine oil must have a TBN of 20 times the percentage of fuel sulfur (TBN as measured by the ASTM D-2896 method). Your oil supplier should be able to furnish the correct oils.

1. Operate lift truck a few minutes to warm oil. Park the lift truck with the forks lowered, parking brake applied, transmission in neutral and the engine stopped.
2. Raise rear of lift truck off the ground and block securely.

WARNING

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

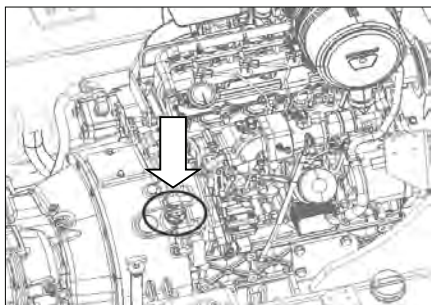


Typical Example

LP Engine (PSI4.3L)

NOTICE

Careless disposal of waste oil can harm the environment and can be dangerous to persons. Make sure to have only authorized personnel dispose waste oil



Typical Example

Diesel Engine (D34P/NAP)



3. Remove the crankcase drain plug and allow oil to drain. Clean and install drain plug.
4. Raise the left side cover.
5. Remove and discard oil filter element.
6. Wipe sealing surface of oil filter element mounting base. Make sure all of the old gasket is removed.
7. Before installing a new filter element, apply a small amount of clean engine oil to the filter element gasket.
8. Install the new filter element. When the gasket contacts the base, tighten it 3/4 of a turn more. Do not over tighten.
9. Raise the lift truck, remove the blocking and lower the lift truck.
10. Fill the crankcase. See "Refill Capacities".
11. Start the engine and allow the oil to fill the filter and passages.
12. Check for oil leaks.

13. Stop the engine and measure the oil level. The oil level should be close as possible to upper point of the oil dip stick.

14. Close side cover.

⚠ WARNING

Do not refill more than upper point.

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 50-100 Service hours or a week.

Transmission Oil & Oil Filter - 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.



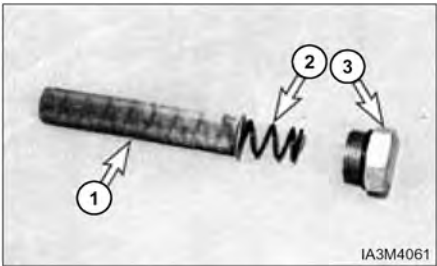
Typical Example

D60/70/80/90S-7 (3 Speed)

1. Remove drain plug. Allow the oil to drain.

NOTICE

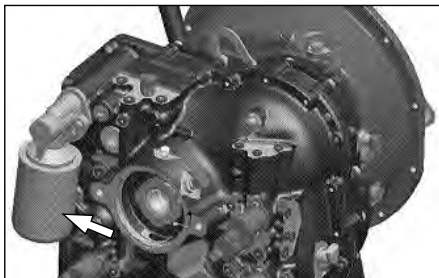
Careless disposal of waste oil can harm the environment and can be dangerous to persons. Make sure to have only authorized personnel dispose waste oil.



2. Wash the strainer (screen), spring and drain plug in clean, nonflammable solvent. Dry the strainer, spring and drain plug. (2 Speed Only)

3. Install the drain plug.

ZF 3WG94



Typical Example D60/70/80/90S-7 (3 Speed)

4. Rotate the oil filter counter clockwise to remove it.

• Replacement Interval of Transmission Oil Filter

D60/70/80/90S-7 (3 Speed)

: Every 1,500 Service Hours or 9 Months.

D(G)60/70S-7 (2 Speed)

: Every 1,000 Service Hours or 6 Months.

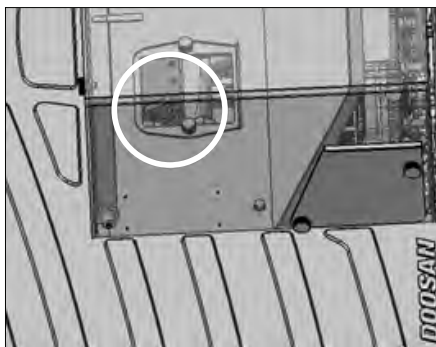
5. Put a small amount of clean oil on the seal gasket on the new filter. Install the filter by hand. When the filter contacts the base, tighten it an additional 3/4 turn.

6. Open the access left door of the seat box.(3 Speed Only)



Typical Example D60/70/80/90S-7 (3 Speed)

7. Open the access door in the seat box.(2 Speed Only)



Typical Example D(G)60/70S-7 (2 Speed)

8. Remove the dip stick/filter cap. Fill the compartment with oil. See "Refill Capacities". Install the dip stick/filter cap.

9. Close the cabin and hood assembly.

10. Start the engine.

11. With the service brake applied and engine at low idle, shift the transmission to forward and reverse to fill the clutches.

12. Shift the transmission into NEUTRAL. Engage the parking brake.

13. Loosen the oil dipstick counter-clockwise, remove and clear it. Insert the oil dipstick slowly into the oil level tube until contact is obtained, and pull the dipstick out again.



14. When the oil temperature is around 40°C, the marking on the oil dipstick must be lying above the cold start mark, "COLD". When the oil temperature is around 80°C, the oil level must be lying in the zone "HOT".

15. Install the oil dipstick again and tighten it clockwise.

16. Check for oil leaks at the filter and drain plug.

17. Stop the engine.

Drive Axle Oil - Change

Park the lift truck on a level surface, parking brake applied, transmission in neutral.

