150 X 210 X 9.5 (H) mm

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CD(CG)15/18S-5, CD(CG)20SC-5

Operation & Maintenance Manual

XSB2353E10NA

XSB2353E10NA
11. 2022

Operation & Maintenance Manual

CD15S-5, CD18S-5, CD20SC-5

FDA01, FDA02, FDA03

V2403 Tier-3

CG15S-5, CG18S-5, CG20SC-5

FGA01, FGA02, FGA03

HMC2.4L NC

FGA1R, FGA1S, FGA1T

HMC2.4L Tier 3/Stage 5

Forklifts

CROWN

Operation & Maintenance Manual

Forklifts

CD15S-5, CD18S-5, CD20SC-5

FDA01, FDA02, FDA03

V2403 Tier-3

CG15S-5, CG18S-5, CG20SC-5

FGA01, FGA02, FGA03

HMC2.4L NC

FGA1R, FGA1S, FGA1T

HMC2.4L Tier 3/Stage 5

2211

⚠ WARNING

A MOVING VEHICLE CAN BE DANGEROUS

You or others around you can be seriously injured or even killed if you are not careful or don't know how to use this truck correctly.

Do not operate this truck unless you are trained and authorised.

Read and obey all warnings and instructions in this Manual* and on the truck.

Make sure the truck is in good working order.

Head, arms, hands or legs outside the operator area can be pinned or crushed when ever the truck is moving. Stay within the operator area and stop completely before getting off.

A dockboard can move or drop while you are on it. Or you could drive off a dock. Falls from docks or dockboards can cause serious injury or even death. Make sure you are safe.

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Information Section

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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 trucks 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 CROWN branch 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 CROWN operator restraint system. Read, study and keep it handy.

⚠ WARNING

Your CROWN 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 CROWN operator restraint system.

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

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

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

Operator training and safety awareness is an effective way to prevent accidents, but accidents can still happen. The CROWN operator restraint system can minimise injuries. The CROWN 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 the Crown internal combustion engine lift trucks are manufactured under ISO 14001 system which is harmonized with ISO 9001.Periodic ENVIRONMENTAL AUDITS & ENVIRONMENTAL PERFORMANCE EVALUATIONS have been made by internal and external inspection entities. LIFE-CYCLE ANALYSIS has also been made through out the total product life. ENVIRONMENT MANAGEMENT SYSTEM includes DESIGN FOR ENVIRONMENT from the initial stage of the design. ENVIRONMENT MANAGEMENT SYSTEM considers environmental laws & regulations, reduction or elimination of resource consumption as well as environmental emission or pollution from industrial activities, energy saving, environment-friendly product design (lower noise, vibration, emission, smoke, heavy metal free, ozone depleting substance free, etc.), recycling, material cost reduction, and even environmentally oriented education for the employee.

Important Safety Information

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

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

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

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

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

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is involved.

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

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

CROWN 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 CROWN 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. CROWN branchs 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.

CROWN 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 authorised lift truck branch. Do not attempt any adjustments or repairs unless trained and authorised to do so.

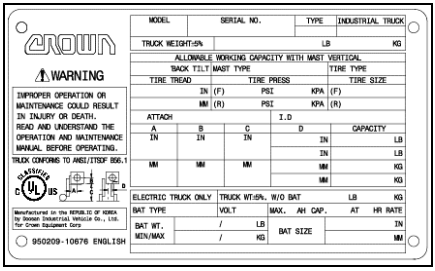
Warning Signs and Labels

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 familiarise yourself with these safety signs.

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 your branch for new labels.

Training Required to Operate or Service Warning



Located on the right of the steering wheel.

⚠ WARNING

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

This also provides allowable lift truck capacity information.

General Warnings to Operator

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

⚠ WARNING

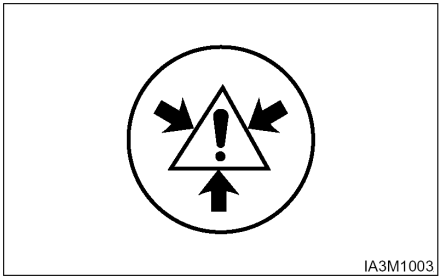
Only trained and authorised personnel may operate this machine. For safe operation, read and follow the operation and maintenance Manual furnished with this lift truck and observe the following warnings:

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.

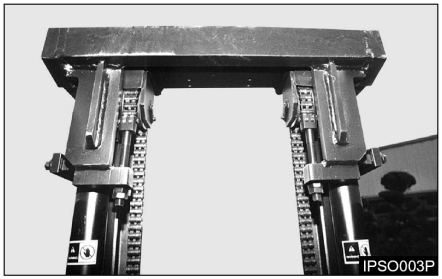


Located on the radiator top tank by the radiator cap.

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.

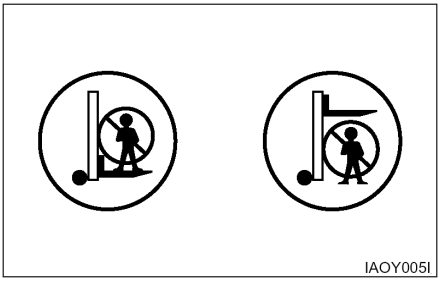


Located on the mast.

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.

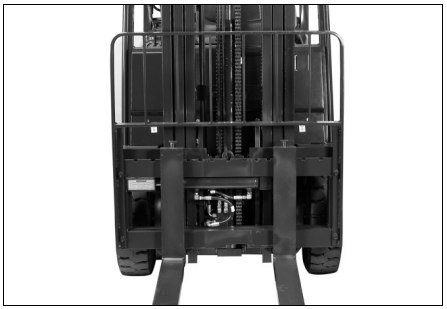


Located on the lift cylinder.

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 4.

This design has been tested with an impact of appropriate value.

Located on the Overhead Guard.

No Riders Warning

⚠ WARNING

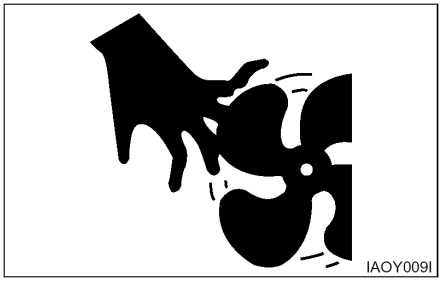
To avoid personal injury, allow no riders. A lift truck is designed for only one operator and no riders.

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

Moving Fan Warning

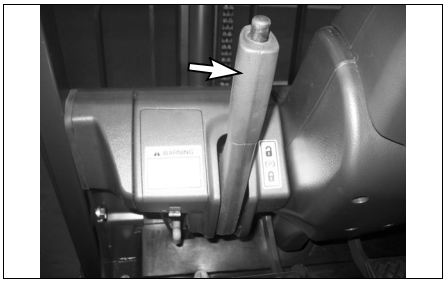
⚠ WARNING

To avoid personal injury, stay clear of moving fan.



Located inside the engine compartment cover.

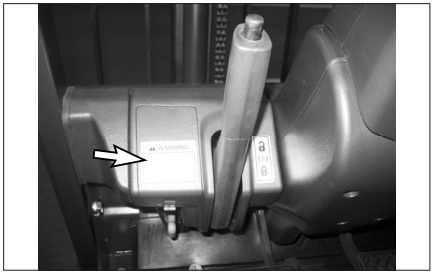
Parking Brake



Pull the lever BACK to engage the parking brake.

Push the lever FORWARD to release the parking brake.

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



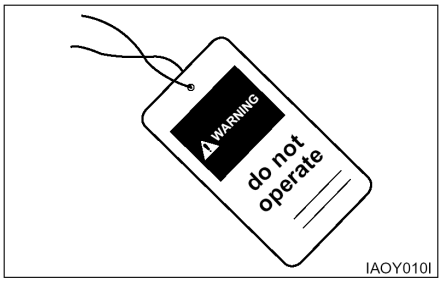
⚠ WARNING

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

⚠ WARNING

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

General Hazard Information



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Obey all traffic rules and warning signs.

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

Do not allow unauthorised 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.

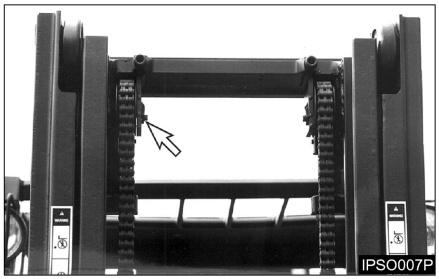
Inhaling Freon gas through a lit cigarette or other smoking method or inhaling fumes released from a flame contacting Freon can cause bodily harm or death. Do not smoke when servicing air conditioners or wherever Freon gas may be present.

Never put maintenance fluids into glass containers.

Use all cleaning solutions with care.

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

Report all needed repairs.



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

For any checkup, repair, adjustments, maintenance and all other work concerning your forklift truck, please contact your CROWN branch. 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 CROWN spare parts waive any liability by CROWN.

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.

Never get on or off a moving lift truck.

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

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

Keep hands and steering wheel free of slippery material.

Before Starting the Lift Truck

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

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

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

Make sure all hydraulic controls are in the HOLD position.

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

Make sure the parking brake is engaged.

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

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

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

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

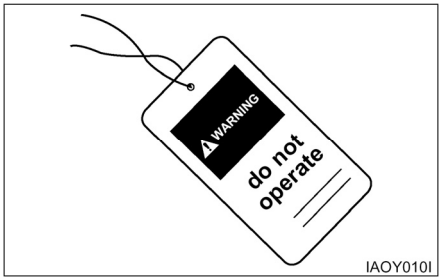
Make sure service and parking brakes, steering, and directional controls are operational.

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

Refer to the topic “Lift Truck Operation” in the

“Operation Section” of this manual for specific starting instructions.

Starting the Lift truck



Do not start the engine or move any of the controls if there is a “DO NOTOPERATE” 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 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.

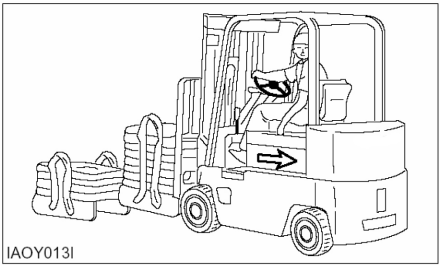
Never leave the lift truck with the engine operating, or with the parking brake disengaged.

Operate the engine only in a well ventilated area.

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

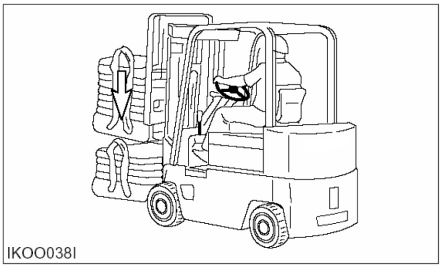
Always observe floor load limits and overhead clearance.

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



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

Do not overload, or handle offset, unstable, or loosely stacked loads. Refer to load capacity plate on the lift truck. Use extreme caution when handing suspended, long, high or wide load.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Tilt elevated load forward only when directly over unloading area and with load as low as possible.

Do not stunt ride or indulge in horseplay.

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

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

Stay in designated travel path, clear of dock edges, ditches, other dropoffs 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 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 authorised 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 and remove the key (if equipped).

Block the drive wheels when parking on an incline.

Maintenance Information

Perform all maintenance unless otherwise specified as follows:

Park the lift truck in authorised 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 pin-hole 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 CROWN branch 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 plexiglass cover.

Any altering done that is not specifically authorised by CROWN invalidates CROWN'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 CROWN branch 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 fill cap is cool enough to remove with your bare hand.

Remove the cooling system fill 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 fill cap only after the engine has been stopped and the fill cap is cool enough to remove with your bare hand.

Remove the hydraulic tank fill 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 operation the lift truck.

Keep all fuels and lubricants stored in properly marked containers and away from all unauthorised 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 unauthorised 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 CROWN branch 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.

Armouring embedded in the outer cover.

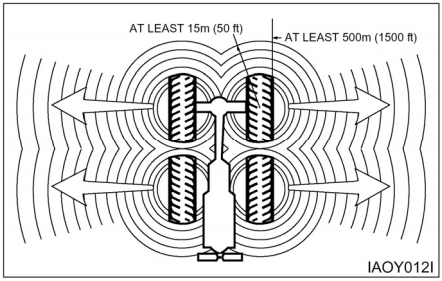
End fittings displaced.

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

Tyre Information

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

A tyre explosion is much more violent than a blowout. The explosion can propel the tyre, 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 tyre 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 tyres. If the tyres were originally inflated with air, nitrogen is still preferred for adjusting the pressure. Nitrogen mixes properly with air.

Nitrogen inflated tyres reduce the potential of a tyre 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 overinflation. A tyre blowout or rim failure can result from improper or misused equipment.

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

Servicing, changing tyres 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 tyres and rims, the assemblies could burst with explosive force and cause serious personal injury or death. Follow carefully the specific information provided by your tyre or rim servicing personnel or branch.

CROWN 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 CROWN lift truck has the following tipover warning decals.

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

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

⚠ WARNING

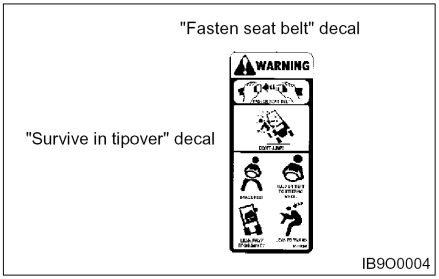
Tipover can occur if the truck is improperly operated. In the event of tipover, injury or death could result.

"Survive in tipover" decal

IB9O0002

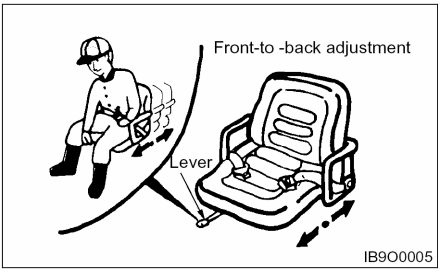
"Survive in tipover" decal

IB9O0003



The “Survive in tipover” 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.

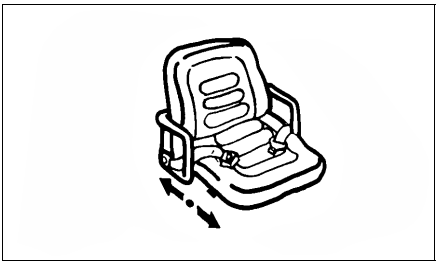
⚠ WARNING

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

If Optional Suspension Seat (Weight Adjusting Type) Equipped

Forward and Backward Adjustment

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



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

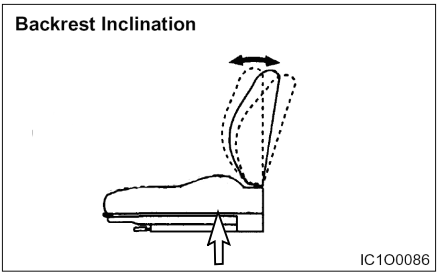
Weight adjustment

Pull the weight adjustment lever upwards and downwards.
Adjust to driver's weight in 7 steps (50 ~ 150 kg)

NOTICE

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

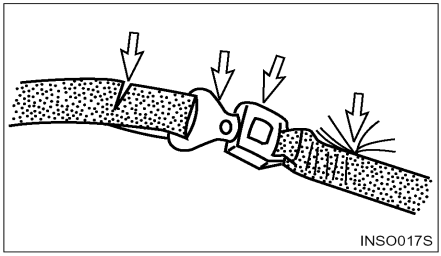
Backrest Inclination
The backrest angle can be adjusted by using the lever on the left side of seat.



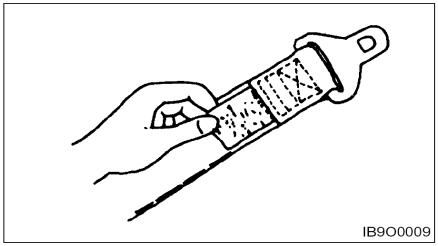
Seat Belt

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

Inspection



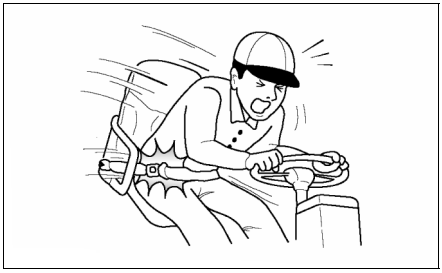
1. If the seat belt is torn, if pulling motion is interrupted during extension of the belt, or if the belt cannot be inserted into the buckle properly, replace the seat belt assembly.



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

⚠ WARNING

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



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

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

Cut or frayed strap

Worn or damaged hardware including anchor points

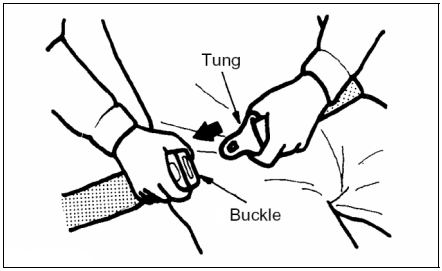
Buckle or retractor malfunction

Loose stitching

⚠ WARNING

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

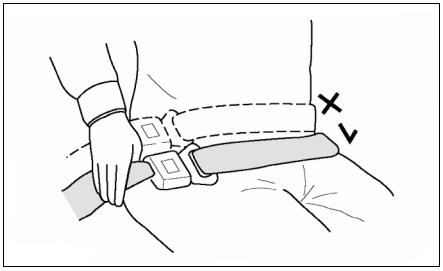
Fasten the Seat Belt



1. Grip the plate (connector) of the belt and pull the belt from the retractor. Then insert the plate into the slot of the buckle until a snap is heard. Pull on the belt to confirm it is latched.
2. Make sure the belt is not twisted.

⚠ WARNING

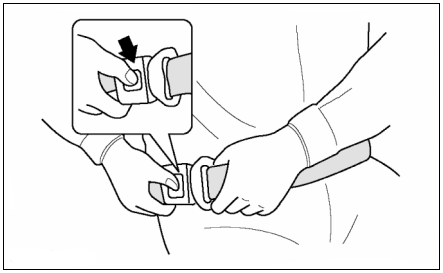
If you fasten the belt across your abdomen, the belt may injure your abdomen in an accident.



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

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

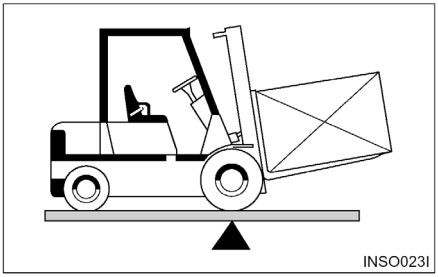
Release the Seat Belt



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

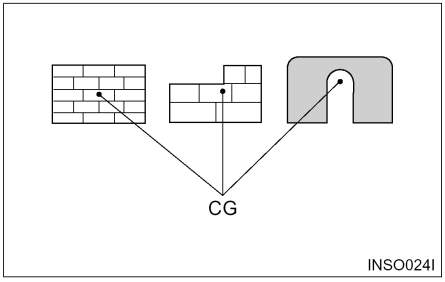
Avoiding Lift Truck Tipover

Lift Truck Stability



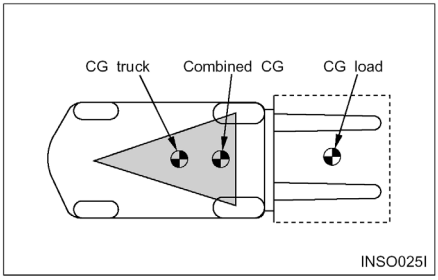
Counterbalanced lift truck design is based on the balance of two weights on opposite sides of a fulcrum (the front axle). The load on the forks must be balanced by the weight of the lift truck. The location of the centre of gravity of both the truck and the load is also a factor. This basic principle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

Centre of Gravity (CG)



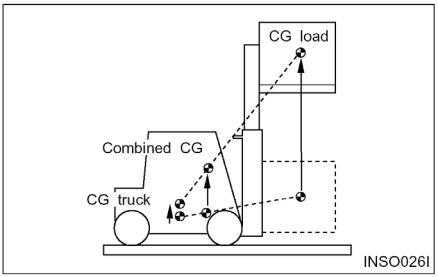
The point within an object, at which the whole weight of the object may be regarded as being concentrated, is called the centre of gravity or CG. If the object is uniform, its geometric centre will coincide with its CG. If it is not uniform, the CG could be at a point outside of the object. When the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

Stability and Centre of Gravity



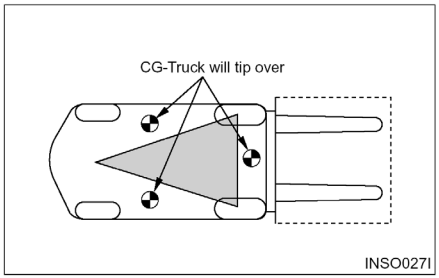
The stability of the lift truck is determined by the location of its CG; or, if the truck is loaded, the combined CG of the truck and load. The lift truck has moving parts and, therefore, has a CG that moves. The CG moves forward or backward as the mast is tilted forward or backward. The CG moves up 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 tyre pressure dynamic forces created when the lift truck is accelerated, braked or turned condition and grade of surfaces on which the lift truck is operated



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

Lift Truck Stability Base

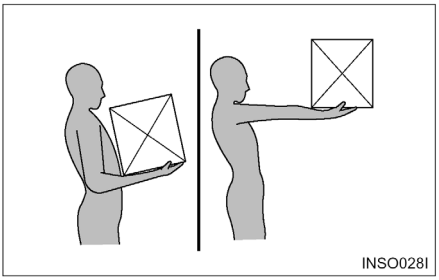


For the lift truck to be stable (not tip over forward or to the side), the CG must stay within the area of the lift truck stability base – a triangular area between the front wheels and the pivot of the steer wheels. If the CG moves forward of the front axle, the lift truck will tip forward. If the CG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

⚠ WARNING

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

Capacity Load (Weight and Load Centre)



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 centre. The load centre is determined by the location of the CG of the load.

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

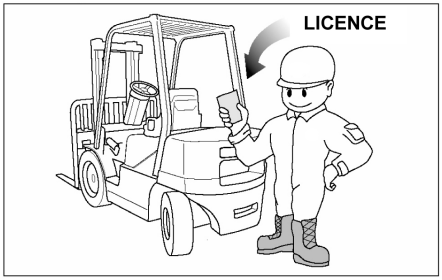
Remember that, unless otherwise indicated, the capacity load shown on the nameplate is for a standard lift truck with standard backrest, forks and mast, and having no special-purpose attachment. In addition, the capacity load assumes that the load centre is no further from the top of the forks than it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

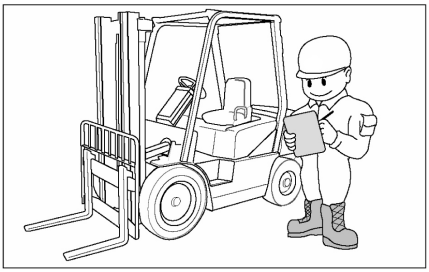
NOTICE

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

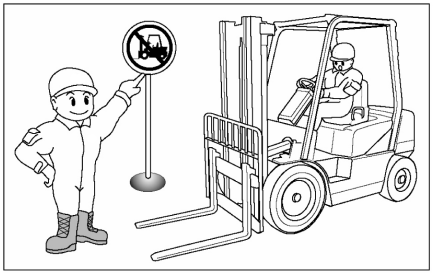
Safety Rules



Only properly trained and authorised 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.

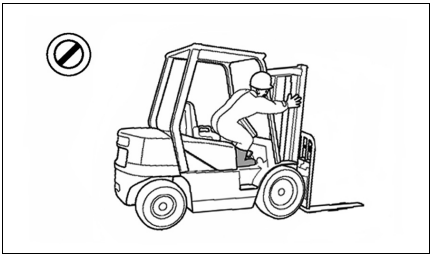


Do not operate your truck in unauthorised areas.

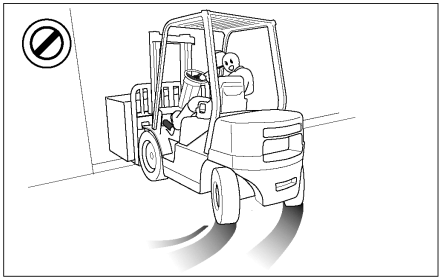
Know your forklift truck and think safety.

Do not compromise safety.

Follow all safety rules and read all warning signs.

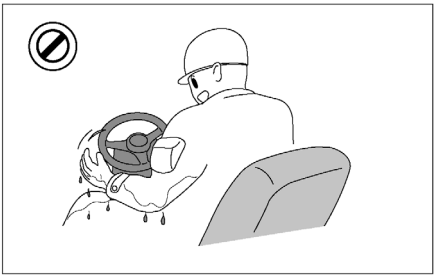


Do not operate a lift truck unless you are in the operator's seat. Keep hands and feet inside the operator's compartment. Do not put any part of the body outside of the operator's compartment. Never put any part of body into the mast structure or between the mast and the truck



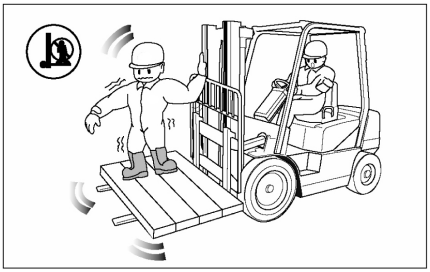
Do not start, stop, turn or change direction suddenly or at high speed. Sudden movement can cause the lift truck to tip over. Slow the speed of your truck and use the horn near corners, exits, entrances, and near people.