WARNING

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

Oil Cooled Disc Brake (OCDB) Type

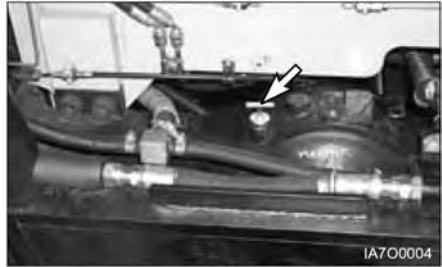
Park the lift truck on a level surface. Apply the parking brake. Place the directional control lever in NEUTRAL and stop the engine.



1. Remove three drain plugs of the drive axle housing and both wheel ends. Allow the oil to drain into a suitable container. Clean the magnetic drain plugs. Check O-ring seal and replace if necessary.
2. Install the drain plug.
3. Remove strainer assembly.



4. Wash the strainer assembly in clean, nonflammable solvent and dry it.
5. Install the strainer assembly and reconnect the hose and harness.



6. Remove the dip stick/filter cap. Fill the drive axle housing with oil. See "Lubricant Specification - Drive Axle Oil" and "Refill Capacity".
7. Start the lift truck. With the engine at low idle, place the directional control lever to the NEUTRAL.
8. Maintain the oil level between lower mark and upper mark on the dip stick/filter cap.
9. Install the dip stick/filter cap.

Parking Brake - Test, Adjust

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.

NOTE: Be sure area around the lift truck is clear of personnel and obstructions.

1. Drive the lift truck with a rated load up a 15% incline.
2. Halfway up the incline, stop the lift truck by applying the service brakes.



Typical Example

3. Engage the parking brake and slowly release the service brake.
4. If the parking brake has the correct adjustment the lift truck will be hold in place. If the parking brake does not hold, adjust the parking brake.

To Adjust

Park the lift truck level, with the forks lowered, transmission in NEUTRAL, the engine stopped and the wheels securely blocked.

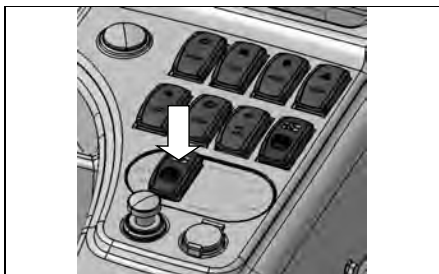
Mechanical Parking Brake (If Installed)



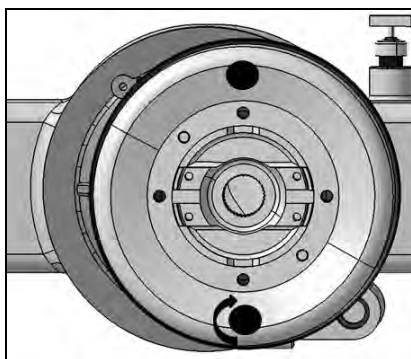
Typical Example

1. Release the parking brake
2. Turn the adjustment knob, clockwise to tighten the brake.
3. Test the parking brake adjustment. Repeat the adjustment procedure, if necessary.

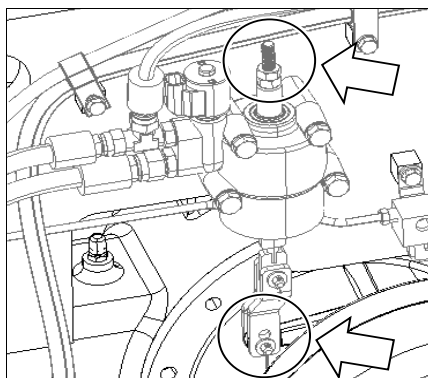
Electronic Parking Brake (If Installed)



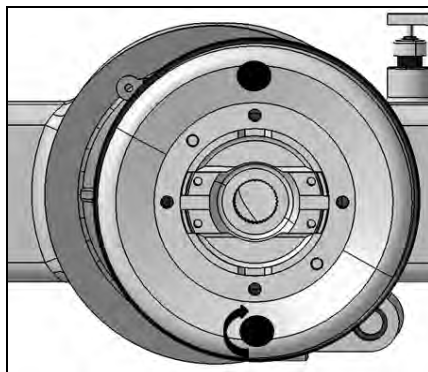
1. Park the vehicle with the parking brake drum's rubber cap positioned at 6 o'clock and then turn off the ignition.



2. Secure the wheels firmly with blocks.
3. Tilt the cabin open.
4. Completely loosen two nuts (1) of the hydraulic actuator located at the fore part of the vehicle.
5. Check that the parking brake lever is completely put down to the horizontal position.



6. Remove the 6-o'clock-positioned rubber cap from the parking brake drum.
7. Screw up the adjuster as far as possible.
8. Screw down the adjuster exactly by two clicks.
9. Install the rubber cap on the parking brake drum.
10. Put a nut on the hydraulic actuator and tighten it up to a height of 23-25 mm.
11. Put the other nut and tighten it firmly.
12. Close down the cabin.
13. Turn on the ignition and press the parking brake switch to check if the parking brake works normally.
14. Test the parking brake.



Every 250 Service Hours or Monthly

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

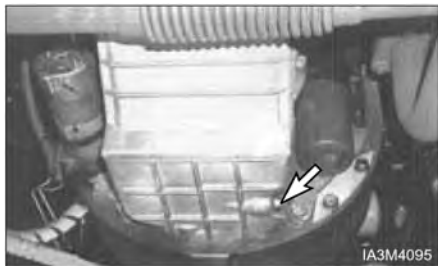
Engine Oil & Filter (LP Engine) - Change

LP Engine Crankcase

1. Operate lift truck a few minutes to warm oil. Park the lift truck with the forks lowered, parking brake applied, transmission in neutral and the engine stopped.
2. Raise rear of lift truck off ground and block securely.

WARNING

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



3. Remove the crankcase drain plug and allow oil to drain. Clean and install drain plug.
4. Raise the hood and seat assembly.
5. Remove and discard oil filter element.
6. Wipe sealing surface of oil filter element mounting base. Make sure all of the old gasket is removed.
7. Before installing a new filter element, apply a small amount of clean engine oil to the filter element gasket.
8. Install the new filter element. When the gasket contacts the base, tighten it 3/4 of a turn more. Do not overtighten.
9. Raise the lift truck, remove the blocking and lower the lift truck.

10. Fill the crankcase. See "Refill Capacities".

11. Start the engine and allow the oil to fill the filter and passages.

12. Check for oil leaks.



13. Stop the engine and measure the oil level. Maintain the oil level to the FULL mark on the dip stick.

14. Close hood and seat assembly.

NOTICE

Engine Oil Service hours can be extended to 500 hours by using Doosan supplied specific oil. Please consult Doosan dealer about it.

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.

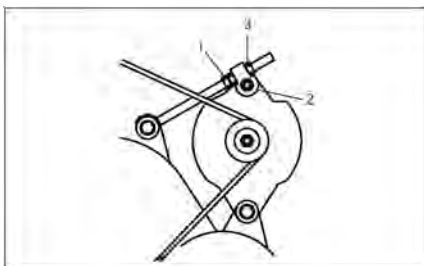
Belts (Diesel E/G Only) - Check, Adjust



Typical Example

Diesel (G2 D34)

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.



Typical Example

NOTICE

Failure to loosen the alternator mounting bolt (2) will cause excessive stress and break the alternator mounting ear.

2. To adjust the alternator drive belt, loosen adjusting bracket nut (1), mounting bolt and nut (2) and nut (3). Move the nut (1) in or out as required. Tighten the mounting bolt and nut (1, 2, 3).

Mast Hinge Pins - Lubricate

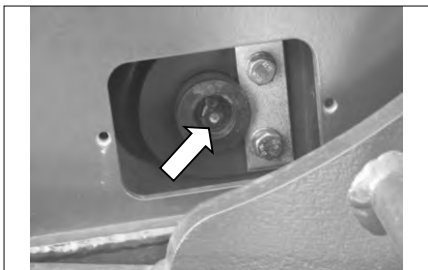


Typical Example

1. Lower the forks and tilt the mast forward.
2. Lubricate the two fittings for the mast hinge pins, one on each side of the mast.

Tilt Cylinders - Check, Adjust, Lubricate

Chassis Pivot Eyebolts



Typical Example

1. Lubricate two fittings for the pivot eyebolts, one on each tilt cylinder.
2. Check the pivot eye pins for loose retainer bolts and wear.

Mast Pivot Eyes

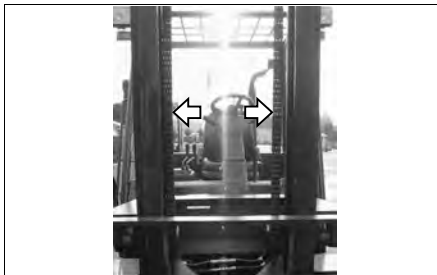


Typical Example

1. Lubricate two fittings for the mast pivot eyes, one on each side of the mast.
2. Check the pivot eye pins for loose retainer bolts and wear.

Crosshead Rollers - Inspect

1. 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

2. Check for damaged crosshead rollers, guards and retainer rings.

Parking Brake - Test, Adjust

See topic, "Parking Brake - Test, Adjust "in" First 50-100 Service Hours or a Week."

Drive Axle Oil (OCDB) - Change

See topic, "Drive Axle Oil - Change" in "First 50-100 Service Hours or a Week".

Horn and Lights(If Equipped) - Check



Typical Example

1. Press horn button, to determine if horn is operational.
2. Check and replace all defective gauges.
3. 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.

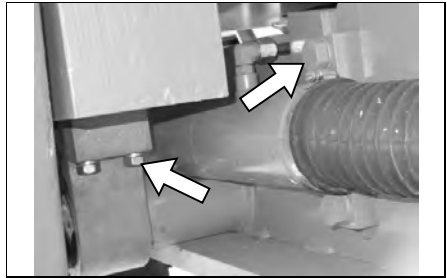
Overhead Guard (If Equipped) - Inspect



Typical Example

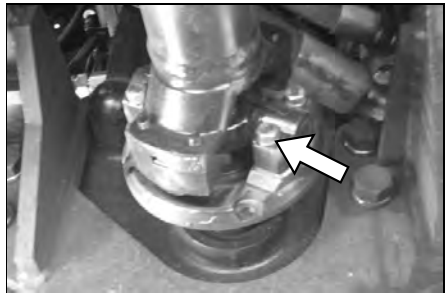
1. Check tightness of overhead guard mounting bolts at 240 N-m (175 lb-ft).
2. Check overhead guard for bent or cracked sections. Have repairs made if needed.

Steer Suspension - Inspect



1. Inspect the suspension mounting bolts. Tighten suspension each four mounting bolts (total eight bolts), if necessary, to 240 ± 40 N-m (177 ± 29 lb-ft).
2. Look for leaks at the power steering hose and tube connections.
3. Remove any trash buildup on the suspension or steer axle.

Universal Joint - Inspect, Lubricate



Typical Example

Check for worn or damaged bearings. Check for loose retaining bolts and nuts. Tighten the bolts and nuts, if necessary. (55N-m, 41 lb-ft) Lubricate one fitting on the universal joint.

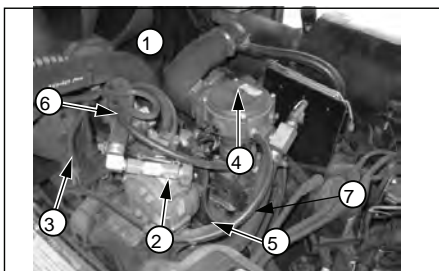
Engine Oil & Filter (Diesel Engine Only) - Change

Diesel Engine Crankcase

See topic, "Engine Oil & Filter (Diesel E/G Only) - Change" in "First 50-100 Service Hours or a Week".