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



Never operate a lift truck with wet hands or shoes.

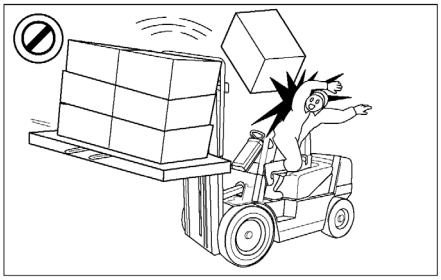
Never hold any controls with grease on your hands. Your hands or feet will slide off of the controls and cause an accident.



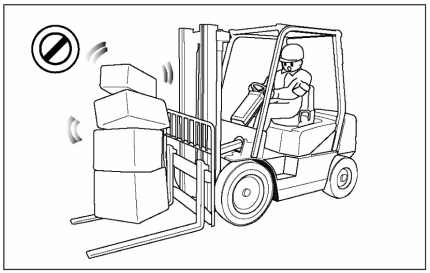
Do not raise anyone on the forks of your lift truck.

Do not let other people ride on the truck.

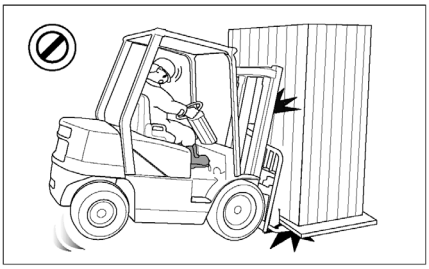
Lift trucks are designed to carry loads, not people.



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

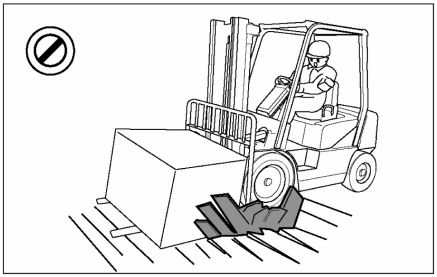


Do not lift or move loads that are not safe. Do not pick up an off centre load. Such a load increases the possibility of a tipover to the side. Make sure loads are correctly stacked and positioned across both forks. Always use the proper size pallet. Position the forks as wide as possible under the load.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



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

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



Do not drive on soft ground.

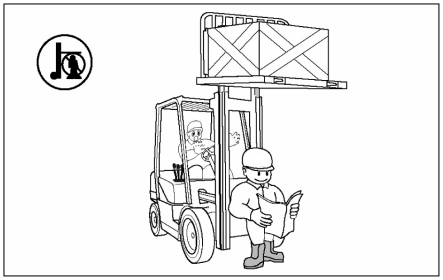
Observe all signs, especially those on maximum permitted floor loadings, elevator capacities and clearance heights.

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

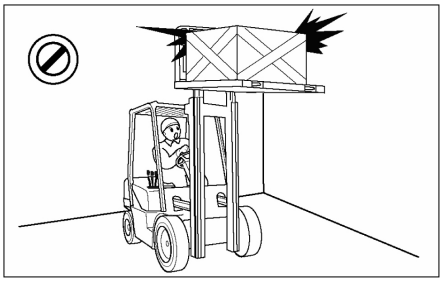
Do not drive on slippery surfaces.

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

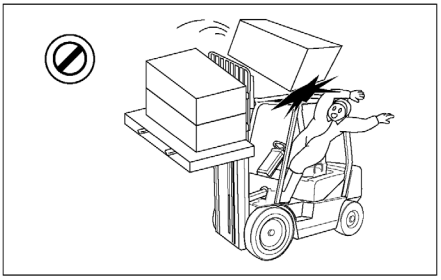
If unavoidable, slow down.



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



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

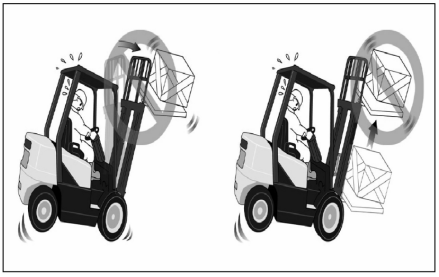


Do not move loose loads that are higher than the load backrest.

Be alert for falling loads when stacking.

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

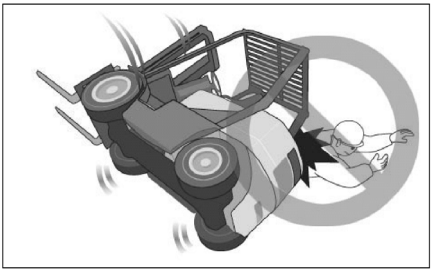
This will increase stability to the truck and load and permit better visibility for you.



Do not elevate the load with the mast tilted forward.

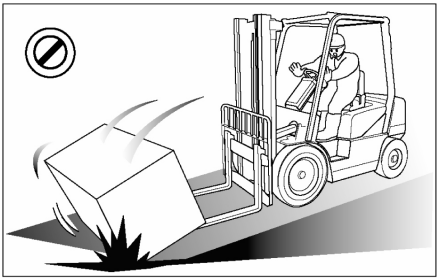
Do not tilt the elevated loads forwards.

This will cause the lift truck to tip over forward.



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

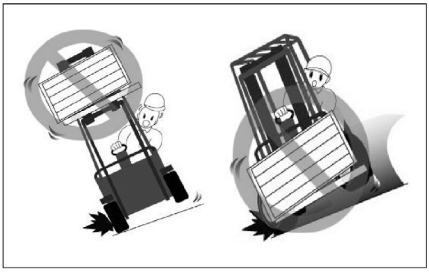
Stay in your seat to survive.



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

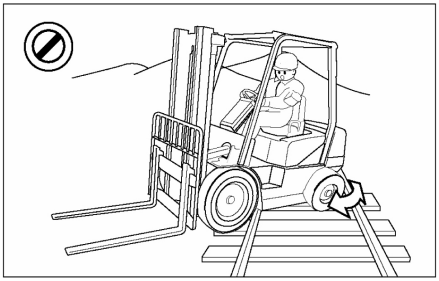
Never elevate a load with the forklift truck on an incline.

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



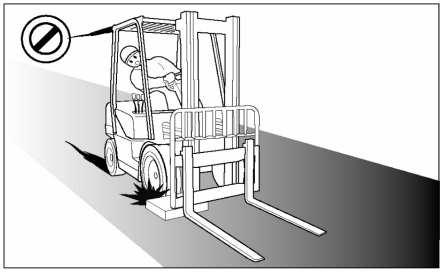
Do not stack or turn on ramps.

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



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

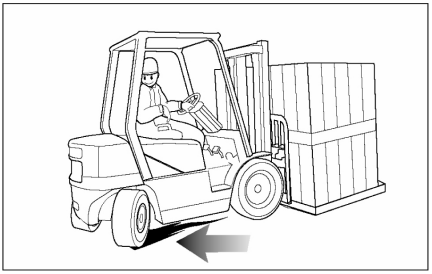
Cross railroad tracks slowly and diagonally whenever possible. A railroad crossing can give a loaded forklift truck a real jolt. For smoother crossing, cross the railroad diagonally so one wheel crosses at a time.



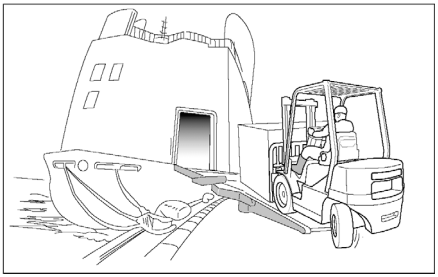
Avoid running over loose objects.

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

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

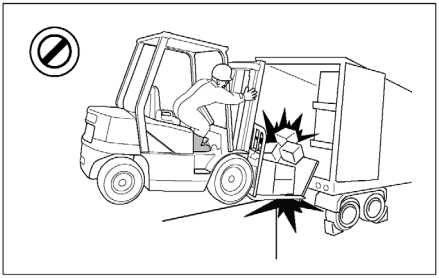


Do not drive in forward direction when loads restrict your visibility. Operate your lift truck in reverse to improve visibility except when moving up a ramp.



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

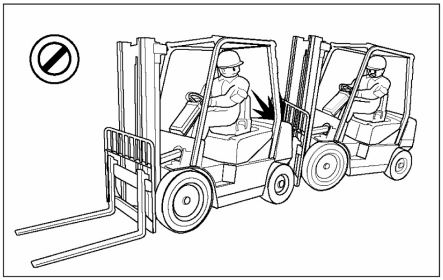
The truck can fall over the edge and cause injury or death.



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

Make sure that they are correctly positioned.

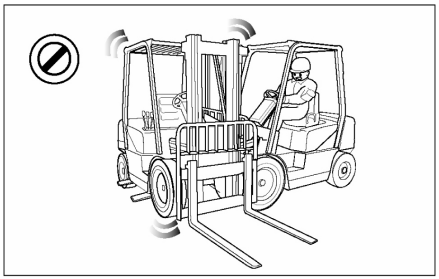
Put blocks on the vehicle you enter to keep it from moving.



Do not operate your truck close to another truck.

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

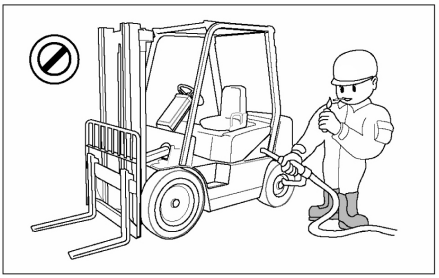
Never overtake other vehicles.



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

Do not let another push or tow your truck.

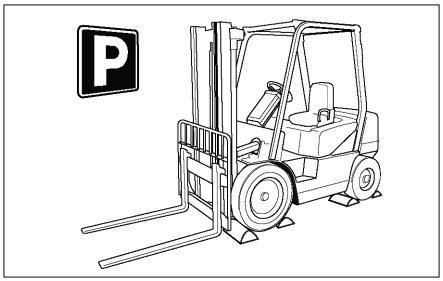
If a truck will not move, call a service technician.



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

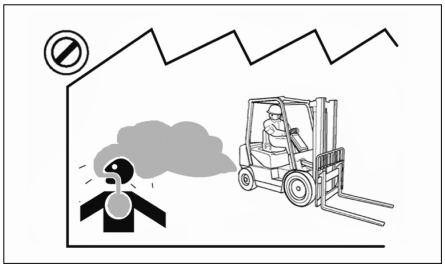
Smoking and handling of naked flames during refueling are strictly prohibited. This prohibition also applies during the changing of the LPG (liquefied propane gas) tank.

Mop up spilt fuel and do not forget to close the fuel tank before restarting the engine.

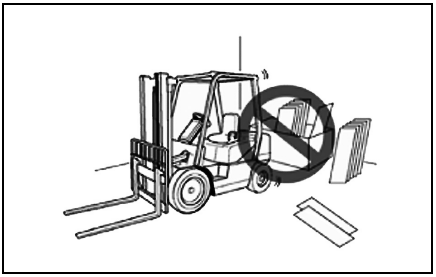


Park your lift truck in authorised areas only. Fully lower the forks to the floor, put direction lever in NEUTRAL position, engage the parking brake, and turn the key to the OFF position. Remove the key and put blocks behind the wheels to prevent the truck from rolling. Shut off your forklift truck when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

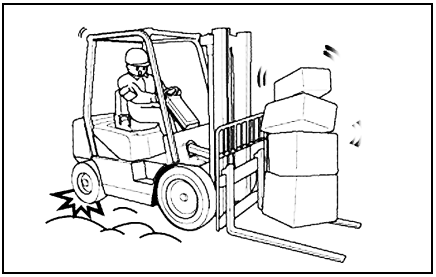
Check the condition of your forklift truck after the day's work.



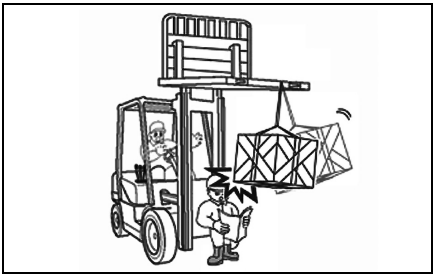
Exhaust from all internal combustion engines contains carbon monoxide, a colorless, odorless, tasteless, poisonous gas. Exposure to carbon monoxide can cause serious injury or health problems, including death. And avoid unnecessary idling of the engine. If nausea, dizziness or headaches are experienced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



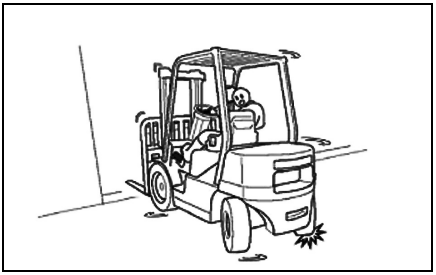
Do not operate forklifts near flammable or combustible materials.
To avoid the discoloration, deformation or combustion of materials (such as lumber, veneer board, paper products and other similar items), always park at least 30 cm (12 inches) away from them



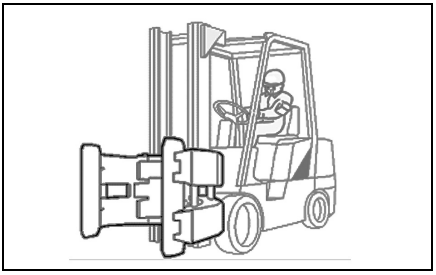
Forklift trucks are not cars. They often have small tyres, no suspension, and are very heavy.
The forklift's centre of gravity will also change when carrying loads.
Avoid uneven bumps, pot holes and other hazards whenever possible.



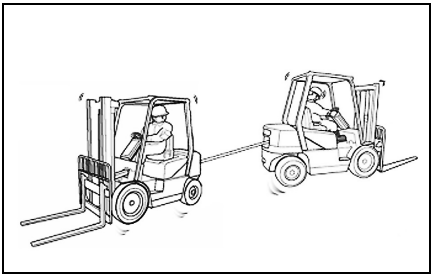
Carrying a load suspended on a chain or a cable may unbalance a truck.
Take extra care around pedestrians with a suspended load as it may sway or even strike them.



An unloaded forklift may be easier to tip over than a loaded truck.
When traveling without a load, the risk of lateral overturn is greater.



There are many special attachments available to replace the forks on a lift truck.
All carry safety implications and special training in their operation is highly recommended.

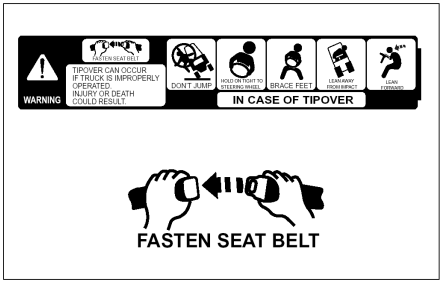


The counterweight draw bar should not be used for towing the forklift or for towing another forklift.
Towing is only advised in emergencies, by trained operators and at low speed, no faster than 2 km/h, to a convenient location for repair.

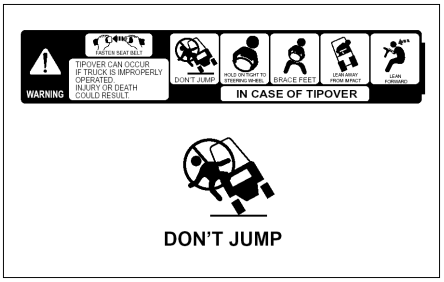
How to Survive in a Tipover

⚠ WARNING

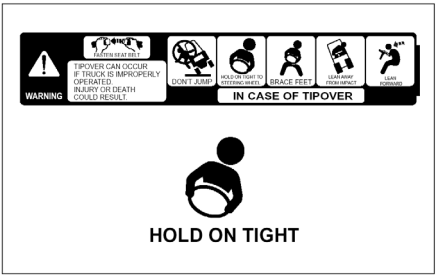
In the event of a tipover, the risk of serious injury or death will be reduced if the operator is using the operator restraint system and follows the instructions provided.



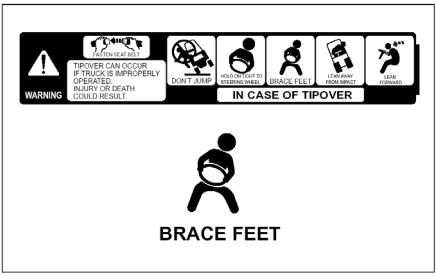
Always use operator restraint system.



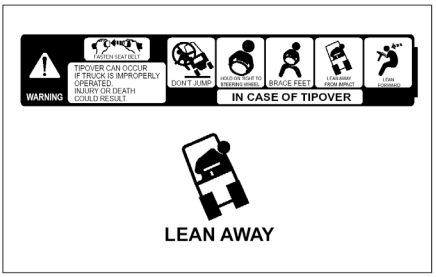
Don't jump.



Hold on tight.



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



Lean away from the direction of fall.

Lean forward.

Declaration of Conformity

We,

Manufacturer
Doosan Industrial Vehicle Co., Ltd.
468, Injung-ro, Dong-gu, Incheon, Korea 22503

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

herewith declare
that the following equipment conforms with the appropriate requirements of the Directives 2006/42/EC(Machinery Directive), 2000/14/EC as amended by 2005/88/EC (Noise Emission in the environment by equipment for use outdoors), exhaust gas directive (97/68/EC amended by 2004/26/EC), and 2014/30/EU (EMC Directive) based on its design and type, as brought into circulation by us

Type : Lift Truck, Combustion-engine driven, Counterbalanced

Function : Lifting and Moving materials

Family : CD15 / 18S-5, CD20SC-5 Series

Model / Commercial Name :

Serial Number :

Net installed power [kW] : CD15 / 18S-5, CD20SC-5 Series - 34.1 kW

CG15 / 18S-5, CG20SC-5 Series - 37.4 kW

Measured sound power level representative for this type :

CD15 / 18S-5, CD20SC-5 Series - 104 dB(A)

CG15 / 18S-5, CG20SC-5 Series - 99 dB(A)

Guaranteed sound power level for this equipment :

CD15 / 18S-5, CD20SC-5 Series - 105 dB(A)

CG15 / 18S-5, CG20SC-5 Series - 100 dB(A)

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

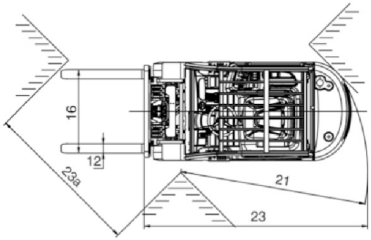
Applicable EC Directives : 2006/42/EC, 2014/30/EU, 2000/14/EC, 97/68/EC amended by 2004/26/EC

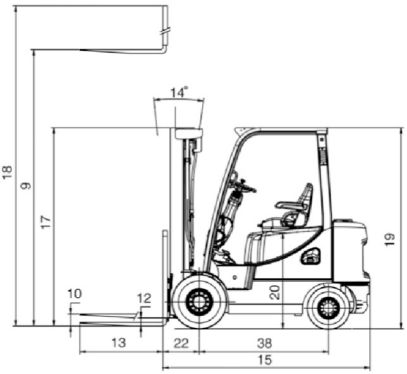
Applicable harmonized standard : EN 16307-1;2013+A1;2015, EN ISO 3691-1;2015 EN 1175-2;1998+A1;2010, EN 1175-3;1998+A1;2010 EN 12895;2015+A1:2019

Specifications

	CHARACTERISTICS			
1	Manufacturer			
2	Model			
3	Capacity	at rated load centre		lb(kg)
4	Load centre	distance		in(mm)
5	Power type	electric, diesel, gasoline, LPG		
6	Operator type	Stand-on, rider seated		
7	Tyres	c = cushion, p = pneumatic		
8	Wheels (x = driven)	number, front/rear		
	DIMENSIONS			
9	Lift with STD two - stage mast	maximum fork height with rated load		in(mm)
10		free lift		in(mm)
11		special free lift		in(mm)
12	Fork carriage	ISO class		
13	Forks	thickness X width X length		in(mm)
		fork spacing (minimum X maximum)		in(mm)
14	Tilt of mast	forward/backward		deg
15	Overall dimensions	length without forks		in(mm)
16		width		in(mm)
17		mast lowered height		in(mm)
18		mast extended height		in(mm)
19		overhead guard height		in(mm)
20		seat height		in(mm)
21	Outside turning radius			in(mm)
22	Load moment constant (from centre of front wheel to fork face)			in(mm)
23	90° stacking aisle (add load length and clearance)			in(mm)
23a	90° intersecting aisle			in(mm)
	PERFORMANCE			
24	Speeds	travel, loaded/unloaded		mph(km/h)
25		lift, loaded/unloaded		fpm(mm/s)
26		lowering, loaded/unloaded		fpm(mm/s)
28	Drawbar pull	at 1.6 km/h, loaded/unloaded		lbf(kgf)
30	Gradeability	at 1.6 km/h, loaded/unloaded		%
31	Acceleration time	traveling loaded/unloaded		s
	WEIGHT			
32	Total weight			lb(kg)
33	Axle load	with load	front/rear	lb(kg)
34		without load	front/rear	lb(kg)
	CHASSIS			
35	Tyres	number of front/rear		
36		size	front size	
37			rear size	
38	Wheelbase			in(mm)
39	Tread	front/rear		in(mm)
40	Ground clearance	loaded	at the lowest point	in(mm)
41			at the centre of wheelbase	in(mm)
42	Service brake			
43	Parking brake			
	DRIVE			
45	Battery	voltage/capacity		V/AH
49	Engine	manufacturer/model		
50		rated output (at rpm)		hp(kW)
51		max. torque (at rpm)		lbf·ft(N·m)
52		cycle/cylinders/displacement		cc
53		fuel consumption		gpm(l/hr)
55	Transmission	Type		
56		number of speeds forward/reverse		

CROWN	**CROWN**	**CROWN**	1
CD15S-5	**CD18S-5**	**CD20SC-5**	2
3,000(1,350)	3,500(1,575)	4,000(1,800)	3
24(600)	24(600)	24(600)	4
diesel	diesel	diesel	5
rider - seated	rider-seated	rider-seated	6
p	p	p	7
X2/2	X2/2	X2/2	8
130(3,300)	130(3,300)	130(3,300)	9
5.3(135)	5.3(135)	5.3(135)	10
			11
II	II	II	12
1.4 x 4 x 35.4 (35 X 100 X 900)	1.4 x 4 x 35.4 (35 X 100 X 900)	1.6 x 4 x 35.4 (40 X 100 X 900)	13
	9.4 x 35.6(240 X 905)		
6/8	6/8	6/8	14
85.4(2,170)	87.2(2,215)	88.6(2,250)	15
42.1(1,070)	42.1(1,070)	42.1(1,070)	16
86(2,185)	86(2,185)	86(2,185)	17
171(4,355)	171(4,355)	172(4,360)	18
85.4(2,170)	85.4(2,170)	85.4(2,170)	19
39.6(1,005)	39.6(1,005)	39.6(1,005)	20
77.8(1,977)	79.6(2,022)	80.7(2,050)	21
15.5(394)	15.5(394)	15.7(399)	22
92.9(2,360)	94.4(2,398)	95.4(2,422)	23
67.7(1,720)	68.9(1,750)	70.1(1,780)	23a
11.9/12.2 (19.1/19.7)	11.9/12.2 (19.1/19.7)	11.9/12.2 (19.1/19.7)	24
118/128(600/650)	118/128(600/650)	118/128(600/650)	25
98.4/88.6(500/450)	98.4/88.6(500/450)	98.4/88.6(500/450)	26
3,069(1,392)	3,069(1,392)	3,069(1,392)	28
33	30	28	30
			31
6,349(2,880)	6,812(3,090)	7,165(3,250)	32
8,378/1,279 (3,800/580)	9,182/1,493 (4,165/677)	10,020/1,554 (4,545/705)	33
2,954/3,439 (1,340/1,560)	2,844/4,057 (1,290/1,840)	2,778/4,387 (1,260/1,990)	34
2/2	2/2	2/2	35
6.50 X 10 - 12	6.50 X 10 - 12	6.50 X 10 - 12	36
5.00 X 8 - 10	5.00 X 8 - 10	5.00 X 8 - 10	37
55.1(1,400)	55.1(1,400)	55.1(1,400)	38
35/35.8(890/910)	35/35.8(890/910)	35/35.8(890/910)	39
4.7(120)	4.7(120)	4.7(120)	40
5.9(150)	5.9(150)	5.9(150)	41
foot/hydraulic	foot/hydraulic	foot/hydraulic	42
hand/mechanical	hand/mechanical	hand/mechanical	43
12/65	12/65	12/65	45
KUBOTA/V2403	KUBOTA/V2403	KUBOTA/V2403	49
45.7(34.1)/2,400	45.7(34.1)/2,400	45.7(34.1)/2,400	50
115(155.9)/1,600	115(155.9)/1,600	115(155.9)/1,600	51
4/4/2,434	4/4/2,434	4/4/2,434	52
			53
Powershift	Powershift	Powershift	55
1/1	1/1	1/1	56