Inspect Vacuum Lines and Fittings (LP Engine only)

- Visually inspect vacuum lines and fittings for physical damage such as brittleness, cracks and kinks. Repair/replace as required.
- Solvent or oil damage may cause vacuum lines to become soft resulting in a collapsed line while the engine is running.
- If abnormally soft lines are detected, replace as necessary.



- (1) LP fuel lock-off,
- (2) LP regulator/converter
- (3) Fuel Trim Valve(FTV) : LP only)
- (4) LP mixer
- (5) Vacuum lines,
- (6) Coolant lines,
- (7) LP fuel line

Fuel Trim Valve (FTV) Inspection (LP Engine only)

- Visually inspect the Fuel trim valve(3) for abrasions or cracking. Replace as necessary.
 - To ensure the valve is not leaking a blow-by test can be performed.
1. With the engine off, disconnect the electrical connector to the FTV.
 2. Disconnect the vacuum line from the FTV to the pressure regulator/converter, at the converter's tee connection.
 3. Lightly blow through the vacuum line connected to the FTV. Air should not pass through the FTV when de-energized. If air leaks past the FTV when de-energized replace the FTV.

Inspect Electrical System (LP Engine only)

- Check for loose, dirty or damaged connectors and wires on the harness including: Fuel lock-off, TMAP sensor, O2 sensor, Electronic throttle, Control Relays, Fuel Trim Valve, Foot Pedal, and Distributor sensor.
- Repair and/or replace as necessary

Fuel Filter - Check, Clean, Change Diesel Engine

Park lift truck with the forks lowered, parking brake applied, transmission in neutral, engine stopped and cool.

1. Open left door of hood.

WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. Turn the disconnect switch OFF or disconnect the battery when changing fuel filters.



Typical Example

Diesel Engine Truck

2. Remove fuel filter cartridge assembly.
3. Before installing a new cartridge assembly, apply a small amount of clean fuel to the filter cartridge gasket.

NOTICE

Do not fill fuel filters with fuel before installing them. Contaminated fuel will cause accelerated wear to fuel system parts.

4. Install the new fuel filter cartridge assembly.
5. Turn the new fuel filter cartridge assembly until the filter gasket is fitted against the sealing face.
6. Turn the fuel filter cartridge assembly an additional 2/3 of turn.

Wheel Bolts & Nuts - Inspect Inspect Tightness

Steer Wheels



Typical Example

1. Install steer wheel. Put two nuts opposite each other (180°). Tighten bolt.
2. Inspect tightness of wheel nuts in a sequence opposite each other 620 ~ 680 N·m.

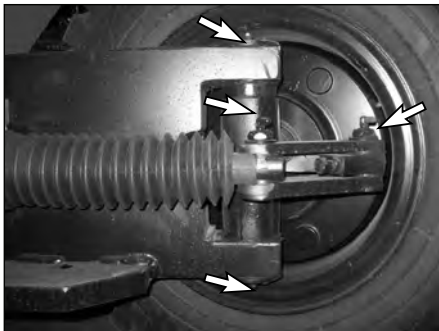
Drive Wheels



Typical Example

1. Install drive wheel. Put two nuts opposite each other (180°).
2. Inspect tightness of wheel nuts in a sequence opposite each other to 620 ~ 680 N·m

Steering Mechanism - Check, Lubricate



Typical Example

1. Lubricate the steer axle kingpins, total of four fittings. Two on the right side and two on the left side.
2. Lubricate the steering link bearings, total of four fittings. Two on the right side and two on the left side
3. Check for any worn or loose components of the steering mechanism. Remove any debris or trash as required.

Steering Axle Support - Check, Oiling



1. Apply lubricant to the fitting at the end of the tube connected to the steering axle support. Lubricate the point in the event of abnormal noise.

Air Intake System - Check, Clean Precleaner or rain cap (when Equipped)

NOTICE

Never service pre-cleaner with the engine running.



Typical Example

1. Check the pre-cleaner bowl for dirt build-up. If the dirt is up to the line, remove the pre-cleaner bowl and empty it. Periodically wash the cover and bowl in water.

Servicing Filter Element

NOTICE

Never service filter with the engine running.



Typical Example

Diesel Engine Truck

Service the air cleaner when the red target in the service indicator stays locked in the visible position with the engine stopped.

1. To service the air cleaner, raise the side cover. Loosen the cover latches and remove the cover.

Diesel Engine Truck (Dual Element)



Typical Example

2. Replace the nut and clamp.
3. Remove the element to separate it from its base and remove it from the air cleaner housing.
4. Clean and inspect the 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 and loose clamps. Tighten or replace parts as necessary to prevent leakage.

NOTICE

Do not allow dirty air to enter the intake hose when cleaning the inside of the 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 1000 Service Hours or 6 months section.
11. Stop the engine and close the right side cover.

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.

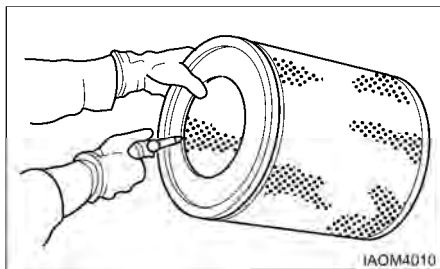
When cleaning with pressure air, use 205 kPa (30 psi) maximum pressure to prevent filter element damage.

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.

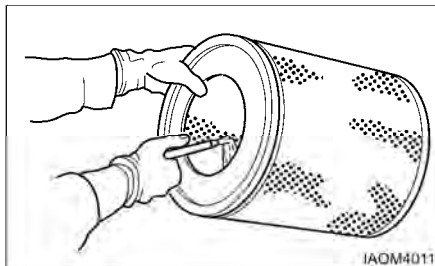
The primary element should be replaced after a year's service or after cleaning no more than 6 times.

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-280 kPa (40 psi) Maximum Pressure

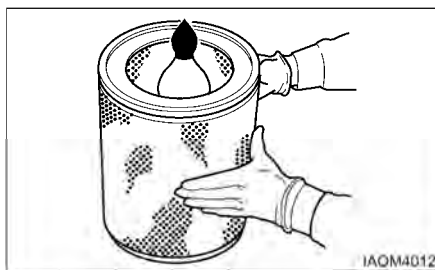


Direct water on the inside and outside of the element along the length of the pleats. Air-dry it thoroughly and then examine it.

Detergent

1. Wash the element in warm water and mild household detergent.
2. Rinse the element with clean water. See instructions in preceding topic for cleaning with water.
3. Air dry it thoroughly, and then examine it.

Checking Element



1. Insert a light inside the clean dry element and examine it. Discard the element if tears, rips or damage are found.
2. Wrap and store good elements in a clean, dry place.

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.

Air Intake System - Change

Changing Primary Element

See topic, "Air Intake System - Check, Clean" in "Every 500 Service Hours or 3 Months".

Changing Secondary Element

Replace the secondary element after the primary element has been cleaned three times or yearly.

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. Tighten the latches.
4. 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.
5. Stop the engine. Close the hood and seat assembly.

Carburetor (LP - Gas Engine Only) - Adjust, Clean

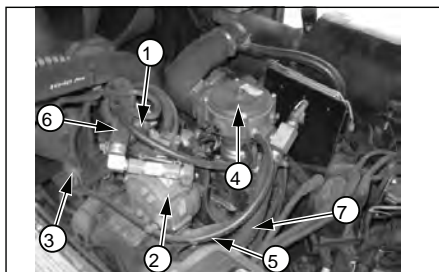
If the engine is hard to start or the exhaust is smoking, the carburetor may need cleaning and adjusting.

Before adjusting the carburetor make sure the engine is at normal operating temperature. Park the lift truck with the forks lowered, parking brake applied, transmission in neutral and the engine stopped.

For the complete procedure and specifications for your specific engine, see the "Service Manual".

Inspect Coolant Hoses (LP Engines Only)

- Visually inspect coolant hoses and clamps. Remember to check the two coolant lines that connect to the pressure regulator/converter.
- Replace any hose that shows signs of swelling, cracking, abrasion or deterioration.



- (1) LP fuel lock-off,
- (2) LP regulator/converter
- (3) Fuel Trim Valve(FTV),
- (4) LP mixer
- (5) Vacuum lines,
- (6) Coolant lines,
- (7) LP fuel line

LP Regulator/Converter Inspection (LP Engine Only)

- Visually inspect the pressure regulator/converter housing(2) for coolant leaks and detect the fuel pipe joints, LP mixer and regulator/converter for LP fuel leaks.

To detect the LP fuel leaks, smear detected parts with suds, visually inspect whether there are bubbles after the engine start.

NOTE: For pressure testing and internal inspection of the pressure regulator/converter, contact to the Doosan service.

Fuel Lines & Fittings – Check

Visually inspect fuel lines and fittings for physical damage. Replace as required.

Inspect Mixer Assembly (LP Engine Only)

Refer to the LP mixer section of the engine service manual for procedures.

Inspect Throttle Assembly (LP Engine Only)

- Visually inspect the throttle assembly motor housing for coking, cracks and missing cover-retaining clips. Repair and/or replace as necessary.

NOTE: Refer to the LP mixer and throttle section of the service manual for procedures on removing the mixer and inspecting the throttle plate.

Hydraulic Oil, Return Filter, Strainer & Breather - 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.



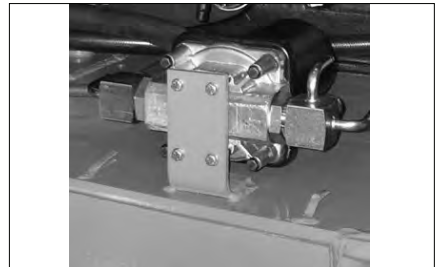
1. Remove the hydraulic tank drain plug located on the bottom of the frame. Allow the oil to drain in a suitable container. Clean and install the plug.



2. Loosen the bolts of the hydraulic tank cover.
3. Remove the strainer from the tank.
4. Install the new strainer by hand.
5. Install the hydraulic tank cover and fasten the bolts.



6. Remove the breather.
7. Wash the breather in clean, nonflammable solvent and dry it.
8. Fill the hydraulic tank. See topic, "Refill Capacities."
9. Install the breather.



10. Remove the floor plate.
11. Remove bolts and filter housing.
12. Remove and discard filter element from filter housing.
13. Clean the filter housing with a clean, nonflammable solvent.
14. Clean the housing base.
15. Insert a new filter element into the filter housing.
16. Inspect the filter housing seal. Replace if necessary.
17. Apply a small amount of clean oil to the filter element seal and housing seal.

18. Install the filter housing with filter to the housing base. Install bolts and tighten 20 to 30 N·m (15 to 20 lb·ft).
19. Start the engine and operate the hydraulic controls, and the steering system, through a few cycles to fill the lines. Look for oil leaks.
20. Stop the engine and check the oil level. With all cylinders retracted, maintain the oil level to the FULL mark on the dip stick/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 wear.