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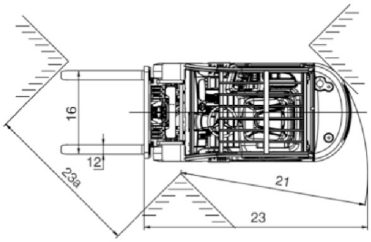
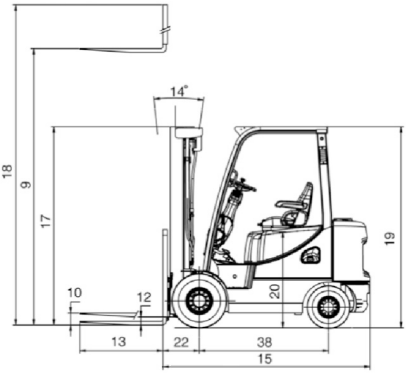
8	Wheels (x = driven)	number, front/rear		
	DIMENSIONS			
9	Lift with STD two - stage mast	maximum fork height with rated load		in(mm)
10		free lift		in(mm)
11		special free lift		in(mm)
12	Fork carriage	ISO class		
13	Forks	thickness X width X length		in(mm)
		fork spacing (minimum X maximum)		in(mm)
14	Tilt of mast	forward/backward		deg
15	Overall dimensions	length without forks		in(mm)
16		width		in(mm)
17		mast lowered height		in(mm)
18		mast extended height		in(mm)
19		overhead guard height		in(mm)
20		seat height		in(mm)
21	Outside turning radius			in(mm)
22	Load moment constant (from centre of front wheel to fork face)			in(mm)
23	90° stacking aisle (add load length and clearance)			in(mm)
23a	90° intersecting aisle			in(mm)
	PERFORMANCE			
24	Speeds	travel, loaded/unloaded		mph(km/h)
25		lift, loaded/unloaded		fpm(mm/s)
26		lowering, loaded/unloaded		fpm(mm/s)
28	Drawbar pull	at 1.6 km/h, loaded/unloaded		lbf(kgf)
30	Gradeability	at 1.6 km/h, loaded/unloaded		%
31	Acceleration time	traveling loaded/unloaded		s
	WEIGHT			
32	Total weight			lb(kg)
33	Axle load	with load	front/rear	lb(kg)
34		without load	front/rear	lb(kg)
	CHASSIS			
35	Tyres	number of front/rear		
36		size	front size	
37			rear size	
38	Wheelbase			in(mm)
39	Tread	front/rear		in(mm)
40	Ground clearance	loaded	at the lowest point	in(mm)
41			at the centre of wheelbase	in(mm)
42	Service brake			
43	Parking brake			
	DRIVE			
45	Battery	voltage/capacity		V/AH
49	Engine	manufacturer/model		
50		rated output (at rpm) gas/LPG		hp(kW)
51		max. torque (at rpm) gas/LPG		lbf·**ft(**N·m)
52		cycle/cylinders/displacement		cc
53		fuel consumption		gpm(l/hr)
55	Transmission	Type		
56		number of speeds forward/reverse		

CROWN	**CROWN**	**CROWN**	1
CG15S-5 (Non Certi)	**CG18S-5 (Non Certi)**	**CG20SC-5 (Non Certi)**	2
3,000(1,350)	3,500(1,575)	4,000(1,800)	3
24(600)	24(600)	24(600)	4
gas/LPG	gas/LPG	gas/LPG	5
rider - seated	rider-seated	rider-seated	6
p	p	p	7
X2/2	X2/2	X2/2	8
130(3,300)	130(3,300)	130(3,300)	9
5.3(135)	5.3(135)	5.3(135)	10
			11
II	II	II	12
1.4 x 4 x 35.4 (35 X 100 X 900)	1.4 x 4 x35.4 (35 X 100 X 900)	1.6 x 4 x 35.4 (40 X 100 X 900)	13
9.4 x 35.6(240 X 905)			
6/8	6/8	6/8	14
85.4(2,170)	87.2(2,215)	88.6(2,250)	15
42.1(1,070)	42.1(1,070)	42.1(1,070)	16
86(2,185)	86(2,185)	86(2,185)	17
171(4,355)	171(4,355)	172(4,360)	18
85.4(2,170)	85.4(2,170)	85.4(2,170)	19
39.6(1,005)	39.6(1,005)	39.6(1,005)	20
77.8(1,977)	79.6(2,022)	80.7(2,050)	21
15.5(394)	15.5(394)	15.7(399)	22
92.9(2,360)	94.4(2,398)	95.4(2,422)	23
67.7(1,720)	68.9(1,750)	70.1(1,780)	23a
11.2/11.8(18/19)	11.2/11.8(18/19)	11.2/11.8(18/19)	24
118/128(600/650)	118/128(600/650)	118/128(600/650)	25
98.4/88.6(500/450)	98.4/88.6(500/450)	98.4/88.6(500/450)	26
3,175(1,440)	3,153(1,430)	3131(1,420)	28
35.5	31	28.5	30
			31
6,173(2,800)	6,636(3,010)	6,989(3,170)	32
8,322/1,157 (3,775/525)	9,127/1,367 (4,140/620)	9,965/1,433 (4,520/650)	33
2,910/3,274 (1,320/1,485)	2,800/3,836 (1,270/1,740)	2,723/4,266 (1,235/1,935)	34
2/2	2/2	2/2	35
6.50 X 10 - 12	6.50 X 10 - 12	6.50 X 10 - 12	36
5.00 X 8 - 10	5.00 X 8 - 10	5.00 X 8 - 10	37
55.1(1,400)	55.1(1,400)	55.1(1,400)	38
35/35.8(890/910)	35//35.8(890/910)	35/35.8(890/910)	39
4.7(120)	4.7(120)	4.7(120)	40
5.9(150)	5.9(150)	5.9(150)	41
foot/hydraulic	foot/hydraulic	foot/hydraulic	42
hand/mechanical	hand/mechanical	hand/mechanical	43
12/45	12/45	12/45	45
G424I	G424I	G424I	49
45.5(33.9)/2450	45.5(33.9)/2450	45.5(33.9)/2450	50
109(147.8)/1,600	109(147.8)/1,600	109(147.8)/1,600	51
4/4/2,359	4/4/2,359	4/4/2,359	52
			53
Powershift	Powershift	Powershift	55
1/1	1/1	1/1	56

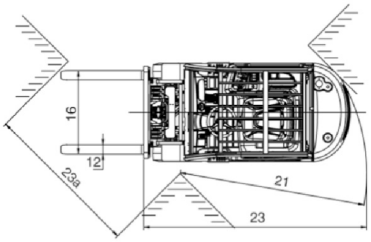


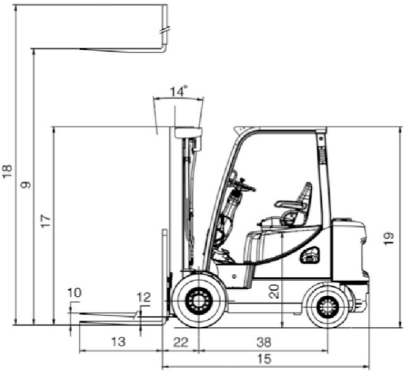


Specifications

	CHARACTERISTICS			
1	Manufacturer			
2	Model			
3	Capacity	at rated load centre		lb(kg)
4	Load centre	distance		in(mm)
5	Power type	electric, diesel, gasoline, LPG		
6	Operator type	Stand-on, rider seated		
7	Tyres	c = cushion, p = pneumatic		
8	Wheels (x = driven)	number, front/rear		
	DIMENSIONS			
9	Lift with STD two - stage mast	maximum fork height with rated load		in(mm)
10		free lift		in(mm)
11		special free lift		in(mm)
12	Fork carriage	ISO class		
13	Forks	thickness X width X length		in(mm)
		fork spacing (minimum X maximum)		in(mm)
14	Tilt of mast	forward/backward		deg
15	Overall dimensions	length without forks		in(mm)
16		width		in(mm)
17		mast lowered height		in(mm)
18		mast extended height		in(mm)
19		overhead guard height		in(mm)
20		seat height		in(mm)
21	Outside turning radius			in(mm)
22	Load moment constant (from centre of front wheel to fork face)			in(mm)
23	90° stacking aisle (add load length and clearance)			in(mm)
23a	90° intersecting aisle			in(mm)
	PERFORMANCE			
24	Speeds	travel, loaded/unloaded		mph(km/h)
25		lift, loaded/unloaded		fpm(mm/s)
26		lowering, loaded/unloaded		fpm(mm/s)
28	Drawbar pull	at 1.6 km/h, loaded/unloaded		lbf(kgf)
30	Gradeability	at 1.6 km/h, loaded/unloaded		%
31	Acceleration time	traveling loaded/unloaded		s
	WEIGHT			
32	Total weight			lb(kg)
33	Axle load	with load	front/rear	lb(kg)
34		without load	front/rear	lb(kg)
	CHASSIS			
35	Tyres	number of front/rear		
36		size	front size	
37			rear size	
38	Wheelbase			in(mm)
39	Tread	front/rear		in(mm)
40	Ground clearance	loaded	at the lowest point	in(mm)
41			at the centre of wheelbase	in(mm)
42	Service brake			
43	Parking brake			
	DRIVE			
45	Battery	voltage/capacity		V/Ah
49	Engine	manufacturer/model		
50		rated output (at rpm) gas/LPG		hp(kW)
51		max. torque (at rpm) gas/LPG		lbf·**ft**(N·m)
52		cycle/cylinders/displacement		cc
53		fuel consumption		gpm(l/hr)
55	Transmission	Type		
56		number of speeds forward/reverse		

CROWN	**CROWN**	**CROWN**	1
CG15S-5 (TIER-3/STAGE5)	**CG18S-5 (TIER-3/STAGE5)**	**CG20SC-5 (TIER-3/STAGE5)**	2
3,000(1,350)	3,500(1,575)	4,000(1,800)	3
24(600)	24(600)	24(600)	4
LPG	LPG	LPG	5
rider - seated	rider-seated	rider-seated	6
p	p	p	7
X2/2	X2/2	X2/2	8
130(3,300)	130(3,300)	130(3,300)	9
5.3(135)	5.3(135)	5.3(135)	10
			11
II	II	II	12
1.4 x 4 x 35.4 (35 X 100 X 900)	1.4 x 4 x35.4 (35 X 100 X 900)	1.6 x 4 x35.4 (40 X 100 X 900)	13
9.4x35.6(240 X 905)			
6/8	6/8	6/8	14
85.4(2,170)	87.2(2,215)	88.6(2,250)	15
42.1(1,070)	42.1(1,070)	42.1(1,070)	16
86(2,185)	86(2,185)	86(2,185)	17
171(4,355)	171(4,355)	172(4,360)	18
85.4(2,170)	85.4(2,170)	85.4(2,170)	19
39.6(1,005)	39.6(1,005)	39.6(1,005)	20
77.8(1,977)	79.6(2,022)	80.7(2,050)	21
15.5(394)	15.5(394)	15.7(399)	22
92.9(2,360)	94.4(2,398)	95.4(2,422)	23
67.7(1,720)	68.9(1,750)	70.1(1,780)	23a
11.2/11.8(18/19)	11.2/11.8(18/19)	11.2/11.8(18/19)	24
124/128(630/650)	122/128(620/650)	120/128(610/650)	25
98.4/88.6(500/450)	98.4/88.6(500/450)	98.4/88.6(500/450)	26
3,549/3,395 (1,610/1,540)	3,516/3,384 (1,595/1,535)	3,494/3,373 (1,585/1,530)	28
40.3/65.7	35.1/59.2	32.2/55.0	30
			31
6,173(2,800)	6,636(3,010)	6,989(3,170)	32
8,322/1,157 (3,775/525)	9,127/1,367 (4,140/620)	9,965/1,433 (4,520/650)	33
2,910/3,274 (1,320/1,485)	2,800/3,836 (1,270/1,740)	2,723/4,266 (1,235/1,935)	34
2/2	2/2	2/2	35
6.50 X 10 - 12	6.50 X 10 - 12	6.50 X 10 - 12	36
5.00 X 8 - 10	5.00 X 8 - 10	5.00 X 8 - 10	37
55.1(1,400)	55.1(1,400)	55.1(1,400)	38
35/35.8(890/910)	35/35.8(890/910)	35/35.8(890/910)	39
4.7(120)	4.7(120)	4.7(120)	40
5.9(150)	5.9(150)	5.9(150)	41
foot/hydraulic	foot/hydraulic	foot/hydraulic	42
hand/mechanical	hand/mechanical	hand/mechanical	43
12/45	12/45	12/45	45
HMC2.4	HMC2.4	HMC2.4	49
50.2(37.4)/2,450	50.2(37.4)/2,450	50.2(37.4)/2,450	50
116.7(158.2)/1,600	116.7(158.2)/1,600	116.7(158.2)/1,600	51
4/4/2,359	4/4/2,359	4/4/2,359	52
			53
Powershift	Powershift	Powershift	55
1/1	1/1	1/1	56

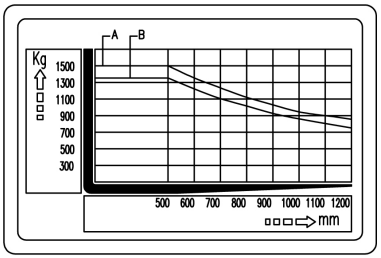
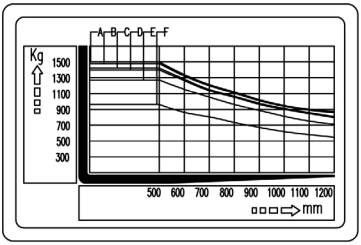
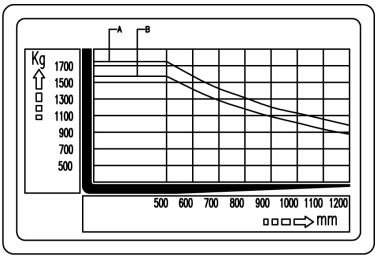
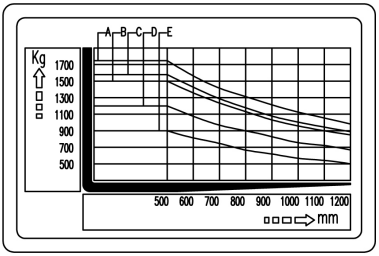
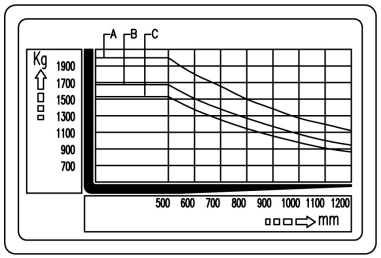
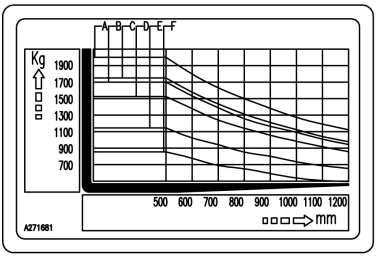




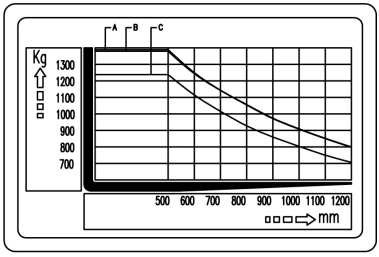
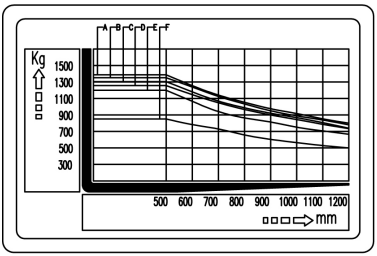
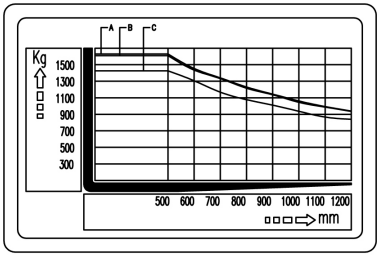
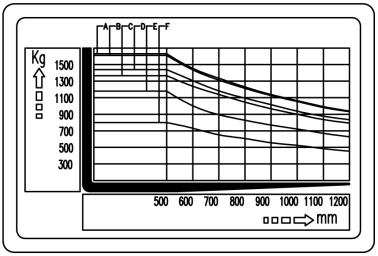
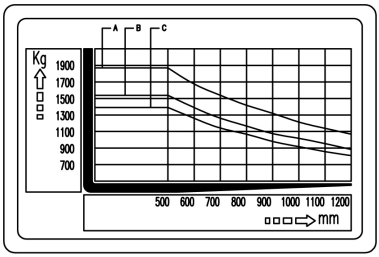
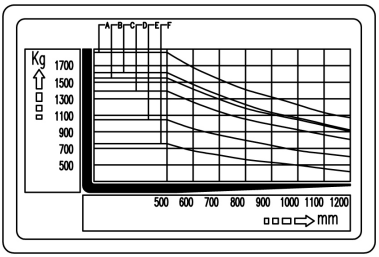
Noise and Vibration

Model	Sound Pressure Level at Operator's ear (Leq.) according to EN12053 Guaranteed Sound	Power level(L_{WA}) By Noise Directive 2000/14/EC	Whole-body Vibration Level according to EN13059 (m/s^2)	
	dB(A)	dB(A)	Mean	Uncertainty
CD15/18S-5, CD20SC-5 (W/O Cabin)	83	105	0.8	0.2
CG15/18S-5, CG20SC-5 CG424I(E) Engine (W/O Cabin)	81	104		
CG15/18S-5, CG20SC-5 HMC2.4L Engine (W/O Cabin)	80	100		

Capacity Chart - Without Sideshift

MODEL	SINGLE TYRE	
	STD, FFL	FFT
CG15S-5 CD15S-5	 A. 2500 ~ 4500 mm MFH MAST B. 5000 mm MFH MAST	 A. 4000 mm MFH MAST B. 4500 mm MFH MAST C. 4750 mm MFH MAST D. 5000 mm MFH MAST E. 5500 mm MFH MAST F. 6000 mm MFH MAST
CG18S-5 CD18S-5	 A. 2500 ~ 4500 mm MFH MAST B. 5000 mm MFH MAST	 A. 4000 ~ 4500 mm MFH MAST B. 4750 mm MFH MAST C. 5000 mm MFH MAST D. 5500 mm MFH MAST E. 6000 mm MFH MAST
CG20SC-5 CD20SC-5	 A. 2500 ~ 4000 MFH MAST B. 4500 mm MFH MAST C. 5000 mm MFH MAST	 A. 4000 mm MFH MAST B. 4500 mm MFH MAST C. 4750 mm MFH MAST D. 5000 mm MFH MAST E. 5500 mm MFH MAST F. 6000 mm MFH MAST

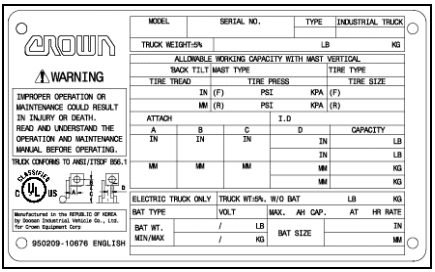
Capacity Chart - With Sideshift

MODEL	SINGLE TYRE	
	STD, FFL	FFT
CG15S-5 CD15S-5	 A. 2500 ~ 4000 mm MFH MAST B. 4500 mm MFH MAST C. 5000 mm MFH MAST	 A. 4000 mm MFH MAST B. 4500 mm MFH MAST C. 4750 mm MFH MAST D. 5000 mm MFH MAST E. 5500 mm MFH MAST F. 6000 mm MFH MAST
CG18S-5 CD18S-5	 A. 2500 ~ 4000 mm MFH MAST B. 4500 mm MFH MAST C. 5000 mm MFH MAST	 A. 4000 mm MFH MAST B. 4500 mm MFH MAST C. 4750 mm MFH MAST D. 5000 mm MFH MAST E. 5500 mm MFH MAST F. 6000 mm MFH MAST
CG20SC-5 CD20SC-5	 A. 2500 ~ 4000 mm MFH MAST B. 4500 mm MFH MAST C. 5000 mm MFH MAST	 A. 4000 mm MFH MAST B. 4500 mm MFH MAST C. 4750 mm MFH MAST D. 5000 mm MFH MAST E. 5500 mm MFH MAST F. 6000 mm MFH MAST

Serial Number

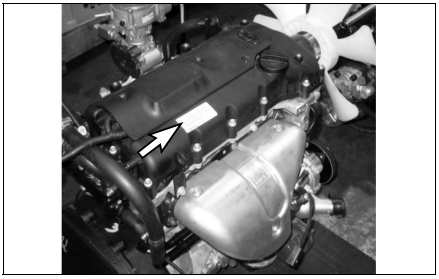
Serial Number Locations

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



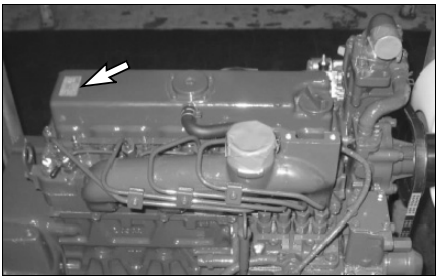
Lift Truck Serial Number

•_____



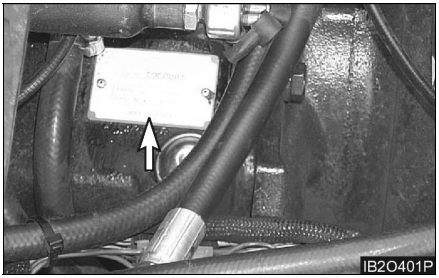
2.4 liter Spark-Ignition Engine Serial Number [HMC2.4L, G424I]

•_____



2.3 liter Diesel Engine Serial Number

•_____



Power Shift Transmission Serial Number

•_____

Side Shift Serial Number (If Equipped)

•_____

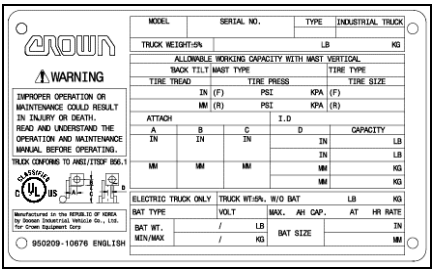
Operator's Warning and Identification Plate

Familiarise yourself with the OPERATOR'S WARNING Plate and IDENTIFICATION, LIFT CAPACITY and ATTACHMENTPLATES. DO NOT exceed Capacity as equipped load ratings

Operator's Warning Plate

Located by the left side of the overhead gurad.

Identification, Lift Capacity and Attachment Plate



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

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 centre. For example: a capacity of 1500kg(3300 lb) at 500mm(24in) means that the lift truck can lift 1500kg(3300lb) if the load centre is 500 mm (24in) from both the vertical and horizontal faces of the forks.

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

HSS - Hook-type Sideshift Carriage (ITA)

CW - Counterweight

SF - Special Forks

SWS - Swing Shift, Sideshift

RAM - Ram or Boom

DBCBH - Double Cube Block Handler

HFP - Hydraulic Fork Positioner

CR - Crane Arm or Crane Boom

TH - Tyre Handler

CTH - Container Handler

LPP - Load Push-Pull Device

CC - Carton Clamp

RC - Roll Clamp

LS - Load Stabiliser

PWH - Pulp Wood Handler

SS-ST - Sideshift-Side Tilt Carriage

Operator's Station and Monitoring Systems

Instrument Panel

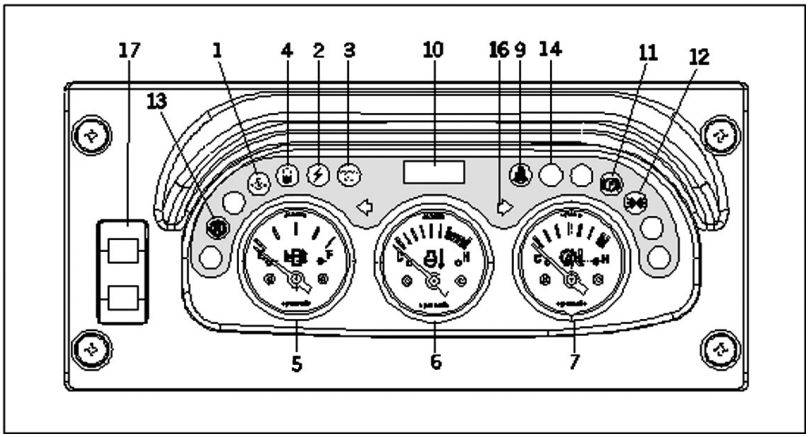
Your lift truck may not have the same indicator or warning lights as shown in the illustrations.

Due to the various options available, typical instrument panels are shown.

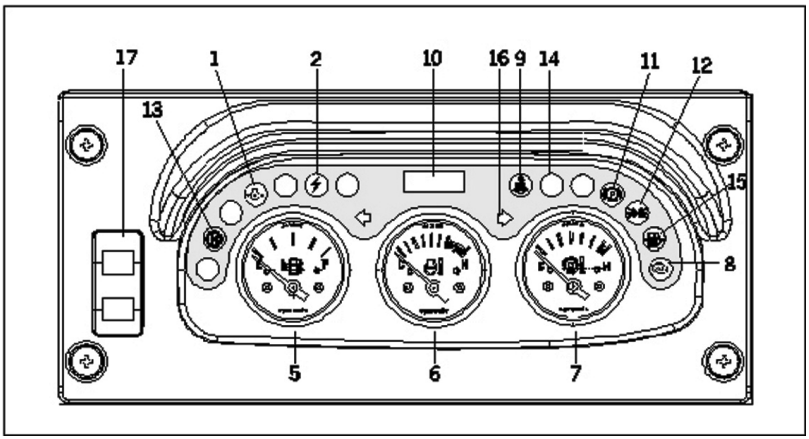
However, the symbols on the indicators and lights on your panel identify what those particular items are.

Also, the symbol for each of the items is identified and an explanation of their function and location is described on the following pages.

Diesel (12V)



LPG/GAS (12V)



1. Engine Oil Pressure Indicator Light - Indicates insufficient engine oil pressure. The light will come on when the ignition switch is turned to the ON position. The light should go off after the engine is started. If the light turns on while operating the lift truck, insufficient engine oil pressure is indicated. Park the lift truck and stop the engine.

Check the system for a malfunction. The light will turn on when the oil pressure drops to approximately 70kPa (10psi).

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

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

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

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

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

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

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

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

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

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

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

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

8. G424I(E) LP Engine Malfunction Indicator Lamp (MIL) – G424I(E) engine control system is equipped with built-in fault diagnostics. Detected system faults can be displayed by the Malfunction Indicator Lamp (MIL) as Diagnostic Fault Codes(DFC) or flash codes, and viewed in detail with the use of service tool software. When the ignition key is turned ON the MIL will perform a self-test, illuminate once and then go OFF. If a detected fault condition exists, the fault or faults will be stored in the memory of the engine control module(ECM). Once a fault occurs the MIL will illuminate and remain ON. This signals the operator that a fault has been detected by the SECM.

9. Seat Belt Warning Light – Indicates when the seat belt does not fastened by operator. The light will come on when the ignition switch is turned to the on position the light should go off often engine is started.

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

11. Parking indicator light - The light will come ON when the parking lever is applied.

12. Front Floodlights - Push down on the switch(17), to the first step, to turn the front floodlights on.

Front and Rear Floodlights – Push down on the switch(17), to the second step, to turn both the front and rear floodlights on. The floodlights are optional.

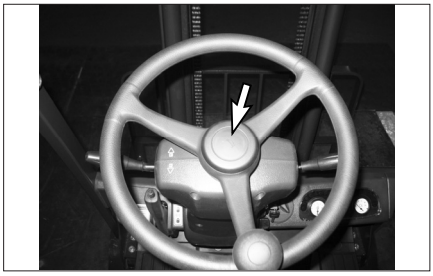
13. Transmission Neutral Position Light - Indicates the neutral position of transmission.

14. Brake Fluid Oil Light (If Equipped) – The light is ON when the brake fluid oil of brake reservoir comes down to low level position. Refill the proper brake fluid oil if its light is ON.

15. Low Level Light of LP GAS – Indicates the low Level of LP GAS (LP or DUAL only)

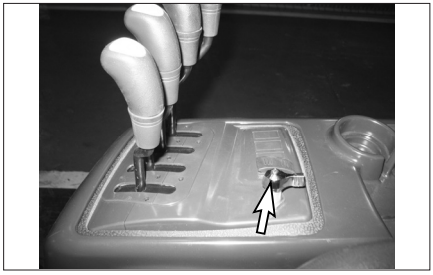
16. Directional Turning Indicator Light

17. Front and Rear Floodlights Switch – The front floodlight is ON when push down switch to the first step.
The front and rear floodlights are ON when push down switch to the second step.



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

Electrical Disconnect Switch (If Equipped)

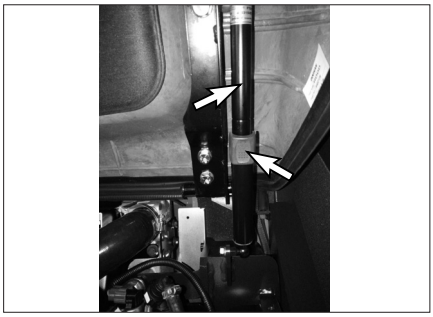


1. ON - Connects the battery for electrical power to all electrical circuits.

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

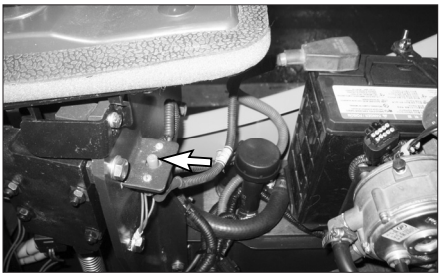
Engine Compartment

1. The engine compartment is accessible by pulling the latch and raising the hood and seat assembly. (Note : Unlock latch before pulling - if key equipped)



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

Circuit Breaker



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

Fuel Selector Switch (If Dual Fuel Equipped)

NOTE : The switch is located in the engine compartment or on the cowl.

1. LPG - This position supplies electrical power to the LP fuel lock solenoid, when the ignition switch is in the ON or the START position. With the LP- Gas fuel tank valve open and when engine oil pressure is present, LP-Gas can then flow the tank through the converter to the carburetor.

2. OFF - This position shuts off all fuel supply to the carburetor and is used when changing from Gasoline to LP-Gas or LP-Gas to Gasoline fuel.

Electrical power shuts off the gasoline fuel lock valve and the LP fuelock solenoid. Before switching to the LPG position, allow the engine to run until all of the gasoline in the carburetor is consumed and the engine stops.

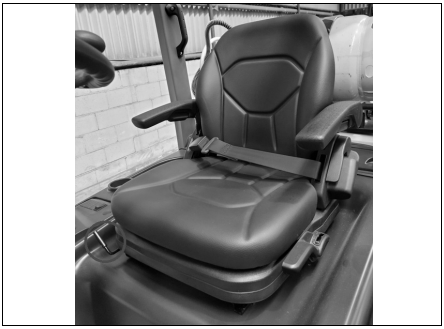
3. GAS - This position supplies electrical power to the gasoline fuelock solenoid. This will allow gasoline fuel to flow from the tank through the fuel filter and fuel pump to the carburetor.

Seat

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

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

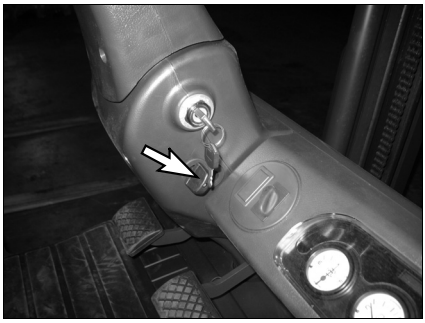
Lock the seat into position before operating, to prevent an unexpected seat change.



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

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

Tilting Steering Column



To adjust the steering column, push down the knob(1) and move the steering column to the desired position, then release the knob(1)

OSS (Operator Sensing System)

Crown forklift truck, Pro 5 series equipped with various kinds of safe devices as standard to satisfy important customer's needs. These safety devices are actively controlled by the presence of operator on driver's seat or not. The OSS (Operator Sensing System) is consisted of 4 characteristics.

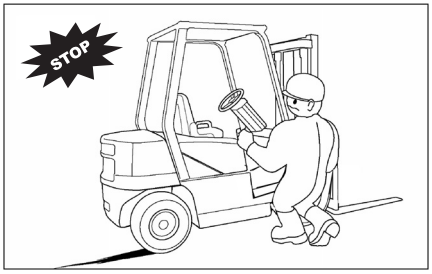
1. No truck moving with an operator's absence on driver seat.
   To prevent motion of the truck without an operator in the seated position, the OSS will shut off the drive power immediately when an operator leaves the seat.

2. Hydraulic lifting and lowering locking.
   The OSS will lock the hydraulic control valve to prevent lifting and lowering fork within three seconds of operator leaving seat. In case of key-off, hydraulic control valve will be locked immediately.

3. Parking Brake Warning.
   An alarm will sound when operator leaves seat without engaging parking brake.

4. Seat Belt Indicator.
   A warning indicator will activate on instrument panel when operator unfasten seat belt.

Seat Switch System



The lift truck is equipped with a SEAT SWITCH SYSTEM. In normal operation if the direction lever is placed in either forward or reverse, the lift truck will move at a speed proportional to the accelerator pedal's position. If the operator leavers the seat without setting the parking brake, within three

seconds after leaving the seat, the SEAT SWITCH SYSTEM will automatically disengage the transmission. The directional lever, however, will remain in that forward or reverse location although internally the transmission will have shifted into neutral.

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

.

⚠ WARNING

WHEN LEAVING MACHINE APPLY PARKING BRAKE!

PARKING BRAKE IS NOT AUTOMATICALLY APPLIED.

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

NOTICE

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

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

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

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

Lift Truck Controls

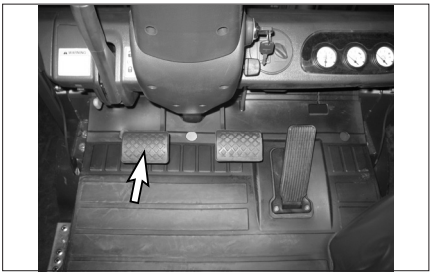
Direction Control Lever

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

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

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

Transmission Inching Control Pedal

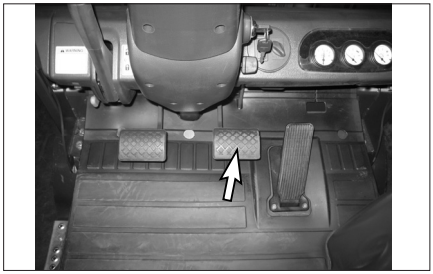


Inching Control Pedal - Pushing down on the inching pedal, modulates the hydraulic pressure to the clutch packs, permitting disc slippage.

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

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

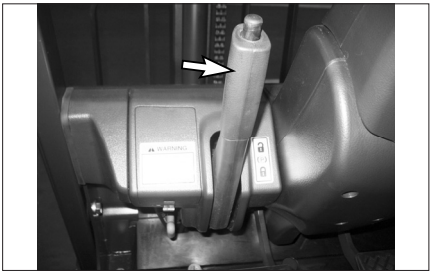
Service Brake Pedal



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

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

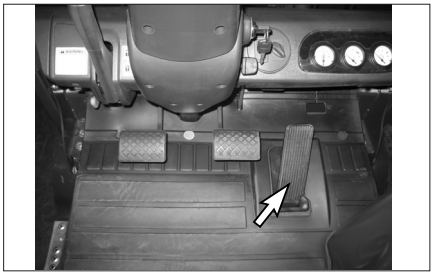
Parking Brake Lever



Pull the lever BACK to engage the parking brake.

Push the lever FORWARD to release the parking brake.

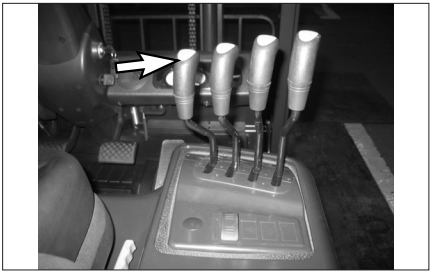
Accelerator Pedal



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

RELEASE the pedal to decrease engine rpm (speed).

Lift Control



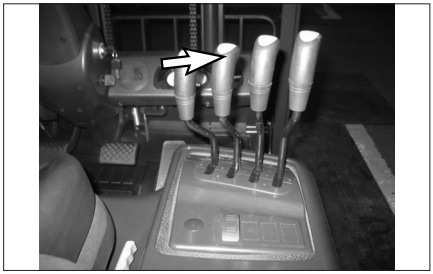
NOTE : To prevent a sudden change of position of the load, operate all lift, tilt and attachment controls smoothly.

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

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

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

Tilt Control

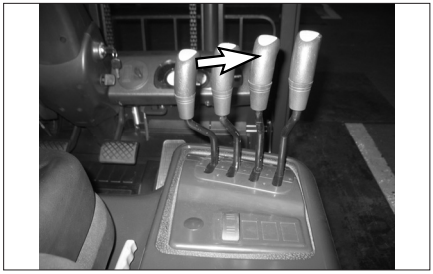


1. Mast Tilt Forward - Push the lever FORWARD smoothly to tilt the mast forward.

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

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

Sideshift Attachment Control (If Equipped)



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

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

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

Refueling

Gasoline or Diesel Engine Equipped

⚠ WARNING

Explosive fumes may be present during refueling. Do not smoke in refueling areas.

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

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

NOTICE

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

Fill the fuel tank at the end of each day of operation to drive out moisture laden air and to prevent condensation. In the cold weather, the moisture condensation can cause rust in the fuel system and hard starting due to its freezing. Do not fill the tank to the top. Fuel expands when it gets warm and may overflow.

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

2. Remove the filler cap.

3. Fill the fuel tank slowly. Install the filler cap. If spillage occurs, wipe off excess fuel and wash down area with water.

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

Changing LP-Gas Tanks

⚠ WARNING

Only trained, authorised personnel should fill or exchange LP-Gas tanks.

Personnel engaged in filling of LP-Gas containers should wear protective clothing such as face shield, long sleeves and gauntlet gloves.

Do not refuel or store LP-Gas powered lift trucks near any underground entrance, elevator shafts or any other place where LP-Gas could collect in a pocket causing a potentially dangerous condition.

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

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

Explosive fumes may be present during refueling.

Do not smoke in refueling areas.

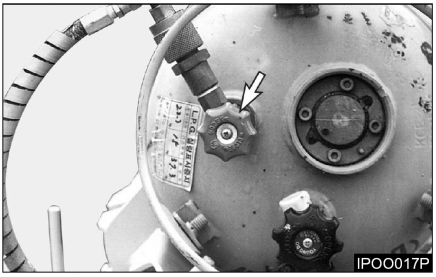
Lift truck should be refueled only at designated safe locations. Safe outdoor locations are preferable to indoor locations.

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

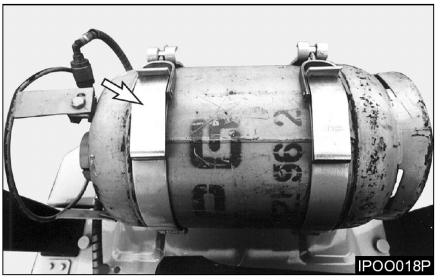
The careless handling of LP-Gas containers can result in a serious accident.

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.



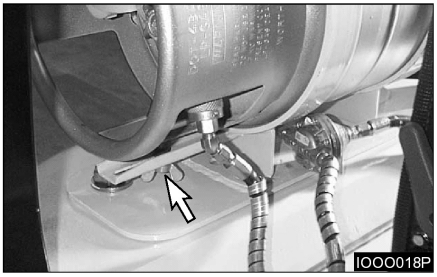
2. Close the fuel shut off valve at the LP - Gas tank. Run the engine until it stops, then turn off the ignition switch and electrical disconnect the switch (if equipped).
3. Disconnect the fuel supply line.



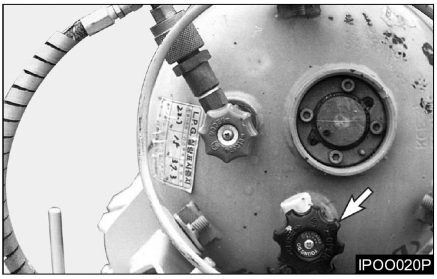
4. Loosen the retaining clamps and remove the tank.
5. Check the mounting to be sure the locating pin (dowel) is not missing or broken.

NOTICE

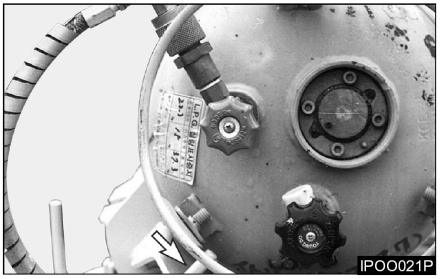
If the location pin (dowel) is missing or broken, be sure the pin is replaced.



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



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



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

⚠ WARNING

The LP-Gas tank must not extend past the counterweight.

12. Clamp the tank securely.
13. Connect the fuel supply line.
14. 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.
15. Inspect the LP-Gas fuel lines and fittings with a soap solution after filling the tank or when looking for leaks.

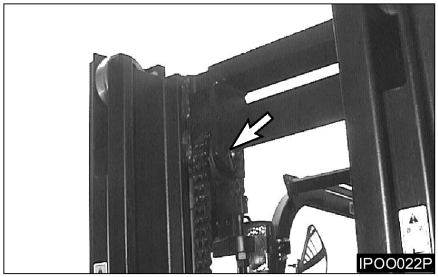
Before Starting the Engine

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 and cut or gouged tyres. Check condition of tyres, mast, carriage, forks or attachments. Have repairs made as needed and all debris removed.

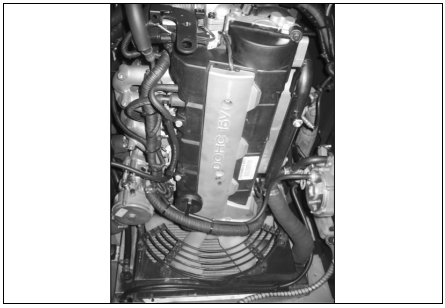
Before starting the gas engine, push the accelerator pedal all the way down once and then slowly it to set the automatic choke.

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.



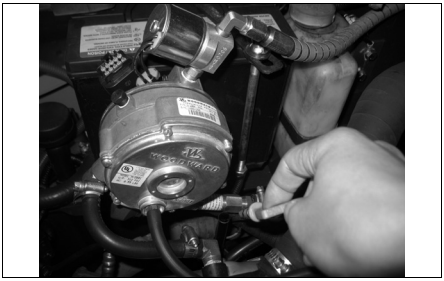
4. Inspect the mast and lift chains for wear, broken links, pins and loose rollers.
5. Inspect the carriage, forks or attachments for wear, damage and loose or missing bolts.
6. Inspect the tyres and wheels for cuts, gouges, foreign objects, inflation pressure and loose or missing bolts.

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



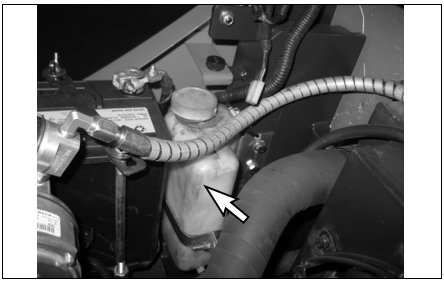
Typical Example

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



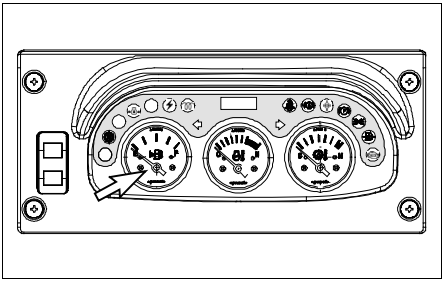
Typical Example

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

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.



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.

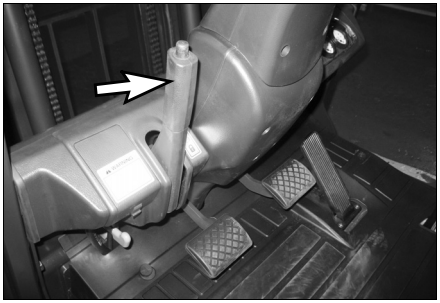
Seat adjustment must be done at the beginning of each shift and when operators change.

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

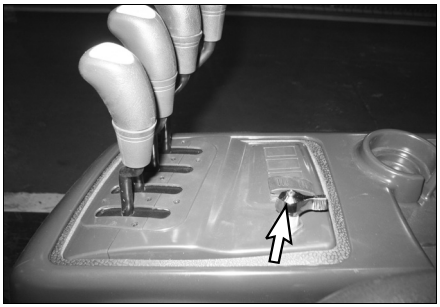
Starting the Engine

Prestart Conditions

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



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



2. Lift trucks equipped with electrical disconnect switches ; the engine will not start unless the disconnect switch is in the ON (closed) position. Before starting, turn the disconnect switch to the OFF (open) position.

NOTICE

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

Gasoline Engine

NOTICE

Do not leave the key in ON position when engine is not running.

Do not engage the starter more than 10 seconds at any one time

1. Don't press accelerator pedal and turn the ignition switch to the START position.

2. Once the engine starts, release the ignition switch.

3. If the engine does not start, repeat step 1.

4. If engine coolant is cold, engine speed could be higher than low idle speed. Don't drive forklift until engine speed becomes normal low idle speed.

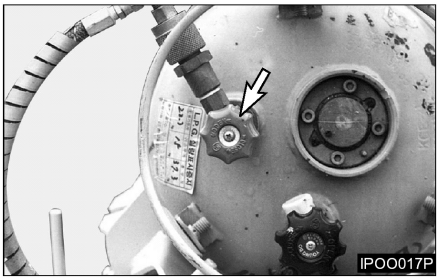
NOTICE

If the inside of engine cylinder is wet by gasoline, the engine could not start. In this case, press accelerator pedal fully and turn the ignition switch to ON position for 10 seconds. The inside of cylinder would be dry because ECM does not allow gasoline fuel injection. Repeat it three times. Don't press accelerator pedal and turn the ignition switch to the START position to start engine.

LP-Gas Engine

⚠ WARNING

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



1. Turn the tank fuel valve ON by slowly turning the valve counterclockwise. Observe the LP – Gas gauge (if equipped).
2. Don't press accelerator pedal, and turn the ignition switch to the START position.
3. Once the engine starts, release the ignition switch.
4. If the engine does not start, repeat step 2.
5. If engine coolant is cold, engine speed could be higher than normal low idle speed. Don't drive forklift until engine speed becomes normal low idle speed.

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 a Warm Diesel Engine (Mechanical Engine)

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

Starting From a 12 Volt External Source

⚠ WARNING

Sparks occurring near the battery could cause vapors to explode.

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

Typical Example

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(-).

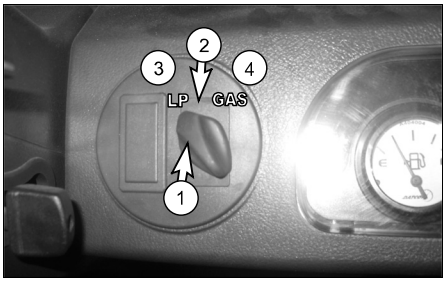
Attach ground cable last, remove first. All lift trucks equipped with CROWN built internal combustion engines are NEGATIVE(-) ground.

G424I Dual Fuel System (If Equipped)

Changing From Gasoline to LP - Gas

NOTE : The Underwriter's Laboratory (U.L.) requires that the gasoline tank must be at least one - quarter full when operating on LP - Gas. This will allow the lift truck to be restarted on gasoline and moved to an approved refueling area, when operating in a hazardous area.

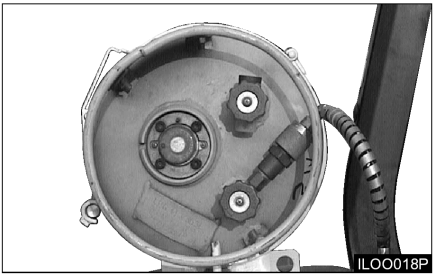
1. Park the lift truck level in an authorised refueling area with the forks lowered, the parking brake applied, the transmission in NEUTRAL and the engine running.



Typical Example

2. Move lever (1), on the fuel selector switch to the OFF(2) position. Leave lever (1) in this position until the engine stops.

3. Move lever (1) to the LPG (3) position.

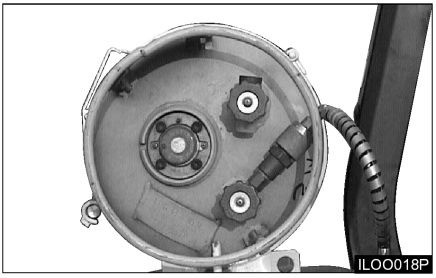


4. Open the fuel valve, on the LP - Gas tank, by slowly turning the valve counterclockwise.

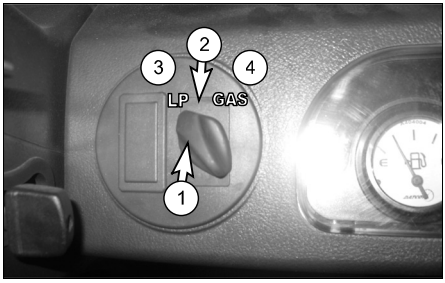
5. Turn the ignition switch key to the OFF position and then to the START position to start the engine. Release it when the engine starts.

Changing From LP - Gas to Gasoline

1. Park the lift truck level in an authorised refueling area with the forks lowered, the parking brake applied, the transmission in NEUTRAL and the engine running.



2. Close the fuel valve on the LP - Gas tank.



Typical Example

3. Move lever (1) from the LPG (3) position to the OFF (2) position. Allow the engine to run until the fuel in the line runs out and engine stops.

4. Move lever (1) to the GAS (4) position.

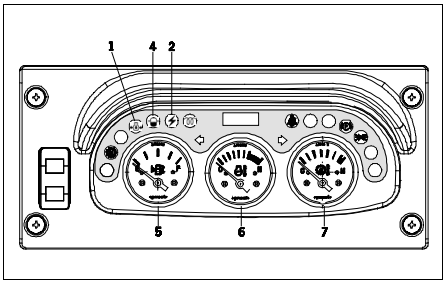
5. Turn the ignition switch key to the OFF position.

6. Turn the ignition switch key to the START position and start the engine. Release it when the engine starts.

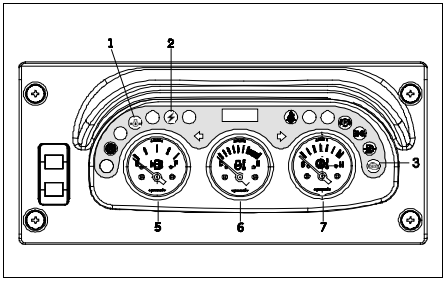
After Starting the Engine

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

Diesel (12V)



LPG/GAS (12V)



1. 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.

2. The alternator indicator light (2), should not come ON during normal operation. The alternator is not producing the sufficient voltage to charge the battery if the light comes ON with the engine running.