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 wear rate is 2% or more, replace the lift 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

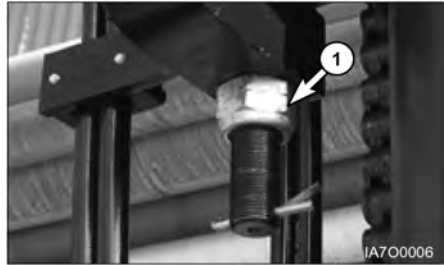


Typical example for carriage equal tension

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 - STD Mast



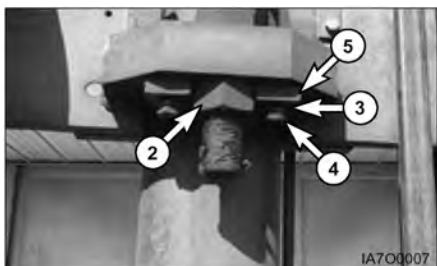
Typical example for carriage chain of STD mast

Make sure that carriage height is correct. If correct, adjust chain for equal tension. If not, adjust chain for correct carriage height by adjusting anchor nuts (1).

NOTE: See the previous section, "Carriage Roller Extrusion" in "When Required" for proper carriage height.

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. Adjust nut (1) to get proper distance from the bottom of inner upright to the bottom of carriage bearing.
3. Make adjustment anchor nut (1) 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) after the adjustment is completed.

Carriage Chain Adjustment - FFT



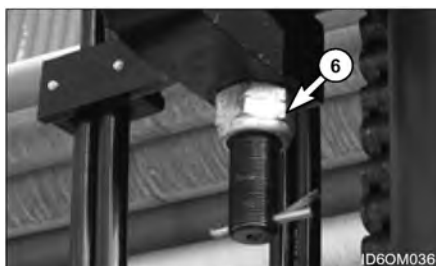
Typical example for carriage chain of FFT mast

Make sure that carriage height is correct. If correct, adjust chain for equal tension. If not, adjust chain for correct carriage height by adjusting anchor nuts (2).

NOTE: See the previous section, "Carriage Roller Extrusion" in "When Required" for proper carriage height.

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. Remove bolt (3), washer (4) and stopper (5) and adjust nut (2) to get proper distance from bottom of inner upright to the bottom of carriage bearing.
3. Make adjustment anchor nut (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 (2) after the adjustment is completed.

Mast Chain Adjustment - FFT



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 (6).

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. Adjust nut (6) to make inner mast bottom flush with outer mast bottom.
3. Make adjustment anchor nut (6) for equal chain tension.
4. Raise the inner mast and check equal chain tension. If not equal, repeat the same procedure above step 1 through step 3.
5. Put LOCTITE No. 242 tread lock on the threads of the anchor nuts (6) after the adjustment is completed.

Transmission Oil (2 Speed Only) – Change

Only for D(G)50/60/70S-7 (2 Speed),

See topic, "Transmission Oil & Oil Filter - Change" in "First 50-100 Service Hours or a Week".

Every 1500 Service Hours or 9 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.

Transmission Oil & Oil Filter – Change (3 Speed, ZF 3WG94)

See topic, "Transmission Oil & Oil Filter – Change" in "First 50-100 Service Hours or a Week".

Inspect Ignition System (LP Engine Only)

1. Disconnect Battery Cables.
2. Remove and inspect the spark plugs. Replace as required.
3. Test secondary cables with an Ohmmeter. If maximum resistance is higher than 25 kOhms, repair and/or replace.
4. Remove distributor cap and perform visual inspection. Replace cap and rotor if corrosion is found on the contacts.
5. Inspect the ignition coil for cracks and heat deterioration. Visually inspect the coil heat sink fins. If any fins are broken replace as required.



Replace Spark Plugs (LP Engine Only)

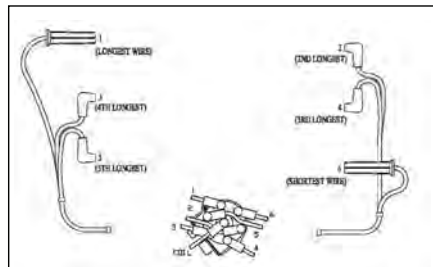
1. Disconnect Battery Cables.
2. Using a gentle twisting motion remove the high voltage cables from the spark plugs. Replace any damaged cables.
3. Remove the spark plugs.
4. Gap the new spark plugs to the proper specifications.
LP Engine: 0.9mm (0.035 inch)
5. Apply anti-seize compound to the spark plug threads and install.
LP Engine: 30 N·m (22 lb·ft)



WARNING

DO NOT OVERTIGHTEN THE SPARK PLUGS.

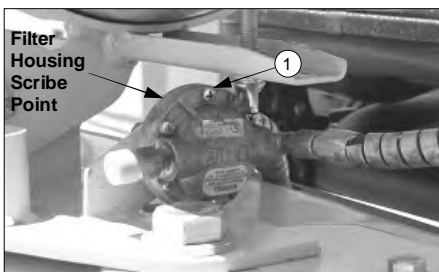
6. Re-install the high voltage cables.



Replace LP Fuel Filter Element (LP Engine Only)

Park the lift truck in an authorized refueling area with the forks lowered, parking brake applied and the transmission in Neutral.

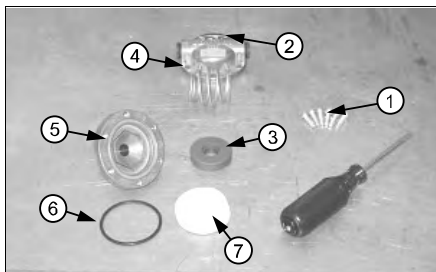
1. Close the fuel shutoff valve on the LP-Fuel tank. Run the engine until the fuel in the system runs out and the engine stops.
2. Turn off the ignition switch.
3. Scribe a line across the filter housing covers, which will be used for alignment purposes when re-installing the filter cover.