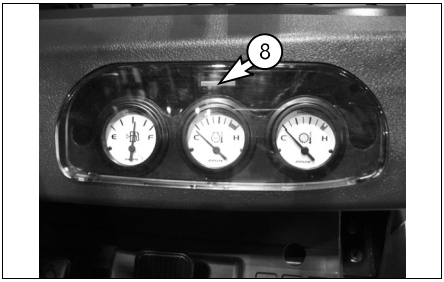
3. The Spark-ignition G424I(E) engine MIL (Malfunction Indicator Light) (3) will not come ON with the engine running, unless the fault or faults are stored in the memory of the engine control module (ECM). Stop the engine and check the electric engine control system if the light comes ON. Refer G424I(E) Engine of this section.

4. The diesel engine water in fuel filter indicator light(4), will not come ON with the engine running, unless water in fuel filter exceeds 100cc. Stop the engine immediately and drain the water if the light comes ON.

5. Observe the fuel level gauge (5) for fuel level in the tank.

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

7. The transmission oil temperature gauge pointer (7), will be in the green band with the engine running, unless the oil temperature is excessive.

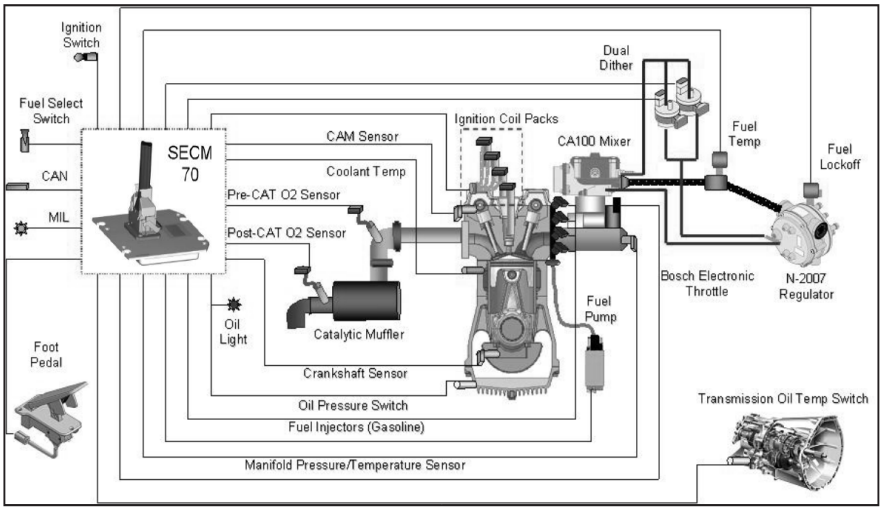


8. Observe the hour meter(8) make sure it is operating properly.

Electronic Controlled Spark-Ignition Engines

HMC2.4L Certified Engine

EMS (Engine management system) of HMC2.4L engine is a closed loop system utilizing a 3-way catalytic muffler to reduce the emission level in the exhaust gas. In order to obtain maximum effect from the catalyst, an accurate control of the air fuel ratio is required. A small engine control module (SECM) uses two heated exhaust gas oxygen sensors (HEGO) in the exhaust system to monitor exhaust gas content. One HEGO is installed in front of the catalytic muffler and one is installed after the catalytic muffler.



EMS schematic of HMC2.4L certified engine

The SECM makes any necessary corrections to the air fuel ratio by controlling the inlet fuel pressure to the air/fuel mixer by modulating the dual fuel trim valves (FTV) connected to the regulator. Reducing the fuel pressure leans the air/fuel mixture and increasing the fuel pressure enriches the air/fuel mixture. To calculate any necessary corrections to the air fuel ratio, the SECM uses a number of different sensors to gain information about the engine's performance. Engine speed is monitored by the SECM through a variable reluctance (VR) or Hall Effect sensor. Intake manifold air temperature and absolute pressure are monitored with a TMAP sensor. MI-21 is a drive-by-wire (DBW) system connecting the accelerator pedal to the electronic throttle through the electrical harness; mechanical cables are not used. A throttle position sensor (TPS) monitors throttle position in relation to the accelerator pedal position sensor (APP) command.

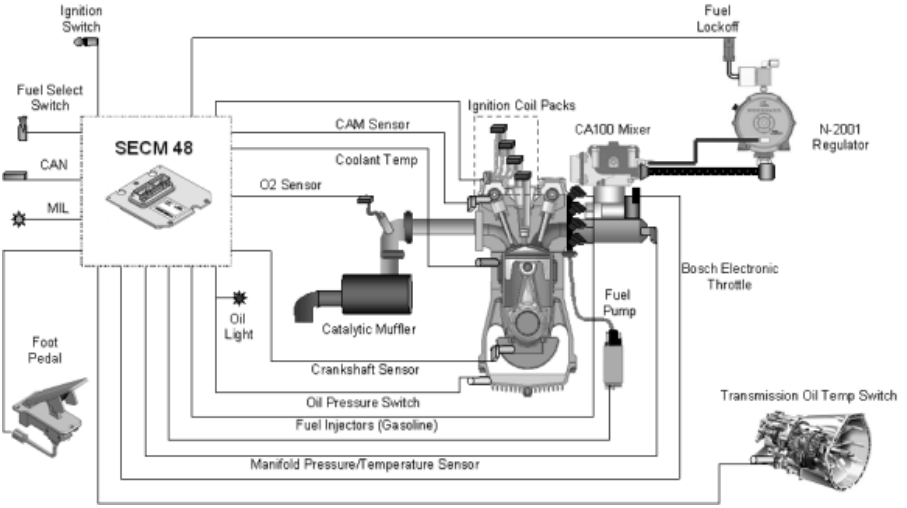
Engine coolant temperature and adequate oil pressure are monitored by the SECM. The SECM controller has full adaptive learning capabilities, allowing it to adapt control function as operating conditions change. Factors such as ambient temperature, fuel variations, ignition component wear, clogged air filter, and other operating variables are compensated.

MPI (multi-point injection) is used for this system. Fuel injection pressure and flow rate depend on engine-specific fuel injection requirements. A variety of regulators and injectors can be used to fit individual needs. The gasoline fuel pressure regulator is a one-way, non-return configuration. All gasoline specific components are automotive production parts and validated to strict automotive standards. Four (4) sequential injection channels are supported.

G424I Engine

EMS (Engine management system) of G424I engine is an open loop LP system and/or closed loop gasoline system. 3-way catalytic muffler is not used for this system.

LPG regulator and the mixer are operated in open loop as no mixture adjustments are made by the SECM. Manifold pressure from the TMAP, rpm from the crank position sensor and throttle position is used by the SECM to calculate load. Feedback from the electronic throttle is still provided to the SECM by the throttle position sensors (TPS).



EMS schematic of G424I Dual Fuel engine

Basic Troubleshooting (LP)

The MI-21(HMC2.4L), MI-07(G424I) 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 Small Engine Control Module (SECM). 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.

Problem	Probable Cause	Corrective Action
Engine Cranking but Will Not Start	Fuel container empty	Fill fuel container • Do not exceed 80% of liquid capacity
	Liquid valve closed	Slowly open liquid valve
	Excess flow valve closed	Reset excess flow valve • Close liquid valve • Wait for a “click” sound • Slowly open liquid valve
	Plugged fuel line	Remove obstruction from the fuel line • Close liquid fuel valve • Using caution, disconnect the fuel line (some propane may escape) • Clear obstruction with compressed air • Re-connect fuel line • Slowly open liquid fuel valve • Leak test
	Broken Fuse - SECM	Replace Fuse for SECM • See Maintenance Section, Fuses replacement
	Clogged fuel filter	Repair/replace as required • *See Maintenance Section, LP Fuel Filter replacement*
	Faulty vapor connection between the pressure regulator/converter and the mixer	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Fuel Lock-off malfunction	Repair/replace Fuel Lock-off • *See Engine Service Manual*
	Pressure regulator/converter malfunction	Test pressure regulator/converter operation • *See Engine Service Manual*
	Incorrect air/fuel or ignition/spark control	See Advanced Diagnostics
	No VR Sensor Signal	Verify the VR signal is present • *See Advanced Diagnostics*

Problem	Probable Cause	Corrective Action
Difficult to Start	Fuel container almost empty	LPG Vapor from liquid outlet • Fill fuel container • Do not exceed 80% of liquid capacity
	Excess flow valve closed	Reset excess flow valve • Close liquid valve • Wait for a “click” sound Slowly open liquid valve
	Clogged fuel filter	Repair/replace as required • *See Maintenance Section, LP Fuel Filter replacement*
	Plugged fuel line	Remove obstruction from the fuel line • Close liquid fuel valve • Using caution, disconnect the fuel line (some propane may escape) • Clear obstruction with compressed air • Re-connect fuel line • Slowly open liquid fuel valve • Leak test
	Faulty vapor connection between the pressure regulator/converter and the mixer	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Pressure regulator/converter malfunction	Test pressure regulator/converter operation • *See Engine Service Manual*
	Fuel container almost empty	LPG Vapor from liquid outlet • Fill fuel container • Do not exceed 80% of liquid capacity
	Air filter clogged	Check air filter • Clean/replace as required
	Incorrect air/fuel or ignition control	See Advanced Diagnostics
	Engine Mechanical	See Engine Service Manual

Problem	Probable Cause	Corrective Action
Will Not Run Continuously	Fuel container almost empty	LPG Vapor from liquid outlet • Fill fuel container • Do not exceed 80% of liquid capacity
	Excess flow valve closed	Reset excess flow valve • Close liquid valve • Wait for a “click” sound Slowly open liquid valve
	Clogged fuel filter	Repair/replace as required • *See Maintenance Section, LP Fuel Filter replacement*
	Plugged fuel line	Remove obstruction from the fuel line • Close liquid fuel valve • Using caution, disconnect the fuel line (some propane may escape) • Clear obstruction with compressed air • Re-connect fuel line • Slowly open liquid fuel valve & Leak test
	Pressure regulator freezes	Check level in cooling system • Must be full, check coolant strength • -35F minimum Check coolant hoses • Watch for kinks and/or pinched hoses • Verify one pressure hose and one return hose
	Fuel Lock-off malfunction	Repair/replace Fuel Lock-off • *See Engine Service Manual*
	Incorrect idle speed or ignition problem	See Advanced Diagnostics
	Engine Mechanical	See Engine Service Manual
Will Not Accelerate/Hesitation During Acceleration	Fuel container almost empty	LPG Vapor from liquid outlet • Fill fuel container • Do not exceed 80% of liquid capacity
	Excess flow valve closed	Reset excess flow valve • Close liquid valve • Wait for a “click” sound Slowly open liquid valve

Problem	Probable Cause	Corrective Action
Will Not Accelerate/Hesitation During Acceleration	Clogged fuel filter	Repair/replace as required • *See Maintenance Section, LP Fuel Filter replacement*
	Faulty vapor connection between the pressure regulator/converter and the mixer	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Throttle butterfly valve not opening or sticking	See Advanced Diagnostics
	Foot Pedal signal incorrect or intermittent	
	Incorrect air/fuel or ignition control	
	Engine Mechanical	See Engine Service Manual
Engine Stalls	Fuel container almost empty	LPG Vapor from liquid outlet • Fill fuel container • Do not exceed 80% of liquid capacity
	Excess flow valve closed	Reset excess flow valve • Close liquid valve • Wait for a “click” sound Slowly open liquid valve
	Clogged fuel filter	Repair/replace as required • *See Maintenance Section, LP Fuel Filter replacement*
	Plugged fuel line	Remove obstruction from the fuel line • Close liquid fuel valve • Using caution, disconnect the fuel line (some propane may escape) • Clear obstruction with compressed air • Re-connect fuel line • Slowly open liquid fuel valve & Leak test

Problem	Probable Cause	Corrective Action
Engine Stalls	Fuel Lock-off malfunction	Repair/replace Fuel Lock-off • *See Engine Service Manual*
	Faulty vapor connection between the pressure regulator/converter and the mixer	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Pressure regulator freezes	Check level in cooling system • Must be full, check coolant strength • -35F minimum • Check coolant hoses • Watch for kinks and/or pinched hoses • Verify one pressure hose and one return hose
	Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Vacuum leak	Check for vacuum leaks • Between mixer and throttle body • Between throttle body and intake manifold • Between intake manifold and cylinder head
	Air/Fuel Mixer malfunction	Check mixer • *See Engine Service Manual*
	Engine Mechanical	See Engine Manufacturers Service Manual
Rough Idle	Faulty vapor connection between the pressure regulator/converter and the mixer	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Vacuum leak	Check for vacuum leaks • Between mixer and throttle body • Between throttle body and intake manifold • Between intake manifold and cylinder head
	Air/Fuel Mixer malfunction	Check mixer • *See Engine Service Manual*

Problem	Probable Cause	Corrective Action
Rough Idle	Incorrect Idle speed control	See Advanced Diagnostics & See Engine Service Manual
	Incorrect timing or spark control	
	Engine Mechanical	See Engine Service Manual
High Idle Speed	Incorrect Idle speed control	See Advanced Diagnostics & See Engine Service Manual
	Throttle sticking	
	Foot pedal sticking or incorrect pedal signal	Check pedal return spring travel for binding • *See Advanced Diagnostics*
Poor High Speed Performance	Clogged fuel filter	Repair/replace as required • *See Maintenance section, Fuel Filter replacement*
	Plugged fuel line	Remove obstruction from the fuel line • Close liquid fuel valve • Using caution, disconnect the fuel line (some propane may escape) • Clear obstruction with compressed air • Re-connect fuel line • Slowly open liquid fuel valve & Leak test
	Air filter clogged	Check air filter • Clean/replace as required
	Faulty vapor connection between the pressure regulator/converter and the mixer	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Air/Fuel Mixer malfunction	Check mixer • *See Engine Service Manual*
	Restricted exhaust system	Check exhaust system • Measure exhaust back pressure
	Incorrect ignition control	See Advanced Diagnostics & See Engine Service Manual
	Incorrect air/fuel control	
	Incorrect throttle position	

Problem	Probable Cause	Corrective Action
Excessive Fuel Consumption/LPG Exhaust Smell	Air/Fuel Mixer malfunction	Check mixer • *See Engine Service Manual*
	Air filter clogged	Check air filter • Clean/replace as required
	Vacuum leak	Check system vacuum hoses from regulator to FTV and mixer • Repair/replace as necessary
	Pressure regulator malfunction/fuel pressure too high	Test pressure regulator operation • *See Engine Service Manual*
	Faulty FTV	Check FTV for housing cracks or obstructions • *See Advanced Diagnostics FTV operation* • Repair and/or replace as necessary
	Weak ignition and/or spark control	See Advanced Diagnostics
	Incorrect air/fuel control	See Advanced Diagnostics
	Exhaust system leaks	Repair exhaust system
	Oxygen sensor failure	Replace as necessary • *See Advanced Diagnostics*

Basic Troubleshooting (Gasoline)

Problem	Probable Cause	Corrective Action
Engine Cranking but Will Not Start (Gas)	Fuel tank empty	Fill fuel container • The tank should be at least ¼ full to properly prime the fuel pump. • Fuel select switch is not on GAS
	Clogged fuel filter	Repair/replace as required • *See Maintenance section Primary and Secondary Fuel Filter replacement*
	Faulty vapor connection between the pressure regulator/ converter and the mixer (LP)	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Electric Fuel Pump malfunction (GAS)	Check electrical connection • Check Relay and fuse Turn key ON and verify pump is operating
	Fuel Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Fuel Injector malfunction	Test Injector operation • *See Engine Service Manual*
	Incorrect air/fuel or ignition/ spark control	See Advanced Diagnostics
	No VR Sensor Signal	Verify the VR signal is present • *See Advanced Diagnostics*

Problem	Probable Cause	Corrective Action
Difficult to Start (Gas)	Fuel tank almost empty	Fuel Pump Cavitations • The tank should be at least ¼ full to properly prime the fuel pump • Fuel select switch is not on GAS
	Clogged fuel filter	Repair/replace as required • *See Maintenance section, Primary and Secondary Fuel Filter replacement*
	Electric Fuel Pump malfunction (GAS)	Check electrical connection • Check Relay and fuse Turn key ON and verify pump is operating • *See Engine Service Manual*
	Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Fuel Injector malfunction	Test Injector operation • *See Engine Service Manual*
	Air filter clogged	Check air filter • Clean/replace as required
	Incorrect air/fuel or ignition control	See Advanced Diagnostics
	Engine Mechanical	See Engine Service Manual
Will Not Run Continuously (Gas)	Isolate the gasoline system by running the lift truck on LP	Verify LPG cylinder is full and valve is open. If the problem does not exist in LPG mode proceed with the corrective action steps below. If the problem also exists in LPG mode then the root cause is most likely to be something other than the fuel system • *See Advanced Diagnostics*
	Fuel tank almost empty	Fuel Pump Cavitations • The tank should be at least ¼ full to properly prime the fuel pump
	Clogged fuel filter	Repair/replace as required • *See Maintenance section, Primary and Secondary Fuel Filter replacement*

Problem	Probable Cause	Corrective Action
Will Not Run Continuously (Gas)	Electric Fuel Pump malfunction (GAS)	Check electrical connection • Check Relay and fuse • Turn key ON and verify pump is operating • *See Engine Service Manual*
	Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Fuel Injector malfunction	Test Injector operation • *See Engine Service Manual*
	Incorrect idle speed or ignition problem	See Advanced Diagnostics
	Engine Mechanical	See Engine Service Manual
Will Not Accelerate/Hesitation During Acceleration or Engine Stalls (Gas)	Isolate the gasoline system by running the lift truck on LPG	Verify LPG cylinder is full and valve is open. If the problem does not exist in LPG mode proceed with the corrective action steps below. If the problem also exists in LPG mode then the root cause is most likely to be something other than the fuel system • *See Advanced Diagnostics*
	Fuel tank almost empty	Fuel Pump Cavitations • The tank should be at least ¼ full to properly prime the fuel pump
	Clogged fuel filter	Repair/replace as required • *See Maintenance section, Primary and Secondary Fuel Filter replacement*
	Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Fuel Injector malfunction	Test Injector operation

Problem	Probable Cause	Corrective Action
Will Not Accelerate/Hesitation During Acceleration or Engine Stalls (Gas)	Throttle butterfly valve not opening or sticking	See Advanced Diagnostics
	Foot Pedal signal incorrect or intermittent	
	Incorrect air/fuel or ignition control	
	Engine Mechanical	See Engine Service Manual
Rough Idle (Gas)	Isolate the gasoline system by running the lift truck on LPG	Verify LPG cylinder is full and valve is open. If the problem does not exist in LPG mode proceed with the corrective action steps below. If the problem also exists in LPG mode then the root cause is most likely to be something other than the fuel system • *See Advanced Diagnostics & Service Manual*
	Pressure regulator malfunction	Test pressure regulator operation *See Engine Service Manual*
	Clogged fuel filter	Repair/replace as required • *See Maintenance section, Primary and Secondary Fuel Filter replacement*
	Pressure regulator malfunction	Test pressure regulator operation • *See Engine Service Manual*
	Fuel Injector malfunction	Test Injector operation • *See Engine Service Manual*
	Vacuum leak	Check for vacuum leaks • Between mixer and throttle body • Between throttle body and intake manifold • Between intake manifold and cylinder head

Problem	Probable Cause	Corrective Action
Rough Idle (Gas)	Incorrect Idle speed control	See Advanced Diagnostics & Engine Service Manual
	Incorrect timing or spark control	
	Engine Mechanical	See Engine Service Manual
High Idle Speed (Gas)	Incorrect Idle speed control	See Advanced Diagnostics & Engine Service Manual
	Throttle sticking	
	Foot pedal sticking or incorrect pedal signal	Check pedal return spring travel for binding See Advanced Diagnostics

Problem	Probable Cause	Corrective Action
Poor High Speed Performance (Gas)	Isolate the gasoline system by running the lift truck on LPG	Verify LPG cylinder is full and valve is open. If the problem does not exist in LPG mode proceed with the corrective action steps below. If the problem also exists in LPG mode then the root cause is most likely to be something other than the fuel system • See Advanced Diagnostics & Dual Fuel Engine Service Manual
	Clogged fuel filter	Repair/replace as required • *See Maintenance section, Fuel Filter replacement*
	Plugged fuel line	Remove obstruction from the fuel line • Close liquid fuel valve • Using caution, disconnect the fuel line (some propane may escape) • Clear obstruction with compressed air • Re-connect fuel line • Slowly open liquid fuel valve & Leak test
	Air filter clogged	Check air filter Clean/replace as required
	Faulty vapor connection between the pressure regulator/converter and the mixer	Check connection • Verify no holes in hose • Clamps must be tight • Look for kinked, pinched and/or collapsed hose
	Pressure regulator malfunction	Test pressure regulator operation • See Dual Fuel Engine Service Manual

Problem	Probable Cause	Corrective Action
Poor High Speed Performance (Gas)	Air/Fuel Mixer malfunction	Check mixer • *See Engine Service Manual*
	Restricted exhaust system	Check exhaust system • *Measure exhaust back pressure*
	Incorrect ignition control	See Advanced Diagnostics & Engine Service Manual
	Incorrect air/fuel control	
	Incorrect throttle position	

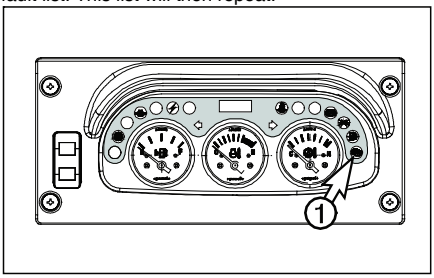
Advanced Diagnostics for HMC2.4L Engines

MI-21 systems are equipped with built-in fault diagnostics. Detected system faults can be displayed by the Malfunction Indicator Lamp (MIL) as Diagnostic Fault Codes (DFC) or flash codes, and viewed in detail with the use of the Service Tool software. When the ignition key is turned on, the MIL will illuminate and remain on until the engine is started. Once the engine is started, the MIL lamp will go out unless one or more fault conditions are present. If a detected fault condition exists, the fault or faults will be stored in the memory of the small engine control module (SECM). Once an active fault occurs the MIL will illuminate and remain ON. This signals the operator that a fault has been detected by the SECM.

Reading Diagnostic Fault Codes

All MI-21 fault codes are three-digit codes. When the fault codes are retrieved (displayed) the MIL will flash for each digit with a short pause (0.5 seconds) between digits and a long pause (1.2 seconds) between fault codes. A code 12 is displayed at the end of the code list.

EXAMPLE: A code 461 (ETCSticking) has been detected and the engine has shut down and the MIL has remained ON. When the codes are displayed the MIL will flash four times (4), pause, then flash six times (6), pause, then flash one time (1) This identifies a four sixty one (461), which is the ETCSticking fault. If any additional faults were stored, the SECM would again have a long pause, then display the next fault by flashing each digit. Since no other faults were stored there will be a long pause then one flash (1), pause, then two flashes (2). This identifies a twelve, signifying the end of the fault list. This list will then repeat.



(1) Malfunction Indicator Lamp(MIL) for Engine control system.

Displaying Fault Codes (DFC) from SECM Memory

To enter code display mode you must turn OFF the ignition key. Now turn ON the key but do not start the engine. As soon as you turn the key to the ON position you must cycle the foot pedal by depressing it to the floor and then fully releasing the pedal (pedal maneuver). You must fully cycle the foot pedal three (3) times within five (5) seconds to enable the display codes feature of the SECM. Simply turn the key OFF to exit display mode. The code list will continue to repeat until the key is turned OFF.