(1) SCREW

4. Remove the cover retaining screws (1)

Fuel Filter - Disassembly

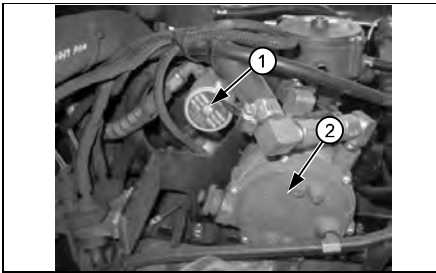


5. Remove top cover (2), magnet (3), spring (4), and filter element (7) from bottom cover (5).
6. Replace the filter element (7).
7. Check bottom cover O-ring seal (6) for damage. Replace if necessary.
8. Re-assemble the filter assembly aligning the scribe lines on the top and bottom covers.
9. Install the cover retaining screws, tightening the screws in an opposite sequence across the cover.
10. Open the fuel valve by slowly turning the valve counterclockwise.
11. Crank the engine several revolutions to open the fuel lock-off. **DO NOT START THE ENGINE.** Turn the ignition key switch to the off position.
12. Check the filter housing, fuel lines and fittings for leaks. Repair as necessary.

Testing Fuel Lock-off Operation (LP Engine Only)

- Start engine.
- Locate the electrical connector for the fuel lock
- Disconnect the electrical connector.
- The engine should run out of fuel and stop within a short period of time.
- Turn the ignition key switch off and re-connect the fuel lock-off connector.

NOTE: The length of time the engine runs on trapped fuel vapor increases with any increase in distance between the fuel lock-off and the pressure regulator/converter.



- (1) LP fuel lock-off,
(2) LP regulator/converter

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 procedures.

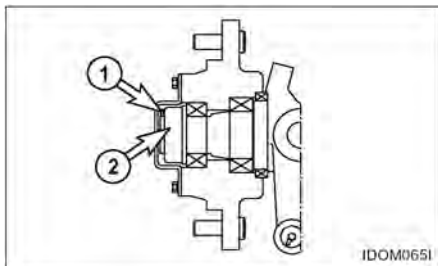
Steer Wheel Bearings - Reassemble

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 and gasket.



Typical Example

3. Remove the pin (1) and nut (2). Remove the outer wheel bearing.



Typical Example

4. Remove the wheel assembly. Examine the wheel for damage and wear. Replace the wheel if necessary.
5. Remove the inner bearing. Clean and lubricate the steering knuckle. Reassemble both the inner and outer bearing cones.
6. Install the inner bearing. Lubricate the seal and install the wheel assembly on the knuckle.
7. Install the outer wheel bearing and the outer nut.
8. Tighten the nut to 200 N·m (148 lb-ft), while turning wheel hub to seat the bearing.
9. Install the pin.
10. Install the hub cap.
11. Raise the lift truck and remove the blocking. 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 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 injury.

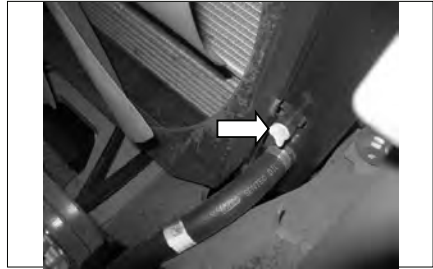
Use all cleaning solutions with care.

The lift truck must be level, the forks lowered, the parking brake engaged, the transmission in NEUTRAL and the engine stopped and cool.



Typical Example

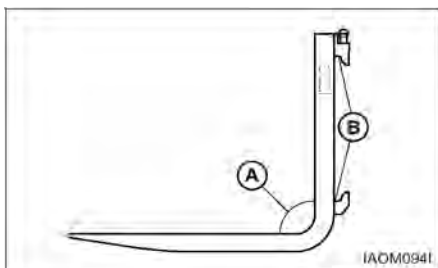
1. Turn the radiator cap slowly to relieve the pressure, then remove the cap.
2. Remove the block drain plug.



Typical Example

3. Open radiator drain valve. Allow the coolant to drain. Drain the recovery bottle.
4. Close radiator drain valve and install block drain plug. Fill the cooling system with 1 kg (2 lb) sodium bisulphate per 40 liters (10 gallons) of water. Most commercial cooling system cleaners can be used.
5. Start and run the engine for 30 minutes.
6. Stop the engine and drain the cleaning solution.
7. Flush the system with clean water, until draining water is clear.
8. Close the drain valve and install the block drain plug. Fill the system with neutralizing solution, 250 g (1/2 lb) sodium carbonate per 40 liters (10 gallons) of water.
9. Start and run the engine for 10 minutes.
10. Stop the engine and drain the neutralizing solution.
11. Flush the system with clean water until draining water is clear.
12. Close the drain valve and install the block drain plug. Add coolant to the top of the filter neck.
13. Start and run the engine to stabilize the coolant level. See topic, "Coolant level - Check" in "Every 10 Service Hours or Daily".

Fork - Inspect



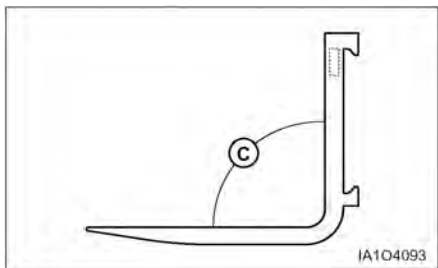
Forks should be inspected, at a minimum, every 12 months. If the truck is being used in a multi-shift or heavy duty operation, they should be checked every six months.

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.

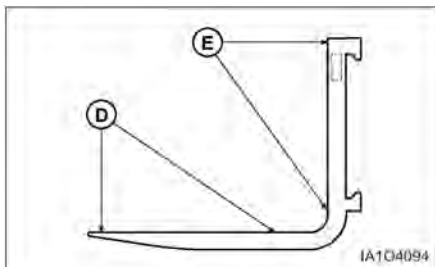
Forks with cracks should be removed from service.

"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.

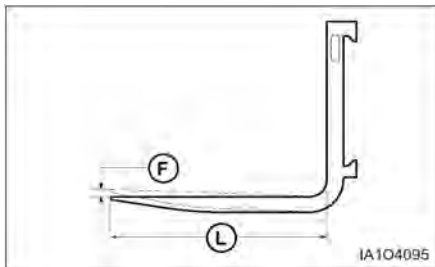


2. Check the angle between the upper face of the blade and the front face of the shank. The fork should be withdrawn from service if angle (C) exceeds 93 degrees or deviates by more than 3 degrees from an original angle other than 90 degrees, as may be found in some special application forks.



3. Check the straightness of the upper face of blade (D) and the front face of shank (E) with a straight edge.

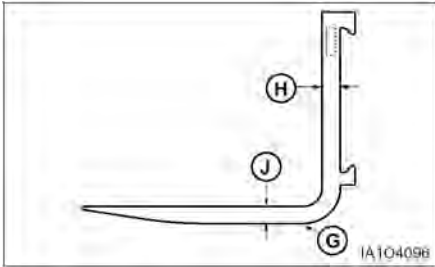
The fork should be withdrawn from service if the deviation from straightness exceeds 0.5 percent of the length of the blade and/or the height of the shank respectively 5 mm/1000 mm (0.18"/36").



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.

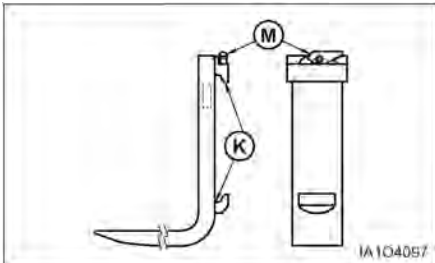
The maximum recommended difference in fork tip elevation (F) is 6.5 mm (0.25") for pallet forks and 3 mm (0.125") for fully tapered forks. The maximum allowable difference in fork tip elevation between the two or more forks is 3 percent of blade length (L).

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.



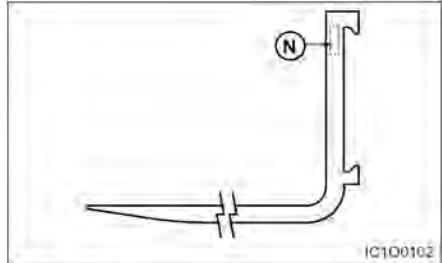
6. Check the fork mountings (K) for wear, crushing and other local deformation, which can cause excessive side to side wobble of the forks. Excessive clearance on hook type forks may allow them to fall from the carrier. Forks which show visible signs of such damage should be removed from service.

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.

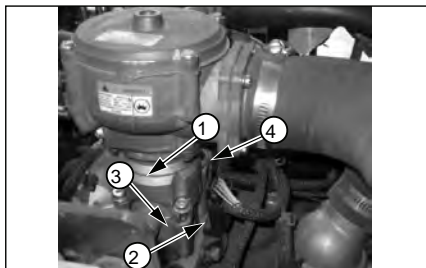
Inspect Battery System

- Clean battery outer surfaces with a mixture of baking soda and water.
- Inspect battery outer surfaces for damage and replace as necessary.
- Remove battery cable and clean, repair and/or replace as necessary.



Checking the TMAP Sensor (LP Engine Only)

1. Verify that the TMAP sensor (2) is mounted tightly into the manifold adapter (3), with no leakage.
2. If the TMAP is found to be loose, remove the TMAP retaining screw and the TMAP sensor from the manifold adapter.
3. Visually inspect the TMAP O-ring seal for damage. Replace as necessary.
4. Apply a thin coat of an approved silicon lubricant to the TMAP o-ring seal.
5. Re-install the TMAP sensor into the manifold adapter and securely tighten the retaining screw.



- (1) Adapter-Throttle body
(2) TMAP sensor,
(3) Adapter-Manifold,
(4) Throttle body

Inspect for Intake Leaks (LP Engine Only)

1. Visually inspect the intake manifold, throttle assembly (4), and manifold adapters (3), for looseness and leaks. Repair as necessary.

Replace PCV Valve and breather element - Change (LP Engine Only)

1. Loosen the hose clamps and remove the PCV valve.
2. Assemble new PCV valve and hose.
3. Tighten the hose clamps



Replace Oxygen Sensor (LP Engine Only)



Exhaust Tube



Muffler Ass'y

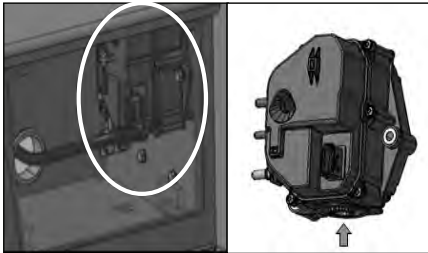
When indicated by MIL, replace oxygen sensors on the exhaust tube and muffler assembly.

1. Stop engine and wait until the exhaust pipe and exhaust pipe is cooled.
2. Disconnect the electrical connector of oxygen sensor.
3. Remove oxygen sensor.
4. Assemble new oxygen sensor Tightening torque: 45 N·m (32.5 lb·ft)
5. Connect the electrical connector of oxygen sensor.

Every 3000 Service Hours or 36 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.

DEF/Ad-Blue Supply module filter replacement (D34P Engine Only)



1. Loosen the supply module plug located on the inside of frame step (LH).
2. Remove the filter element from the supply module.
3. Insert a new filter element.
4. Fasten with the supply module plug.

For more details, refer to the “engine service manual”

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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