MI-21 Diagnostic Fault Codes (Flash Codes)

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
131	**Inj1Fault** Fuel Injector 1 open circuit, broken injector 1 wire or defective injector	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) DelayedEngine Shutdown (4) CheckEngineLight	Check INJ1 wiring for an open circuit SECM (Signal) Pin#34 to Injector 1 Pin A Switched 12V to Injector 1 Pin B Check that Injector 1 Resistance is, 13 to 16 ohms @68°F(20°C)
132	**Inj2Fault** Fuel Injector 2 open circuit, broken injector 2 wire or defective injector	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) DelayedEngine Shutdown (4) CheckEngineLight	Check INJ2 wiring for an open circuit SECM (Signal) Pin#35 to Injector 2 Pin A Switched 12V to Injector 2 Pin B Check that Injector 2 Resistance is, 13 to 16 ohms @68°F(20°C)
133	**Inj3Fault** Fuel Injector 3 open circuit, broken injector 3 wire or defective injector	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) DelayedEngine Shutdown (4) CheckEngineLight	Check INJ3 wiring for an open circuit SECM (Signal) Pin#1 to Injector 3 Pin A Switched 12V to Injector 3 Pin B Check that Injector 3 Resistance is, 13 to 16 ohms @68°F(20°C)
134	**Inj4Fault** Fuel Injector 4 open circuit, broken injector 4 wire or defective injector	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) DelayedEngine Shutdown (4) CheckEngineLight	Check INJ4 wiring for an open circuit SECM (Signal) Pin#12 to Injector 4 Pin A Switched 12V to Injector 4 Pin B Check that Injector 4 Resistance is, 13 to 16 ohms @68°F(20°C)
141 (14)	**ECTRangeLow** Coolant Sensor failure or shorted to GND	(1) TurnOnMIL (2) CheckEngineLight (3) DelayedEngine Shutdown	Check ECT sensor connector and wiring for a short to GND SECM (Signal) Pin#40 To ECT Pin 2 SECM (Sensor GND) Pin#32 to ECT Pin 1 SECM (System GND) Pin#32, Pin#69 (or 70)
151 (15)	**ECTRangeHigh** Coolant sensor disconnected or open circuit	(1) TurnOnMIL (2) CheckEngineLight (3) DelayedEngine Shutdown	Check if ECT sensor connector is disconnected or for an open ECT circuit SECM (Signal) Pin#40 to ECT Pin 2 SECM (Sensor GND) Pin#32 to ECT Pin 1
161 (16)	**ECTOverTempFault** Engine coolant temperature is high. The sensor has measured an excessive coolant temperature typically due to the engine overheating.	(1) TurnOnMIL (2) CheckEngineLight (3) DelayedEngine Shutdown	Check coolant system for radiator blockage, proper coolant level and for leaks in the system. Possible ECT short to GND, check ECT signal wiring SECM (Signal) Pin#40 to ECT Pin 2 SECM (Sensor GND) Pin#32 to ECT Pin 1 SECM (System GND) Pin#32, Pin#69 (or 70) Check regulator for coolant leaks

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
171	**ECT_IR_Fault** Engine coolant temperature not changing as expected	(1) TurnOnMIL (2) CheckEngineLight	Check for coolant system problems, e.g. defective or stuck thermostat
181	**FuelSelectConflict** Conflict in fuel select signals, normally set if both of the fuel select signals are shorted to ground	(1) TurnOnMIL (2) CheckEngineLight (3) DelayedEngine Shutdown	Check fuel select switch connection for a short to GND SECM (Gas Fuel Signal) Pin#27 SECM (Liquid Fuel Signal) Pin#29 SECM (Sensor GND) Pin#32
191	**CamEdgesFault** No CAM signal when engine is known to be rotating, broken crankshaft sensor leads or defective CAM sensor	(1) TurnOnMIL (2) CheckEngineLight	Check CAM sensor connections SECM (SIGNAL) Pin#30 to CAM sensor Pin 2 SECM (Sensor GND) Pin#32 to CAM sensor Pin 1 Switched 12V to CAM sensor Pin 3 Check for defective CAM sensor
192	**CamSyncFault** Loss of synchronization on the CAM sensor, normally due to noise on the signal or an intermittent connection on the CAM sensor	(1) TurnOnMIL (2) CheckEngineLight	Check CAM sensor connections SECM (SIGNAL) Pin#30 to CAM sensor Pin 2 SECM (Sensor GND) Pin#32 to CAM sensor Pin 1 Switched 12V to CAM sensor Pin 3 Check for defective CAM sensor
193	**CrankEdgesFault** No crankshaft signal when engine is known to be rotating, broken crankshaft sensor leads or defective crank sensor	(1) TurnOnMIL (2) CheckEngineLight	Check Crankshaft sensor connections SECM (SIGNAL) Pin#31 to Crank sensor Pin 2 SECM (Sensor GND) PIN#32 to Crank sensor Pin 1 Switched 12V to Crank sensor Pin 3 Check for defective Crank sensor
194	**CrankSyncFault** Loss of synchronization on the crankshaft sensor, normally due to noise on the signal or an intermittent connection on the crankshaft sensor	(1) TurnOnMIL (2) CheckEngineLight	Check Crankshaft sensor installation if sensor sifts from correct position Check CAM sensor installation if sensor sifts from correct position Check CAM encoder installation if encoder sifts from correct position Check Crank encoder for mechanical damage Check CAM encoder for mechanical damage

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
221 (22)	**TPS1RangeLow** TPS1 sensor voltage out of range low, normally set if the TPS1 signal has shorted to ground, circuit has opened or sensor has failed	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector connection and TPS1 sensor for an open circuit or short to GND SECM Pin#28 (signal) to ETC Pin 6 SECM Pin#48 (sensor5V) to ETC Pin 3 SECM Pin#32 (sensor GND) to ETC Pin 2 SECM (system GND) Pin#69, 70
222	**TPS2RangeLow** TPS2 sensor voltage out of range low, normally set if the TPS2 signal has shorted to ground, circuit has opened or sensor has failed	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector connection and TPS2 sensor for an open circuit or short to GND SECM Pin#24 (signal) to ETC Pin 5 SECM Pin#32 (sensor GND) to ETC Pin 2 SECM (system GND) Pin#69, 70
231 (23)	**TPS1RangeHigh** TPS1 sensor voltage out of range high, normally set if the TPS1 signal has shorted to power or the ground for the sensor has opened	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector and TPS1 sensor wiring for a shorted circuit SECM Pin#28 (signal) to ETC Pin 6 SECM Pin#32 (sensor GND) to ETC Pin 2
232	**TPS2RangeHigh** TPS2 sensor voltage out of range high, normally set if the TPS2 signal has shorted to power or the ground for the sensor has opened	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector and TPS2 sensor wiring for a shorted circuit SECM Pin#24 (signal) to ETC Pin 5 SECM Pin#32 (sensor GND) to ETC Pin 2
241 (24)	**TPS1AdaptLoMin** Learned closed throttle end of TPS1 sensor range lower than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion. Check TPS1 voltage with minimum throttle position to find TPS1 drifting or mechanical failure
242	**TPS2AdaptLoMin** Learned closed throttle end of TPS2 sensor range lower than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion Check TPS2 voltage with minimum throttle position to find TPS2 drifting or mechanical failure
251 (25)	**TPS1AdaptHiMax** Learned WOT end of TPS1 sensor range higher than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion. Check TPS1 voltage with minimum throttle position to find TPS1 drifting or mechanical failure
252	**TPS2AdaptHiMax** Learned WOT end of TPS2 sensor range higher than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion Check TPS2 voltage with minimum throttle position to find TPS2 drifting or mechanical failure

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
271	**TPS1AdaptHiMin** Learned WOT end of TPS1 sensor range lower than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion. Check TPS1 voltage with minimum throttle position to find TPS1 drifting or mechanical failure
272	**TPS2AdaptHiMin** Learned WOT end of TPS2 sensor range lower than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion Check TPS2 voltage with minimum throttle position to find TPS2 drifting or mechanical failure
281	**TPS1AdaptLoMax** Learned closed throttle end of TPS1 sensor range higher than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion. Check TPS1 voltage with minimum throttle position to find TPS1 drifting or mechanical failure
282	**TPS2AdaptLoMax** Learned closed throttle end of TPS2 sensor range higher than expected	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check throttle connector to find loose pin, damaged pin or corrosion Check TPS2 voltage with minimum throttle position to find TPS2 drifting or mechanical failure
291	**TPS_Sensors_Conflict** TPS sensors differ by more than expected amount **NOTE:** ***The TPS is not a serviceable item and can only be repaired by replacing the DV-EV throttle assembly.***	(1) TurnOnMIL (2) CutThrottle (3) CheckEngineLight	If DFC 221, 222, 231, 232, 241, 242, 251, 252, 271, 272, 281 or 282 occurred, resolve that fault before DFC291 troubleshooting. Check the throttle connector and pins for corrosion Check TPS1 voltage change with traveling throttle position to confirm TPS1 tracking with throttle position Check TPS2 voltage change with traveling throttle position to confirm TPS2 tracking with throttle position
292	**TPS_Intermittent** Signal from the SECM to the throttle position sensor power or ground is not continuous	(1) TurnOnMIL	Check the throttle connector and pins for corrosion. Check continuity between throttle body Pin 3 and SECM Pin#48 (XDPR +5Vdc) Check continuity between throttle body Pin 2 and SECM Pin#32 (sensor GND) Check continuity on TPS1: between throttle body Pin 6 and SECM Pin #28 Check continuity on TPS2: between throttle body Pin 5 and SECM Pin #24 *Note: move wires around when checking for continuity to duplicate intermittent signal

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
331 (33)	**MAPTimeRangeLow** Manifold Absolute Pressure sensor input is low, normally set if the TMAP pressure signal wire has been disconnected or shorted to ground or the circuit has opened to the SECM	(1) TurnOnMIL (2) CheckEngineLight	Check TMAP connector and MAP signal wiring for an open circuit TMAP Pin 4 to SECM Pin#44 (signal) TMAP Pin 1 to SECM Pin#32 (sensor GND) TMAP Pin 3 to SECM Pin#48 (XDRP +5 Vdc) Check the MAP sensor by disconnecting the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) [approx. 3.81kΩ ± 20% @68°F(20°C)] TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) [approx. 2.39kΩ ± 20% @68°F(20°C)]
332	**MAPRangeLow** Manifold Absolute Pressure sensor input is low, normally set if the TMAP pressure signal wire has been disconnected or shorted to ground or the circuit has opened to the SECM	(1) TurnOnMIL (2) EngineShutdown (3) CheckEngineLight	Check TMAP connector and MAP signal wiring for an open circuit TMAP Pin 4 to SECM Pin#44 (signal) TMAP Pin 1 to SECM Pin#32 (sensor GND) TMAP Pin 3 to SECM Pin#48 (XDRP +5 Vdc) Check the MAP sensor by disconnecting the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) [approx. 3.81kΩ ± 20% @68°F(20°C)] TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) [approx. 2.39kΩ ± 20% @68°F(20°C)]

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
341 (34)	**MAPTimeRangeHigh** Manifold Absolute Pressure Sensor Input is High, normally set if the TMAP pressure signal wire has become shorted to power, shorted to the IAT signal, the TMAP has failed or the SECM has failed.	(1) TurnOnMIL (2) CheckEngineLight	Check TMAP connector and MAP signal wiring for an open circuit TMAP Pin 4 to SECM Pin#44 (signal) TMAP Pin 1 to SECM Pin#32 (sensor GND) TMAP Pin 3 to SECM Pin#48 (XDRP +5 Vdc) Check the MAP sensor by disconnecting the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) [approx. 3.81kΩ ± 20% @68°F(20°C)] TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) [approx. 2.39kΩ ± 20% @68°F(20°C)]
342	**MAPRangeHigh** Manifold Absolute Pressure Sensor Input is High, normally set if the TMAP pressure signal wire has become shorted to power, shorted to the IAT signal, the TMAP has failed or the SECM has failed	(1) TurnOnMIL (2) EngineShutdown (3) CheckEngineLight	Check TMAP connector and MAP signal wiring for an open circuit TMAP Pin 4 to SECM Pin#44 (signal) TMAP Pin 1 to SECM Pin#32 (sensor GND) TMAP Pin 3 to SECM Pin#48 (XDRP +5 Vdc) Check the MAP sensor by disconnecting the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) [approx. 3.81kΩ ± 20% @68°F(20°C)] TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) [approx. 2.39kΩ ± 20% @68°F(20°C)]

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
351	**MAP_IR_HI** MAP sensor indicates higher pressure than expected	(1) TurnOnMIL (2) CheckEngineLight	Check for vacuum leaks. Check that TMAP sensor is mounted properly. Possible defective TMAP sensor.
352	**MAP_IR_LO** MAP sensor indicates lower pressure than expected	(1) TurnOnMIL (2) CheckEngineLight	Possible defective TMAP sensor.
353	**MAP_STICKING** MAP sensor not changing as expected	(1) TurnOnMIL (2) CheckEngineLight	Check that TMAP sensor is mounted properly. Possible defective TMAP sensor.
371 (37)	**IATRangeLow** Intake Air Temperature Sensor Input is Low normally set if the IAT temperature sensor wire has shorted to chassis ground or the sensor has failed.	(1) TurnOnMIL (2) CheckEngineLight	Check TMAP connector and IAT signal wiring for a shorted circuit TMAP Pin 2 to SECM Pin#39 (signal) TMAP Pin 1 to SECM Pin#32 (sensor GND) To check the IAT sensor of the TMAP disconnect the TMAP connector and measure the IAT resistance Resistance is approx 2400 ohms at room temperature @68°F(20°C)
381 (38)	**IATRangeHigh** Intake Air Temperature Sensor Input is High normally set if the IAT temperature sensor wire has been disconnected or the circuit has opened to the SECM.	(1) TurnOnMIL (2) CheckEngineLight	Check TMAP connector and IAT signal wiring for a shorted circuit TMAP Pin 2 to SECM Pin#39 (signal) TMAP Pin 1 to SECM Pin#32 (sensor GND) To check the IAT sensor of the TMAP disconnect the TMAP connector and measure the IAT resistance Resistance is approx 2400 ohms at room temperature @68°F(20°C)
391	**IAT_IR_Fault** Intake Air Temperature not changing as expected	(1) TurnOnMIL (2) CheckEngineLight	Check connections to TMAP sensor. Check that TMAP sensor is properly mounted to manifold.

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
421	**EST1_Fault** EST1 output open, possibly open EST1 signal or defective spark module	(1) TurnOnMIL (2) CheckEngineLight	Check coil driver wiring and connector for open circuit SECM Pin#6 (EST1) to OEM ignition system. See application note. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.
422	**EST2_Fault** EST2 output open, possibly open EST2 signal or defective spark module	(1) TurnOnMIL (2) CheckEngineLight	Check coil driver wiring and connector for open circuit SECM Pin#8 (EST2) to OEM ignition system. See application note. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.
423	**EST3_Fault** EST3 output open, possibly open EST3 signal or defective spark module	(1) TurnOnMIL (2) CheckEngineLight	Check coil driver wiring and connector for open circuit SECM Pin#11 (EST3) to OEM ignition system. See application note. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.
424	**EST4_Fault** EST4 output open, possibly open EST4 signal or defective spark module	(1) TurnOnMIL (2) CheckEngineLight	Check coil driver wiring and connector for open circuit SECM Pin#21 (EST4) to OEM ignition system. See application manual. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
461 (26)	**ETC_Sticking** Electronic Throttle Control is sticking. This can occur if the throttle plate (butterfly valve) inside the throttle bore is sticking. The plate sticking can be due to some type of obstruction, a loose throttle plate, or worn components shaft bearings. **NOTE:** ***The throttle assembly is not a serviceable item and can only be repaired by replacing the DV-EV throttle assembly.***	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle (4) EngineShutdown	Check for debris or obstructions inside the throttle body Perform the throttle test using the Service Tool and re-check for fault • Check throttle-plate shaft for bearing wear • Check the ETC driver wiring for an open circuit SECM Pin#52 to ETC + Pin 1 SECM Pin#51 to ETC - Pin 4 Check the ETC internal motor drive by disconnecting the throttle connector and measuring the motor drive resistance at the throttle TPS Pin 1 (+DRIVER) to Pin 4 (-DRIVER) - - Not open circuit (0L or $\infty\Omega$) - Not short coil (<1Ω)
471	**ETC_Open_Fault** Electronic Throttle Control Driver has failed, normally set if driver signals have failed open or become disconnected, electronic throttle or SECM is defective.	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check the ETC driver wiring for an open circuit SECM Pin#52 to ETC + Pin 1 SECM Pin#51 to ETC - Pin 4 Check the ETC internal motor drive by disconnecting the throttle connector and measuring the motor drive resistance at the throttle TPS Pin 1 (+DRIVER) to Pin 4 (-DRIVER) - Not open circuit (0L or $\infty\Omega$) - Not short coil (<1Ω)
481 (28)	**ETCSpringTest** Electronic Throttle Control Spring Return Test has failed. The SECM will perform a safety test of the throttle return spring following engine shutdown. If the drive mechanism is damaged, or the return spring has lost tension the throttle will fail the test and set the fault. **NOTE:** ***The throttle assembly is not a serviceable item and can only be repaired by replacing the DV-EV throttle assembly.***	(1) TurnOnMIL (2) CheckEngineLight (3) EngineShutdown	Perform throttle spring test by cycling the ignition key and re-check for fault

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
491 (29)	**HbridgeFault_ETC** Electronic Throttle Control Driver has failed. Indeterminate fault on Hbridge driver for electronic throttle control. Possibly either ETC+ or ETC- driver signals have been shorted to ground	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check ETC driver wiring for a shorted circuit SECM Pin#52 to ETC + Pin 1 SECM Pin#51 to ETC - Pin 4 • Perform the throttle test using the Service Tool and re-check for fault Check the ETC internal motor drive by disconnecting the throttle connector and measuring the motor drive resistance at the throttle TPS Pin 1 (+DRIVER) to Pin 4 (-DRIVER) - Not open circuit (0L or $\infty\Omega$) - Not short coil (<1Ω)
521 (52)	**LowOilPressureFault** Low engine oil pressure	(1) TurnOnMIL (2) DelayedEngine Shutdown (3) CutThrottle	Check engine oil level Check electrical connection to the oil pressure switch SECM Pin#59 to Oil Pressure Switch
531 (53)	**SysVoltRangeLow** System voltage too low	(1) TurnOnMIL (2) CheckEngineLight	Check battery voltage • Perform maintenance check on electrical connections to the battery and chassis ground • Check battery voltage during starting and with the engine running to verify charging system and alternator function • Measure battery power at SECM with a multimeter (with key on) SECM Pin#67 (DRVP) to SECM Pin#69(DRVG) SECM Pin#67 (DRVP) to SECM Pin#70 (DRVG)
541 (54)	**SysVoltRangeHigh** System voltage too high	(1) TurnOnMIL (2) CheckEngineLight (3) DelayedEngine Shutdown	Check battery voltage • Perform maintenance check on electrical connections to the battery and chassis ground • Check battery voltage during starting and with the engine running to verify charging system and alternator function • Measure battery power at SECM with a multimeter (with key on) SECM Pin#67 (DRVP) to SECM Pin#69(DRVG) SECM Pin#67 (DRVP) to SECM Pin#70 (DRVG)

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
551 (55)	**SensVoltRangeLow** Sensor reference voltage XDRP too low	(1) TurnOnMIL (2) CheckEngineLight (3) DelayedEngine Shutdown	Measure transducer power at the TMAP connector with a multimeter TMAP Pin 3 XDRP +5 Vdc to TMAP Pin 1 XDRG GND Verify transducer power at the SECM with a multimeter SECM Pin#48 +5 Vdc to SECM Pin#32 XDRG GND Verify transducer power to the foot pedal with a multimeter.
561 (56)	**SensVoltRangeHigh** Sensor reference voltage XDRP too high	(1) TurnOnMIL (2) CheckEngineLight (3) DelayedEngine Shutdown	Measure transducer power at the TMAP connector with a multimeter TMAP Pin 3 XDRP +5 Vdc to TMAP Pin 1 XDRG GND Verify transducer power at the SECM with a multimeter SECM Pin#48 +5 Vdc to SECM Pin#32 XDRG GND Verify transducer power to the foot pedal with a multimeter.
571 (57)	**HardOverspeed** Engine speed has exceeded the third level (3 of 3) of overspeed protection	(1) TurnOnMIL (2) HardRevLimit (3) CheckEngineLight (4) EngineShutdown	Usually associated with additional ETC faults • Check for ETC Sticking or other ETC faults Verify if the lift truck was motored down a steep grade
572	**MediumOverspeed** Engine speed has exceeded the second level (2 of 3) of overspeed protection	(1) TurnOnMIL (2) MediumRevLimit (3) CheckEngineLight (4) EngineShutdown	Usually associated with additional ETC faults • Check for ETC Sticking or other ETC faults Verify if the lift truck was motored down a steep grade
573	**SoftOverspeed** Engine speed has exceeded the first level (1 of 3) of overspeed protection	(1) TurnOnMIL (2) SoftRevLimit (3) CheckEngineLight (4) EngineShutdown	Usually associated with additional ETC faults • Check for ETC Sticking or other ETC faults Verify if the lift truck was motored down a steep grade

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
611 (61)	**APP1RangeLow** APP1 sensor voltage out of range low, normally set if the APP1 signal has shorted to ground, circuit has opened or sensor has failed	(1) TurnOnMIL (2) CheckEngineLight	Check foot pedal connector • Check APP1 signal at SECM PIN#22
612 (65)	**APP2RangeLow** APP2 sensor voltage out of range low, normally set if the APP2 signal has shorted to ground, circuit has opened or sensor has failed	(1) TurnOnMIL (2) CheckEngineLight	Check foot pedal connector • Check APP2 signal at SECM PIN#42
621 (62)	**APP1RangeHigh** APP1 sensor voltage out of range high, normally set if the APP1 signal has shorted to power or the ground for the sensor has opened	(1) TurnOnMIL (2) CheckEngineLight	Check foot pedal connector • Check APP1 signal at SECM PIN#22
622 (66)	**APP2RangeHigh** APP2 sensor voltage out of range high, normally set if the APP2 signal has shorted to power or the ground for the sensor has opened	(1) TurnOnMIL (2) CheckEngineLight	Check foot pedal connector • Check APP2 signal at SECM PIN#42
631 (63)	**APP1AdaptLoMin** Learned idle end of APP1 sensor range lower than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP1 signal at SECM Pin#22
632 (67)	**APP2AdaptLoMin** Learned idle end of APP2 sensor range lower than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP2 signal at SECM Pin#42
641 (64)	**APP1AdaptHiMax** Learned full pedal end of APP1 sensor range higher than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP1 signal at SECM Pin#22
642 (68)	**APP2AdaptHiMax** Learned full pedal end of APP2 sensor range higher than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP2 signal at SECM Pin#42
651	**APP1AdaptHiMin** Learned full pedal end of APP1 sensor range lower than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP1 signal at SECM Pin#22
652	**APP2AdaptHiMin** Learned full pedal end of APP2 sensor range lower than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP2 signal at SECM Pin#42
661	**APP1AdaptLoMax** Learned idle end of APP1 sensor range higher than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP1 signal at SECM Pin#22
662	**APP2AdaptLoMax** Learned idle end of APP2 sensor range higher than expected	(1) TurnOnMIL	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP2 signal at SECM Pin#42

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
691 (69)	**APP_Sensors_Conflict** APP position sensors do no not track well, intermittent connections to APP or defective pedal assembly	(1) TurnOnMIL (2) CheckEngineLight (3) CutThrottle	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP1 signal at SECM Pin#22 • Cycle the pedal several times and check APP2 signal at SECM Pin#42
711 (71)	**LSDFault_Dither1** Dither Valve 1 Fault, signal has opened or shorted to ground or power or defective dither 1 valve	(1) TurnOnMIL (2) DisableGasO2Ctrl (3) CheckEngineLight (4) DisableGasPost O2Ctrl (Certified Units Only)	Check FTV1 for an open wire or FTV connector being disconnected FTV1 Pin 1 (signal) to SECM Pin#7 FTV1 Pin 2 (power) to SECM (DRVP) Pin#67 Check FTV1 for an open coil by disconnecting the FTV connector and measuring the resistance (17.2Ω ± 2Ω @ 23 ± 5°C)
712	**LSDFault_Dither2** Dither Valve 2 Fault, signal has opened or shorted to ground or power or defective dither 2 valve	(1) TurnOnMIL (2) DisableGasO2Ctrl (3) CheckEngineLight (4) DisableGasPost O2Ctrl (Certified Units Only)	Check FTV1 for an open wire or FTV connector being disconnected or signal shorted to GND FTV2 Pin 1 (signal) to SECM Pin#10 FTV1 Pin 2 (power) to SECM (DRVP) Pin#67 Check FTV1 for an open coil by disconnecting the FTV connector and measuring the resistance (17.2Ω ± 2Ω @ 23 ± 5°C)
713	**LSDFault_CSValve**	None	N/A
714	**LSDFault_CheckEngine** Check Engine Lamp Fault, signal has opened or shorted to ground or power or defective check engine lamp	(1) TurnOnMIL (2) CheckEngineLight	Check 'Check Engine Lamp' for an open wire or shorted to GND
715	**LSDFault_CrankDisable** Crank Disable Fault, signal has opened or shorted to ground or power or defective crank disable relay	(1) TurnOnMIL (2) CheckEngineLight	N/A
716	**LSDFault_FuelPump** Fuel pump fault, signal has opened, shorted to ground or power, or defective fuel pump	(1) TurnOnMIL (2) CheckEngineLight	Check fuel pump for an open wire or connector being disconnected or signal shorted to GND Fuel Pump Pin B (signal) from Engine Ground SECM Pin#69,70 Fuel Pump Pin A (power) from relay4 output Fuel Pump Relay ground to SECM Pin#20 Fuel Pump Relay power to DRVP Pin#67 of Main relay2 Check Fuel Pump for an open coil by disconnecting the Fuel Pump connector and measuring the resistance Check for 12V to fuel pump

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
717	**LSDFault_LockOff** Fuel lock off Valve Fault, signal has opened or shorted to ground or power or defective Fuel lock off valve	(1) TurnOnMIL (2) CheckEngineLight	Check fuel lock off valve for an open wire or connector being disconnected or signal shorted to GND Lock off Pin B (signal) from SECM Pin#15 Lock off Pin A (power) from main relay 1 or Pin#67(DRVP) Check lock off valve for an open coil by disconnecting the lock off valve connector and measuring the resistance (20Ω ~ 29Ω) Check for 12V to lock off valve
718	**LSDFault_MIL** Malfunction Indicator Lamp Fault, signal has opened or shorted to ground or power or defective MIL lamp	(1) TurnOnMIL (2) CheckEngineLight	Check 'OBD MIL' for an open wire or shorted to GND
721 (72)	**GasFuelAdaptRangeLow** In LPG mode, system had to adapt rich more than expected	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasO2Ctrl (4) DisableGasPost O2Ctrl (Certified Units Only)	Check for vacuum leaks. Check fuel trim valves, e.g. leaking valve or hose Check for missing orifice(s).
731 (73)	**GasFuelAdaptRangeHi** In LPG mode, system had to adapt lean more than expected	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasO2Ctrl (4) DisableGasPost O2Ctrl (Certified Units Only)	Check fuel trim valves, e.g. plugged valve or hose. Check for plugged orifice(s).
741 (74)	**GasO2NotActive** Pre-catalyst O2 sensor inactive on LPG, open O2 sensor signal or heater leads, defective O2 sensor	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasO2Ctrl (4) DisableGasPost O2Ctrl (Certified Units Only)	Check that Pre-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin#66 O2 Pin 2 (HEATER) to SECM Pin#5 O2 Pin 1 (HEATER PWR) to SECM (DRVP + 12V) Pin#67 Verify O2 sensor heater circuit is operating by measuring heater resistance (3.6~4.6Ω @68°F(20°C)) O2 Pin 1 to Pin 2
742	**GasPostO2NotActive** Post-catalyst O2 sensor inactive on LPG, open O2 sensor signal or heater leads, defective O2 sensor.	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasPost O2Ctrl (Certified Units Only)	Check that Post-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin#50 O2 Pin 2 (HEATER) to SECM Pin#4 O2 Pin 1 (HEATER PWR) to SECM (DRVP + 12V) Pin#67 Verify O2 sensor heater circuit is operating by measuring heater resistance (3.6~4.6Ω @68°F(20°C)) O2 Pin 1 to Pin 2

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
751	**GasO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on LPG	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasO2Ctrl (4) DisableGasPost O2Ctrl (Certified Units Only)	Check for vacuum leaks. Check fuel trim valves, e.g. leaking valve or hose. Check for missing orifice(s).
752	**GasPostO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on LPG	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasPost O2Ctrl (Certified Units Only)	Correct other faults that may contribute to 752 (e.g. faults pertaining to dither valves, Pre-Cat O2, Post Cat O2 sensor) Check for vacuum leaks Check for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 742 corrective actions).
771 (77)	**GasO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on LPG	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasO2Ctrl (4) DisableGasPost O2Ctrl (Certified Units Only)	Check dual dither valves, e.g. plugged valve or hose. Check for plugged orifice(s).
772	**GasPostO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on LPG	(1) TurnOnMIL (2) CheckEngineLight (3) DisableGasPost O2Ctrl (Certified Units Only)	Correct other faults that may contribute to 772 (e.g. faults pertaining to FTVs, Pre-Cat O2, Post Cat O2 sensor) Look for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 742 corrective actions).

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
821	**LiqFuelAdaptRangeHi** In Gasoline mode, system had to adapt lean more than expected	(1) TurnOnMIL (2) CheckEngineLight (3) DisableLiquid O2Ctrl (4) DisableLiqPost O2Ctrl (Certified Units Only)	Check for vacuum leaks. Low gasoline fuel pressure, perform gasoline pressure test. Injector problems, e.g. plugged, defective injector.
831	**LiqFuelAdaptRangeLow** In Gasoline mode, system had to adapt rich more than expected	(1) TurnOnMIL (2) CheckEngineLight (3) DisableLiquid O2Ctrl (4) DisableLiqPost O2Ctrl (Certified Units Only)	Low gasoline fuel pressure, perform gasoline pressure test Injector problems, e.g. leaking, defective injector.
841	**LiqO2NotActive** Pre-catalyst O2 sensor inactive on gasoline, open O2 sensor signal or heater leads, defective O2 sensor	(1) TurnOnMIL (2) CheckEngineLight (3) DisableLiquid O2Ctrl (4) DisableLiqPost O2Ctrl (Certified Units Only)	Check that Pre-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin#66 O2 Pin 2 (HEATER) to SECM Pin#5 O2 Pin 1 (HEATER PWR) to SECM (DRVP + 12V) Pin#67 Verify O2 sensor heater circuit is operating by measuring heater resistance (3.6~4.6Ω @68°F(20°C)) O2 Pin 1 to Pin 2
842	**LiqPostO2NotActive** Post-catalyst O2 sensor inactive on gasoline, open O2 sensor signal or heater leads, defective O2 sensor.	(1) TurnOnMIL (2) CheckEngineLight (3) DisableLiqPost O2Ctrl (Certified Units Only)	Check that Post-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin#50 O2 Pin 2 (HEATER) to SECM Pin#4 O2 Pin 1 (HEATER PWR) to SECM (DRVP + 12V) Pin#67 Verify O2 sensor heater circuit is operating by measuring heater resistance (3.6~4.6Ω @68°F(20°C)) O2 Pin 1 to Pin 2
851	**LiqO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on gasoline	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) CheckEngineLight (4) DisableLiqPost O2Ctrl (Certified Units Only)	Check for vacuum leaks. Low gasoline fuel pressure, perform gasoline pressure test. Injector problems, e.g. plugged, defective injector
852	**LiqPostO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on gasoline	(1) TurnOnMIL (2) CheckEngineLight (3) DisableLiqPost O2Ctrl (Certified Units Only)	Correct other faults that may contribute to 852 (e.g. faults pertaining to Injectors, MAP, IAT, Pre-Cat O2, Post Cat O2 sensor) Look for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 842 corrective actions).

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
871	**LiqO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on gasoline	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) CheckEngineLight (4) DisableLiqPost O2Ctrl (Certified Units Only)	High gasoline fuel pressure, perform gasoline pressure test Injector problems, e.g. leaking, defective injector
872	**LiqPostO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on gasoline	(1) TurnOnMIL (2) CheckEngineLight (3) DisableLiqPost O2Ctrl (Certified Units Only)	Correct other faults that may contribute to 872 (e.g. faults pertaining to Injectors, MAP, IAT, Pre-Cat O2, Post Cat O2 sensor) Look for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 842 corrective actions).
911	**O2RangeLow** Pre-catalyst O2 sensor voltage out of range low, sensor signal shorted to ground	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) DisableGasO2Ctrl (4) CheckEngineLight (Certified Units Only)	Check continuity between ECU PreO2 signal Pin 3 to SECM Pin#66
912	**O2_PostCatRangeLow** Post-catalyst O2 sensor voltage out of range low, sensor signal shorted to ground	(1) TurnOnMIL (2) DisableLiqPost O2Ctrl (3) DisableGasPost O2Ctrl (4) CheckEngineLight (Certified Units Only)	Check continuity between ECU PostO2 signal Pin 3 to SECM Pin#50
921	**O2RangeHigh** Pre-catalyst O2 sensor voltage out of range high, sensor signal shorted to power	(1) TurnOnMIL (2) DisableLiquid O2Ctrl (3) DisableGasO2Ctrl (4) CheckEngineLight (Certified Units Only)	Check if O2 sensor installed before catalyst is shorted to +5Vdc or battery. O2 (signal) Pin 3 to SECM Pin#66 SECM (XDRP + 5V) Pin#48 SECM (DRVP + 12V) Pin#67
922	**O2_PostCatRangeHigh** Post-catalyst O2 sensor voltage out of range low, sensor signal shorted to ground	(1) TurnOnMIL (2) DisableLiqPost O2Ctrl (3) DisableGasPost O2Ctrl (4) CheckEngineLight (Certified Units Only)	Check if O2 sensor installed after catalyst is shorted to +5Vdc or battery. O2 (signal) Pin 3 to SECM Pin#50 Possible voltage sources: SECM (XDRP + 5V) Pin#48 and SECM (DRVP + 12V) Pin#67

(*) Fault actions shown are default values specified by the OEM.

MI-21 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
931	**FuelTempRangeLow** Fuel Temperature Sensor Input is Low normally set if the fuel temperature sensor wire has shorted to chassis ground or the sensor has failed.	(1) TurnOnMIL (2) CheckEngineLight	Check fuel temp sensor connector and wiring for a short to GND SECM (signal) Pin#41 to FTS Pin 2 SECM (sensor GND) Pin#32 to FTS Pin 1 SECM (system GND) Pin#69,70
932	**FuelTempRangeHigh** Fuel Temperature Sensor Input is High normally set if the fuel temperature sensor wire has been disconnected or the circuit has opened to the SECM.	(1) TurnOnMIL (2) CheckEngineLight	Check if fuel temp sensor connector is disconnected or for an open FTS circuit SECM (signal) Pin#41 to FTS Pin 2 SECM (sensor GND) Pin#32 to FTS Pin 1
933	**TransOilTemp** Excessive transmission oil temperature	(1) TurnOnMIL (2) DelayedEngine Shutdown	Refer to drivetrain manufacturer's transmission service procedures.

(*) Fault actions shown are default values specified by the OEM.

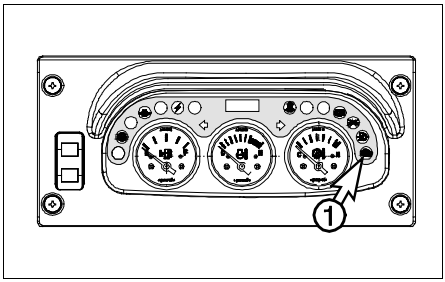
Advanced Diagnostics for G424I Engines

MI-07 systems are equipped with built-in fault diagnostics. Detected system faults can be displayed by the Malfunction Indicator Lamp (MIL) as Diagnostic Fault Codes (DFC) or flash codes, and viewed in detail with the use of the Service Tool software. When the ignition key is turned on, the MIL will illuminate and remain on until the engine is started. Once the engine is started, the MIL lamp will go out unless one or more fault conditions are present. If a detected fault condition exists, the fault or faults will be stored in the memory of the small engine control module (SECM). Once an active fault occurs the MIL will illuminate and remain ON. This signals the operator that a fault has been detected by the SECM.

Reading Diagnostic Fault Codes

All MI-07 fault codes are three-digit codes. When the fault codes are retrieved (displayed) the MIL will flash for each digit with a short pause (0.5 seconds) between digits and a long pause (1.2 seconds) between fault codes. A code 12 is displayed at the end of the code list.

EXAMPLE: A code 461 (ETCSticking) has been detected and the engine has shut down and the MIL has remained ON. When the codes are displayed the MIL will flash four times (4), pause, then flash six times (6), pause, then flash one time (1) This identifies a four sixty one (461), which is the ETCSticking fault. If any additional faults were stored, the SECM would again have a long pause, then display the next fault by flashing each digit. Since no other faults were stored there will be a long pause then one flash (1), pause, then two flashes (2). This identifies a twelve, signifying the end of the fault list. This list will then repeat.



(1) Malfunction Indicator Lamp(MIL) for Engine control system.

Displaying Fault Codes (DFC) from SECM Memory

To enter code display mode you must turn OFF the ignition key. Now turn ON the key but do not start the engine. As soon as you turn the key to the ON position you must cycle the foot pedal by depressing it to the floor and then fully releasing the pedal (pedal maneuver). You must fully cycle the foot pedal three (3) times within five (5) seconds to enable the display codes feature of the SECM. Simply turn the key OFF to exit display mode. The code list will continue to repeat until the key is turned OFF.

MI-07 Diagnostic Fault Codes (Flash Codes)

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
12	**NONE** Signifies the end of one pass through the fault list	NONE	None, used as end of the fault list identification
131	**Inj1Open** Gasoline Injector 1 open circuit, broken injector 1 wire or defective injector	(1) TurnOnMil (2) Disable LiquidO2Ctrl (3) Delayed EngineShutdown	Check INJ1 wiring for an open circuit SECM (Signal) A5 to Injector 1 Pin A Switched 12V to Injector 1 Pin B Check Injector 1 Resistance, 12 to14 ohms (cold)
132	**Inj2Open** Gasoline Injector 2 open circuit, broken injector 2 wire or defective injector	(1) TurnOnMil (2) Disable LiquidO2Ctrl (3) Delayed EngineShutdown	Check INJ2 wiring for an open circuit SECM (Signal) A8 to Injector 2 Pin A Switched 12V to Injector 2 Pin B Check Injector 2 Resistance, 12 to14 ohms (cold)
133	**Inj3Open** Gasoline Injector 3 open circuit, broken injector 3 wire or defective injector	(1) TurnOnMil (2) Disable LiquidO2Ctrl (3) Delayed EngineShutdown	Check INJ3 wiring for an open circuit SECM (Signal) A4 to Injector 3 Pin A Switched 12V to Injector 3 Pin B Check Injector 3 Resistance, 12 to14 ohms (cold)
134	**Inj4Open** Gasoline Injector 4 open circuit, broken injector 4 wire or defective injector	(1) TurnOnMil (2) Disable LiquidO2Ctrl (3) Delayed EngineShutdown	Check INJ4 wiring for an open circuit SECM (Signal) A7 to Injector 4 Pin A Switched 12V to Injector 4 Pin B Check Injector 4 Resistance, 12 to 14 ohms (cold)
141 (14)	**ECTRangeLow** Coolant Sensor failure or shorted to GND	(1) TurnOnMil (2) DelayedEngine Shutdown	Check ECT sensor connector and wiring for a short to GND SECM (Signal) Pin B15 To ECT Pin 3 SECM (Sensor GND) Pin B1 to ECT Pin 1 SECM (System GND) Pin A16, B17
151 (15)	**ECTRangeHigh** Coolant sensor disconnected or open circuit	(1) TurnOnMil (2) DelayedEngine Shutdown	Check if ECT sensor connector is disconnected or for an open ECT circuit SECM (Signal) Pin B15 to ECT Pin 3 SECM (Sensor GND) Pin B1 to ECT Pin 1

(*) Fault actions shown are default values specified by the OEM

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
161 (16)	**ECTOverTempFault** Engine coolant temperature is high. The sensor has measured an excessive coolant temperature typically due to the engine overheating.	(1) TurnOnMil (2) DelayedEngine Shutdown	Check coolant system for radiator blockage, proper coolant level and for leaks in the system. Possible ECT short to GND, check ECT signal wiring SECM (Signal) Pin B15 to ECT Pin 3 SECM (Sensor GND) Pin B1 to ECT Pin 1 SECM (System GND) Pin A16, B17 Check regulator for coolant leaks
171	**ECT_IR_Fault** Engine coolant temperature not changing as expected	TurnOnMil (Disabled in all software MI07SEQ062V05 and higher)	Check for coolant system problems, e.g. defective or stuck thermostat
181	**FuelSelectConflict** Conflict in fuel select signals, normally set if both of the fuel select signals are shorted to ground	(1) TurnOnMil (2) Delayed EngineShutdown	Check fuel select switch connection for a short to GND SECM (SIGNAL) Pin A12 SECM (SIGNAL) Pin A15 SECM (Sensor GND) Pin B1
191	**CamEdgesFault** No CAM signal when engine is known to be rotating, broken crankshaft sensor leads or defective CAM sensor	None	Check CAM sensor connections SECM (SIGNAL) Pin B10 to CAM sensor Pin 2 SECM (Sensor GND) Pin B1 to CAM sensor Pin 3 Switched 12V to CAM sensor Pin 1 Check for defective CAM sensor
192	**CamSyncFault** Loss of synchronization on the CAM sensor, normally due to noise on the signal or an intermittent connection on the CAM sensor	None	Check CAM sensor connections SECM (SIGNAL) Pin B10 to CAM sensor Pin 2 SECM (Sensor GND) Pin B1 to CAM sensor Pin 3 Switched 12V to CAM sensor Pin 1 Check for defective CAM sensor
193	**CrankEdgesFault** No crankshaft signal when engine is known to be rotating, broken crankshaft sensor leads or defective crank sensor	None	Check Crankshaft sensor connections SECM (SIGNAL) Pin B5 to Crank sensor Pin 3 SECM (Sensor GND) PIN B1 to Crank sensor Pin 2 Switched 12V to Crank sensor Pin 1 Check for defective Crank sensor
194	**CrankSyncFault** Loss of synchronization on the crankshaft sensor, normally due to noise on the signal or an intermittent connection on the crankshaft sensor	None	Check Crankshaft sensor connections SECM (SIGNAL) Pin B5 to Crank sensor Pin 3 SECM (Sensor GND) Pin B1 to Crank sensor Pin 2 Switched 12V to Crank sensor Pin 1 Check for defective Crank sensor

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
221 (22)	**TPS1RangeLow** TPS1 sensor voltage out of range low, normally set if the TPS1 signal has shorted to ground, circuit has opened or sensor has failed	(1) TurnOnMil (2) CutThrottle	Check throttle connector connection and TPS1 sensor for an open circuit or short to GND SECM Pin B23 (signal) to ETC Pin 6 SECM Pin B1 (sensor GND) to ETC Pin 2 SECM (system GND) Pin A16, B17
222	**TPS2RangeLow** TPS2 sensor voltage out of range low, normally set if the TPS2 signal has shorted to ground, circuit has opened or sensor has failed	(1) TurnOnMil (2) CutThrottle	Check throttle connector connection and TPS2 sensor for an open circuit or short to GND SECM Pin B4 (signal) to ETC Pin 5 SECM Pin B1 (sensor GND) to ETC Pin 2 SECM (system GND) Pin A16, B17
231 (23)	**TPS1RangeHigh** TPS1 sensor voltage out of range high, normally set if the TPS1 signal has shorted to power or the ground for the sensor has opened	(1) TurnOnMil (2) CutThrottle	Check throttle connector and TPS1 sensor wiring for a shorted circuit SECM Pin B23 (signal) to ETC Pin 6 SECM Pin B1 (sensor GND) to ETC Pin 2
232	**TPS2RangeHigh** TPS2 sensor voltage out of range high, normally set if the TPS2 signal has shorted to power or the ground for the sensor has opened	(1) TurnOnMil (2) CutThrottle	Check throttle connector and TPS1 sensor wiring for a shorted circuit SECM Pin B4 (signal) to ETC Pin 5 SECM pin B1 (sensor GND) to ETC Pin 2
241 (24)	**TPS1AdaptLoMin** Learned closed throttle end of TPS1 sensor range lower than expected	None	N/A
242	**TPS2AdaptLoMin** Learned closed throttle end of TPS2 sensor range lower than expected	None	N/A
251 (25)	**TPS1AdaptHiMax** Learned WOT end of TPS1 sensor range higher than expected	None	N/A
252	**TPS2AdaptHiMax** Learned WOT end of TPS2 sensor range higher than expected	None	N/A
271	**TPS1AdaptHiMin** Learned WOT end of TPS1 sensor range lower than expected	None	N/A

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
272	**TPS2AdaptHiMin** Learned WOT end of TPS2 sensor range lower than expected	None	N/A
281	**TPS1AdaptLoMax** Learned closed throttle end of TPS1 sensor range higher than expected	None	N/A
282	**TPS2AdaptLoMax** Learned closed throttle end of TPS2 sensor range higher than expected	None	N/A
291	**TPS_Sensors_Conflict** TPS sensors differ by more than expected amount **NOTE:** ***The TPS is not a serviceable item and can only be repaired by replacing the DV-EV throttle assembly.***	(1) TurnOnMil (2) CutThrottle	Check the throttle connector and pins for corrosion. To check the TPS disconnect the throttle connector and measure the resistance from: TPS Pin 2 (GND) to Pin 6 (TPS1 SIGNAL) (0.7 Ω ± 30%) TPS Pin 3 (PWR) to Pin 6 (TPS1 SIGNAL) (1.4 Ω ± 30%)
292	**TPS_Intermittent** Signal from the SECM to the throttle position sensor power or ground is not continuous	TurnOnMil	Check the throttle connector and pins for corrosion. Check continuity between throttle body Pin 3 and SECM Pin B24 (XDPR +5Vdc) Check continuity between throttle body Pin 2 and SECM Pin B1 (sensor ground) Check continuity on TPS1: between throttle body Pin 6 and SECM Pin B23 Check continuity on TPS2: between throttle body Pin 5 and SECM Pin B4 *Note: move wires around when checking for continuity to duplicate intermittent signal
331 (33)	**MAPTimeRangeLow** Manifold Absolute Pressure sensor input is low, normally set if the TMAP pressure signal wire has been disconnected or shorted to ground or the circuit has opened to the SECM	TurnOnMil	Check TMAP connector and MAP signal wiring for an open circuit TMAP Pin 4 to SECM Pin B18 (signal) TMAP Pin 1 to SECM Pin B1 (sensor GND) TMAP Pin 3 to SECM Pin B24 (XDRP +5 Vdc) Check the MAP sensor by disconnecting the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) (2.4kΩ - 8.2kΩ) TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) (3.4kΩ - 8.2kΩ)

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
332	**MAPRangeLow** Manifold Absolute Pressure sensor input is low, normally set if the TMAP pressure signal wire has been disconnected or shorted to ground or the circuit has opened to the SECM	(1) TurnOnMil (2) EngineShutdown	Check TMAP connector and MAP signal wiring for an open circuit TMAP Pin 4 to SECM Pin B18 (signal) TMAP Pin 1 to SECM Pin B1 (sensor GND) TMAP Pin 3 to SECM Pin B24 (XDRP +5 Vdc) Check the MAP sensor by disconnect-ing the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) (2.4kΩ - 8.2kΩ) TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) (3.4kΩ - 8.2kΩ)

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
341 (34)	**MAPTimeRangeHigh** Manifold Absolute Pressure Sensor Input is High, normally set if the TMAP pressure signal wire has become shorted to power, shorted to the IAT signal, the TMAP has failed or the SECM has failed.	TurnOnMil	Check TMAP connector and MAP signal wiring for a shorted circuit TMAP Pin 4 to SECM Pin B18 (signal) TMAP Pin 1 to SECM Pin B1 (sensor GND) TMAP Pin 3 to SECM Pin B24 (XDRP +5 Vdc) Check the MAP sensor by disconnect-ing the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) (2.4kΩ - 8.2kΩ) TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) (3.4kΩ - 8.2kΩ)
342	**MAPRangeHigh** Manifold Absolute Pressure Sensor Input is High, normally set if the TMAP pressure signal wire has become shorted to power, shorted to the IAT signal, the TMAP has failed or the SECM has failed	(1) TurnOnMil (2) Engine Shutdown	Check TMAP connector and MAP signal wiring for a shorted circuit TMAP Pin 4 to SECM Pin B18 (signal) TMAP Pin 1 to SECM Pin B1 (sensor GND) TMAP Pin 3 to SECM Pin B24 (XDRP +5 Vdc) Check the MAP sensor by disconnecting the TMAP connector and measuring at the sensor: TMAP Pin 1(GND) to Pin 4 (pressure signal KPA) (2.4kΩ - 8.2kΩ) TMAP Pin 3 (power) to Pin 4 (pressure signal KPA) (3.4kΩ - 8.2kΩ)
351	**MAP_IR_HI** MAP sensor indicates higher pressure than expected	TurnOnMil	Check for vacuum leaks. Check that TMAP sensor is mounted properly. Possible defective TMAP sensor.
352	**MAP_IR_LO** MAP sensor indicates lower pressure than expected	TurnOnMil	Possible defective TMAP sensor.
353	**MAP_STICKING** MAP sensor not changing as expected	TurnOnMil	Check that TMAP sensor is mounted properly. Possible defective TMAP sensor.
371 (37)	**IATRangeLow** Intake Air Temperature Sensor Input is Low normally set if the IAT temperature sensor wire has shorted to chassis ground or the sensor has failed.	TurnOnMil	Check TMAP connector and IAT signal wiring for a shorted circuit TMAP Pin 2 to SECM Pin B12 (signal) TMAP Pin 1 to SECM Pin B1 (sensor GND) To check the IAT sensor of the TMAP disconnect the TMAP connector and measure the IAT resistance Resistance is approx 2400 ohms at room temperature.

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
381 (38)	**IATRangeHigh** Intake Air Temperature Sensor Input is High normally set if the IAT temperature sensor wire has been disconnected or the circuit has opened to the SECM.	TurnOnMil	Check TMAP connector and IAT signal wiring for a shorted circuit TMAP Pin 2 to SECM Pin B12 (signal) TMAP Pin 1 to SECM Pin B1 (sensor GND) To check the IAT sensor of the TMAP disconnect the TMAP connector and measure the IAT resistance Resistance is approx 2400 ohms at room temperature.
391	**IAT_IR_Fault** Intake Air Temperature not changing as expected	None	Check connections to TMAP sensor. Check that TMAP sensor is properly mounted to manifold.
421	**EST1_Open** EST1 output open, possibly open EST1 signal or defective spark module	TurnOnMil	Check coil driver wiring and connector for open circuit SECM Pin A9 (EST1) to OEM ignition system. See application note. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.
422	**EST2_Open** EST2 output open, possibly open EST2 signal or defective spark module	TurnOnMil	Check coil driver wiring and connector for open circuit SECM Pin A10 (EST2) to OEM ignition system. See application note. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.
423	**EST3_Open** EST3 output open, possibly open EST3 signal or defective spark module	TurnOnMil	Check coil driver wiring and connector for open circuit SECM Pin A3 (EST3) to OEM ignition system. See application note. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
424	**EST4_Open** EST4 output open, possibly open EST4 signal or defective spark module	TurnOnMil	Check coil driver wiring and connector for open circuit SECM Pin A6 (EST4) to OEM ignition system. See application manual. Verify GND on ignition module Pin A (of both connectors) Verify +12 Vdc on ignition module Pin B (of both connectors) Refer to application manual for specific engine details.
425	**EST5_Open** EST5 output open, possibly open EST5 signal or defective spark module	None	N/A
426	**EST6_Open** EST6 output open, possibly open EST6 signal or defective spark module	None	N/A
427	**EST7_Open** EST7 output open, possibly open EST7 signal or defective spark module	None	N/A
428	**EST8_Open** EST8 output open, possibly open EST8 signal or defective spark module	None	N/A
431	**EST1_Short** EST1 output shorted high or low, EST1 signal shorted to ground or power or defective spark module	None	N/A

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
432	**EST2_Short** EST2 output shorted high or low, EST2 signal shorted to ground or power or defective spark module	None	N/A
433	**EST3_Short** EST3 output shorted high or low, EST3 signal shorted to ground or power or defective spark module	None	N/A
434	**EST4_Short** EST4 output shorted high or low, EST4 signal shorted to ground or power or defective spark module	None	N/A
435	**EST5_Short** EST5 output shorted high or low, EST5 signal shorted to ground or power or defective spark module	None	N/A
436	**EST6_Short** EST6 output shorted high or low, EST6 signal shorted to ground or power or defective spark module	None	N/A

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
437	**EST7_Short** EST7 output shorted high or low, EST7 signal shorted to ground or power or defective spark module	None	N/A
438	**EST8_Short** EST8 output shorted high or low, EST8 signal shorted to ground or power or defective spark module	None	N/A
461 (26)	**ETC_Sticking** Electronic Throttle Control is sticking. This can occur if the throttle plate (butterfly valve) inside the throttle bore is sticking. The plate sticking can be due to some type of obstruction, a loose throttle plate, or worn components shaft bearings. **NOTE:** ***The throttle assembly is not a serviceable item and can only be repaired by replacing the DV-EV throttle assembly.***	(1) TurnOnMil (2) EngineShutdown (3) CutThrottle	Check for debris or obstructions inside the throttle body Perform the throttle test using the Service Tool and re-check for fault • Check throttle-plate shaft for bearing wear • Check the ETC driver wiring for an open circuit SECM Pin A17 to ETC + Pin 1 SECM Pin A18 to ETC - Pin 4 Check the ETC internal motor drive by disconnecting the throttle connector and measuring the motor drive resistance at the throttle TPS Pin 1 (+DRIVER) to Pin 4 (-DRIVER) ~3.0-4.0Ω
471	**ETC_Open_Fault** Electronic Throttle Control Driver has failed, normally set if driver signals have failed open or become disconnected, electronic throttle or SECM is defective.	(1) TurnOnMil (2) CutThrottle	Check the ETC driver wiring for an open circuit SECM Pin A17 to ETC + Pin 1 SECM Pin A18 to ETC - Pin 4 Check the ETC internal motor drive by disconnecting the throttle connector and measuring the motor drive resistance at the throttle TPS Pin 1 (+DRIVER) to Pin 4 (-DRIVER) ~3.0-4.0Ω
481 (28)	**ETCSpringTest** Electronic Throttle Control Spring Return Test has failed. The SECM will perform a safety test of the throttle return spring following engine shutdown. If the drive mechanism is damaged, or the return spring has lost tension the throttle will fail the test and set the fault. **NOTE:** ***The throttle assembly is not a serviceable item and can only be repaired by replacing the DV-EV throttle assembly.***	(1) TurnOnMil (2) EngineShutdown (3) CutThrottle	Perform throttle spring test by cycling the ignition key and re-check for fault

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
491 (29)	**HbridgeFault_ETC** Electronic Throttle Control Driver has failed. Indeterminate fault on Hbridge driver for electronic throttle control. Possibly either ETC+ or ETC- driver signals have been shorted to ground	(1) TurnOnMil (2) CutThrottle	Check ETC driver wiring for a shorted circuit SECM Pin A17 to ETC + Pin 1 SECM Pin A18 to ETC - Pin 4 • Perform the throttle test using the Service Tool and re-check for fault Check the ETC internal motor drive by disconnecting the throttle connector and measuring the motor drive resistance at the throttle TPS Pin 1 (+DRIVER) to Pin 4 (-DRIVER) ~3.0-4.0Ω
521 (52)	**LowOilPressureFault** Low engine oil pressure	(1) TurnOnMil (2) DelayedEngine Shutdown	Check engine oil level Check electrical connection to the oil pressure switch SECM Pin B9 to Oil Pressure Switch
531 (53)	**SysVoltRangeLow** System voltage too low	TurnOnMil	Check battery voltage • Perform maintenance check on electrical connections to the battery and chassis ground • Check battery voltage during starting and with the engine running to verify charging system and alternator function • Measure battery power at SECM with a multimeter (with key on) SECM Pin A23 (DRVP) to SECM Pin A16 (DRVG) SECM Pin A23 (DRVP) to SECM Pin B17 (DRVG)
541 (54)	**SysVoltRangeHigh** System voltage too high	(1) TurnOnMil (2) DelayedEngine Shutdown	Check battery and charging system voltage • Check battery voltage during starting and with the engine running • Check voltage regulator, alternator, and charging system • Check battery and wiring for overheating and damage • Measure battery power at SECM with a multimeter (with key on) SECM Pin A23 (DRVP) to SECM Pin A16 (DRVG) SECM Pin A23 (DRVP) to SECM Pin B17 (DRVG)

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
551 (55)	**SensVoltRangeLow** Sensor reference voltage XDRP too low	(1) TurnOnMil (2) DelayedEngine Shutdown	Measure transducer power at the TMAP connector with a multimeter TMAP Pin 3 XDRP +5 Vdc to TMAP Pin 1 XDRG GND Verify transducer power at the SECM with a multimeter SECM Pin B24 +5 Vdc to SECM Pin B1 XDRG GND Verify transducer power at ETC with a multimeter ETC Pin 3 XDRP PWR to ETC Pin 2 XDRG GND Verify transducer power to the foot pedal with a multimeter.
561 (56)	**SensVoltRangeHigh** Sensor reference voltage XDRP too high	(1) TurnOnMil (2) DelayedEngine Shutdown	Measure transducer power at the TMAP connector with a multimeter TMAP Pin 3 XDRP +5 Vdc to TMAP Pin 1 XDRG GND Verify transducer power at the SECM with a multimeter SECM Pin B24 +5 Vdc to SECM Pin B1 XDRG GND Verify transducer power at ETC with a multimeter ETC Pin 3 XDRP PWR to ETC Pin 2 XDRG GND Verify transducer power to the foot pedal with a multimeter.
571 (57)	**HardOverspeed** Engine speed has exceeded the third level (3 of 3) of overspeed protection	(1) TurnOnMil (2) HardRevLimit (3) EngineShutdown	Usually associated with additional ETC faults • Check for ETC Sticking or other ETC faults Verify if the lift truck was motored down a steep grade
572	**MediumOverspeed** Engine speed has exceeded the second level (2 of 3) of overspeed protection	(1) TurnOnMil (2) MediumRevLimit (3) DelayedEngine Shutdown	Usually associated with additional ETC faults • Check for ETC Sticking or other ETC faults Verify if the lift truck was motored down a steep grade
573	**SoftOverspeed** Engine speed has exceeded the first level (1 of 3) of overspeed protection	(1) TurnOnMil (2) SoftRevLimit	Usually associated with additional ETC faults • Check for ETC Sticking or other ETC faults Verify if the lift truck was motored down a steep grade
611 (61)	**APP1RangeLow** APP1 sensor voltage out of range low, normally set if the APP1 signal has shorted to ground, circuit has opened or sensor has failed	TurnOnMil	Check foot pedal connector • Check APP1 signal at SECM PIN B7

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
612 (65)	**APP2RangeLow** APP2 sensor voltage out of range low, normally set if the APP2 signal has shorted to ground, circuit has opened or sensor has failed	TurnOnMil	Check foot pedal connector • Check APP2 signal at SECM PIN B16
621 (62)	**APP1RangeHigh** APP1 sensor voltage out of range high, normally set if the APP1 signal has shorted to power or the ground for the sensor has opened	TurnOnMil	Check foot pedal connector • Check APP1 signal at SECM PIN B7
622 (66)	**APP2RangeHigh** APP2 sensor voltage out of range high, normally set if the APP2 signal has shorted to power or the ground for the sensor has opened	TurnOnMil	Check foot pedal connector • Check APP2 signal at SECM PIN B16
631 (63)	**APP1AdaptLoMin** Learned idle end of APP1 sensor range lower than expected	TurnOnMil	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP1 signal at SECM Pin B7
632 (67)	**APP2AdaptLoMin** Learned idle end of APP2 sensor range lower than expected	TurnOnMil	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP2 signal at SECM Pin B16
641 (64)	**APP1AdaptHiMax** Learned full pedal end of APP1 sensor range higher than expected	TurnOnMil	Check APP connector and pins for corrosion Cycle the pedal several times and check APP1 signal at SECM Pin B7
642 (68)	**APP2AdaptHiMax** Learned full pedal end of APP2 sensor range higher than expected	TurnOnMil	Check APP connector and pins for corrosion Cycle the pedal several times and check APP2 signal at SECM Pin B16
651	**APP1AdaptHiMin** Learned full pedal end of APP1 sensor range lower than expected	TurnOnMil	Check APP connector and pins for corrosion Cycle the pedal several times and check APP1 signal at SECM Pin B7
652	**APP2AdaptHiMin** Learned full pedal end of APP2 sensor range lower than expected	TurnOnMil	Check APP connector and pins for corrosion Cycle the pedal several times and check APP2 signal at SECM Pin B16
661	**APP1AdaptLoMax** Learned idle end of APP1 sensor range higher than expected	TurnOnMil	Check APP connector and pins for corrosion Cycle the pedal several times and check APP1 signal at SECM Pin B7
662	**APP2AdaptLoMax** Learned idle end of APP2 sensor range higher than expected	TurnOnMil	Check APP connector and pins for corrosion Cycle the pedal several times and check APP2 signal at SECM Pin B16
691 (69)	**APP_Sensors_Conflict** APP position sensors do no not track well, intermittent connections to APP or defective pedal assembly	(1) TurnOnMil (2) Cut Throttle	Check APP connector and pins for corrosion • Cycle the pedal several times and check APP1 signal at SECM Pin B7 • Cycle the pedal several times and check APP2 signal at SECM Pin B16

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
711 (71)	**LSDFault_Dither1** Dither Valve 1 Fault, signal has opened or shorted to ground or power or defective dither 1 valve	(1) TurnOnMil (2) Disable GasO2 Ctrl (3) Disable GasPost O2Ctrl (Certified Units Only)	Check FTV1 for an open wire or FTV connector being disconnected FTV1 Pin 1 (signal) to SECM Pin A1 FTV1 Pin 2 (power) to SECM (DRVP) Pin A23 Check FTV1 for an open coil by disconnecting the FTV connector and measuring the resistance (~26Ω ± 2Ω)
712	**LSDFault_Dither2** Dither Valve 2 Fault, signal has opened or shorted to ground or power or defective dither 2 valve	(1) TurnOnMil (2) Disable GasO2 Ctrl (3) Disable GasPost O2Ctrl (Certified Units Only)	Check FTV1 for an open wire or FTV connector being disconnected or signal shorted to GND FTV2 Pin 1 (signal) to SECM Pin A2 FTV2 Pin 2 (power) to SECM (DRVP) Pin A23 Check FTV1 for an open coil by disconnecting the FTV connector and measuring the resistance (~26Ω ± 2Ω)
713	**LSDFault_CSValve**	None	N/A
714	**LSDFault_CheckEngine** Check Engine Lamp Fault, signal has opened or shorted to ground or power or defective check engine lamp	None	Check 'Check Engine Lamp' for an open wire or shorted to GND
715	**LSDFault_CrankDisable** Crank Disable Fault, signal has opened or shorted to ground or power or defective crank disable relay	None	N/A
716	**LSDFault_FuelPump** Fuel pump fault, signal has opened, shorted to ground or power, or defective fuel pump	TurnOnMil	Check fuel pump for an open wire or connector being disconnected or signal shorted to GND Fuel Pump Pin B (signal) from SECM Pin A13 Fuel Pump Pin A (power) from main relay 1 Pin A23 Check Fuel Pump for an open coil by disconnecting the Fuel Pump connector and measuring the resistance (~26Ω ± 3Ω) Check for 12V to fuel pump
717	**LSDFault_LockOff** Fuel lock off Valve Fault, signal has opened or shorted to ground or power or defective Fuel lock off valve	TurnOnMil	Check fuel lock off valve for an open wire or connector being disconnected or signal shorted to GND Lock off Pin B (signal) from SECM Pin A11 Lock off Pin A (power) from main relay 1 Pin A23 Check lock off valve for an open coil by disconnecting the lock off valve connector and measuring the resistance (~26Ω ± 3Ω) Check for 12V to lock off valve
718	**LSDFault_MIL** Malfunction Indicator Lamp Fault, signal has opened or shorted to ground or power or defective MIL lamp	None	None

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
721 (72)	**GasFuelAdaptRangeLo** In LPG mode, system had to adapt rich more than expected	(1) TurnOnMil (2) Disable GasO2 Ctrl (3) Disable GasPost O2Ctrl (Certified Units Only)	Check for vacuum leaks. Check fuel trim valves, e.g. leaking valve or hose Check for missing orifice(s).
722	**GasDesEquivLo** In LPG mode, system had to adapt rich more than expected	None	N/A

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
731 (73)	**GasFuelAdaptRangeHi** In LPG mode, system had to adapt lean more than expected	(1) TurnOnMil (2) Disable GasO2 Ctrl (3) Disable GasPost O2Ctrl (Certified Units Only)	Check dual dither valves, e.g. plugged valve or hose. Check for plugged orifice(s).
732	**GasDesEquivHi** In LPG mode, system had to adapt rich more than expected	None	N/A
741 (74)	**GasO2NotActive** Pre-catalyst O2 sensor inactive on LPG, open O2 sensor signal or heater leads, defective O2 sensor	(1) TurnOnMil (2) DisableGas O2Ctrl (3) Disable GasPost O2Ctrl (Certified Units Only)	Check that Pre-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin B13 O2 Pin 2 (HEATER GND) to SECM (DRVG GNG) Pins A16, B17 O2 Pin 1 (HEATER PWR) to SECM (DRVP + 12V) Pin A23 Verify O2 sensor heater circuit is operating by measuring heater resistance (2.1Ω ± 0.4Ω) O2 Pin 2 (HEATER GND) to Pin 1 (HEATER PWR)
742	**GasPostO2NotActive** Post-catalyst O2 sensor inactive on LPG, open O2 sensor signal or heater leads, defective O2 sensor.	(1) TurnOnMil (2) DisableGasPost O2Ctrl (Certified Units Only)	Check that Post-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin B19 O2 Pin 2 (HEATER GND) to SECM (DRVG GNG) Pins A16, B17 O2 Pin 1 (HEATER PWR) to Post O2 Heater Relay. Relay pin 87. This relay only turns on after engine has been running for some time and SECM has calculated that water condensation in exhaust has been removed by exhaust heat. Post O2 Heater Relay has SECM (DRVP + 12V) applied to the relay coil power. The relay coil ground is controlled by SECM Pin A20 to activate the relay to flow current through the post O2 heater. Verify O2 sensor heater circuit is operating by measuring heater resistance (2.1Ω ± 0.4Ω) O2 Pin 2 (HEATER GND) to Pin 1 (HEATER PWR)
743	**GasCatInactive**	None	N/A
751	**GasO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on LPG	(1) TurnOnMil (2) DisableGas O2Ctrl (3) Disable GasPost O2Ctrl (Certified Units Only)	Check for vacuum leaks. Check dual dither valves, e.g. leaking valve or hose. Check for missing orifice(s).
752	**GasPostO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on LPG	(1) TurnOnMil (2) DisableGasPost O2Ctrl (Certified Units Only)	Correct other faults that may contribute to 752 (e.g. faults pertaining to dither valves, Pre-Cat O2, Post Cat O2 sensor) Check for vacuum leaks Check for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 742 corrective actions).

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
771 (77)	**GasO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on LPG	(1) TurnOnMil (2) DisableGas O2Ctrl (3) DisableGasPost O2Ctrl (Certified Units Only)	Check dual dither valves, e.g. plugged valve or hose. Check for plugged orifice(s).

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
772	**GasPostO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on LPG	(1) TurnOnMil (2) DisableGasPost O2Ctrl (Certified Units Only)	Correct other faults that may contribute to 772 (e.g. faults pertaining to FTVs, Pre-Cat O2, Post Cat O2 sensor) Look for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 742 corrective actions).
821	**LiqFuelAdaptRangeHi** In Gasoline mode, system had to adapt lean more than expected	(1) TurnOnMil (2) Disable LiquidO2 Ctrl (3) Disable LiqPost O2Ctrl	Check for vacuum leaks. Low gasoline fuel pressure, perform gasoline pressure test. Injector problems, e.g. plugged, defective injector.
822	**LiqDesEquivHi**	None	N/A
831	**LiqFuelAdaptRangeLow** In Gasoline mode, system had to adapt rich more than expected	(1) TurnOnMil (2) Disable LiquidO2 Ctrl (3) Disable LiqPost O2Ctrl	Low gasoline fuel pressure, perform gasoline pressure test Injector problems, e.g. leaking, defective injector.
832	**LiqDesEquivLo**	None	N/A
841	**LiqO2NotActive** Pre-catalyst O2 sensor inactive on gasoline, open O2 sensor signal or heater leads, defective O2 sensor	(1) TurnOnMil (2) DisableLiquid O2Ctrl (3) DisableLiquid PostO2Ctrl	Check that Pre-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin B13 O2 Pin 2 (HEATER GND) to SECM (DRVG GNG) Pins A16, B17 O2 Pin 1 (HEATER PWR) to SECM (DRVP + 12V) PIN A23 Verify O2 sensor heater circuit is operating by measuring heater resistance (2.1Ω ± 0.4Ω) O2 Pin 2 (HEATER GND) to Pin 1 (HEATER PWR)
842	**LiqPostO2NotActive** Post-catalyst O2 sensor inactive on gasoline, open O2 sensor signal or heater leads, defective O2 sensor.	(1) TurnOnMil (2) DisableLiqPost O2Ctrl (Certified Units Only)	Check that Post-catalyst O2 sensor connections are OK. O2 (signal) Pin 3 to SECM Pin B19 O2 Pin 2 (HEATER GND) to SECM (DRVG GNG) Pins A16, B17 O2 Pin 1 (HEATER PWR) to Post O2 Heater Relay. Relay pin 87. This relay only turns on after engine has been running for some time and SECM has calculated that water condensation in exhaust has been removed by exhaust heat. Post O2 Heater Relay has SECM (DRVP + 12V) applied to the relay coil power. The relay coil ground is controlled by SECM Pin A20 to activate the relay to flow current through the post O2 heater. Verify O2 sensor heater circuit is operating by measuring heater resistance (2.1Ω ± 0.4Ω) O2 Pin 2 (HEATER GND) to Pin 1 (HEATER PWR)
843	**LiqCatInactive**	None	N/A
851	**LiqO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on gasoline	(1) TurnOnMil (2) DisableLiquid O2Ctrl (3)DisableLiquid PostO2Ctrl	Check for vacuum leaks. Low gasoline fuel pressure, perform gasoline pressure test. Injector problems, e.g. plugged, defective injector

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
852	**LiqPostO2FailedLean** Pre-catalyst O2 sensor indicates extended lean operation on gasoline	(1) TurnOnMil (2) DisableLiqPost O2Ctrl (Certified Units Only)	Correct other faults that may contribute to 852 (e.g. faults pertaining to Injectors, MAP, IAT, Pre-Cat O2, Post Cat O2 sensor) Look for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 842 corrective actions).
871	**LiqO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on gasoline	(1) TurnOnMil (2) DisableLiquid O2Ctrl (3) DisableLiquid PostO2Ctrl	High gasoline fuel pressure, perform gasoline pressure test Injector problems, e.g. leaking, defective injector
872	**LiqPostO2FailedRich** Pre-catalyst O2 sensor indicates extended rich operation on gasoline	(1) TurnOnMil (2) DisableLiq PostO2Ctrl (Certified Units Only)	Correct other faults that may contribute to 872 (e.g. faults pertaining to Injectors, MAP, IAT, Pre-Cat O2, Post Cat O2 sensor) Look for leaks in exhaust, catalytic converter, HEGO sensors; repair leaks. Check all sensor connections (see fault 842 corrective actions).
911	**O2RangeLow** Pre-catalyst O2 sensor voltage out of range low, sensor signal shorted to ground	None	N/A
912	**O2_PostCatRangeLow** Post-catalyst O2 sensor voltage out of range low, sensor signal shorted to ground	None	N/A
921	**O2RangeHigh** Pre-catalyst O2 sensor voltage out of range high, sensor signal shorted to power	(1) TurnOnMil (2) DisableLiquid O2Ctrl (3) DisableGas O2Ctrl (Certified Units Only)	Check if O2 sensor installed before catalyst is shorted to +5Vdc or battery. O2 (signal) Pin 3 to SECM Pin B13 SECM (XDRP + 5V) Pin B24 SECM (DRVP + 12V) Pin A23
922	**O2_PostCatRangeHigh** Post-catalyst O2 sensor voltage out of range low, sensor signal shorted to ground	(1) TurnOnMil (2) Disable asoline Post-catalyst O2Ctrl (3) Disable LPG Post-catalyst O2Ctrl (Certified Units Only)	Check if O2 sensor installed after catalyst is shorted to +5Vdc or battery. O2 (signal) Pin 3 to SECM Pin B19 Possible voltage sources: SECM (XDRP + 5V) Pin B24 and SECM (DRVP + 12V) Pin A23

DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
931	**FuelTempRangeLow** Fuel Temperature Sensor Input is Low normally set if the fuel temperature sensor wire has shorted to chassis ground or the sensor has failed.	TurnOnMil (Certified Units Only)	Check fuel temp sensor connector and wiring for a short to GND SECM (signal) Pin B14 to FTS Pin 1 SECM (sensor GND) Pin B1 to FTS Pin 2 SECM (system GND) Pin A16, B17
932	**FuelTempRangeHigh** Fuel Temperature Sensor Input is High normally set if the fuel temperature sensor wire has been disconnected or the circuit has opened to the SECM.	TurnOnMil (Certified Units Only)	Check if fuel temp sensor connector is disconnected or for an open FTS circuit SECM (signal) Pin B14 to FTS Pin 1 SECM (sensor GND) Pin B1 to FTS Pin 2

(*) Fault actions shown are default values specified by the OEM.

MI-07 Diagnostic Fault Codes (Flash Codes) cont'd.

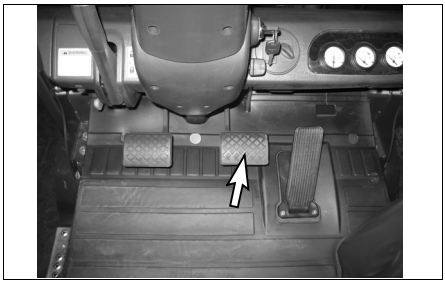
DFC	PROBABLE FAULT	FAULT ACTION *	CORRECTIVE ACTION FIRST CHECK
933	**TransOilTemp** Excessive transmission oil temperature	(1) TurnOnMil (2) DelayedEngine Shutdown	Refer to drivetrain manufacturer's transmission service procedures.
991	**ServiceFault1** Service Interval 1 has been reached	None	Perform service procedure related to Service Interval 1 (determined by OEM)
992	**ServiceFault2** Service Interval 2 has been reached	None	Perform service procedure related to Service Interval 2 (determined by OEM)
993	**ServiceFault3** Service Interval 3 has been reached	None	Perform service procedure related to Service Interval 3 (determined by OEM)
994	**ServiceFault4** Service Interval 4 has been reached-replace HEGO sensors	TurnOnMil (Certified Units Only)	Replace Pre-catalyst HEGO sensor Replace Post-catalyst HEGO sensor
995	**ServiceFault5** Service Interval 5 has been reached-replace timing belt	TurnOnMil	Replace engine timing belt

(*) Fault actions shown are default values specified by the OEM.

Lift Truck Operation

Power Shift Transaxle

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



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

3. Release the parking brake.

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

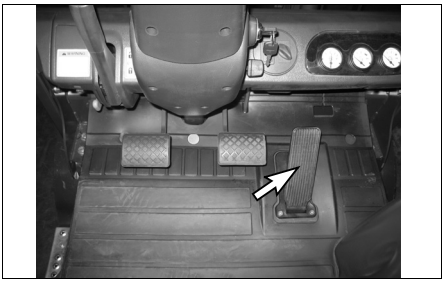
4. Select the direction of travel by pushing the directional lever FORWARD for forward direction or by pulling the lever BACK for reverse direction.

⚠ WARNING

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

This could result in personal injury.

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



5. Release the service brake.

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

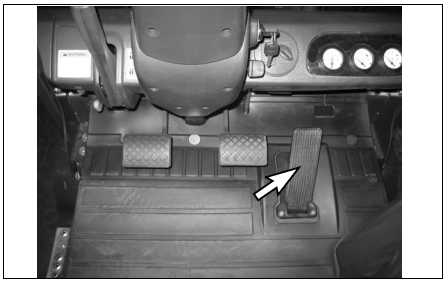
⚠ WARNING

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

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

Failure to comply could result in personal injury.

NOTE : Where conditions permit, directional changes can be made under full power at speeds up to 8 km/h (5 mph). A speed of 8 km/h (5 mph) is a fast walk. Directional shift changes at speeds above 8 km/h (5 mph) are considered abusive. Bring the lift truck to a complete stop where load stability or other factors prevent safe operation under full power shifts safe operation under full power shifts.

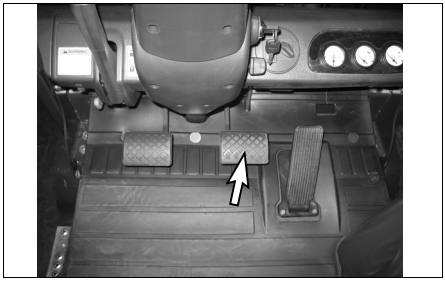


7. To change the lift truck direction of travel, release the accelerator pedal.

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

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

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

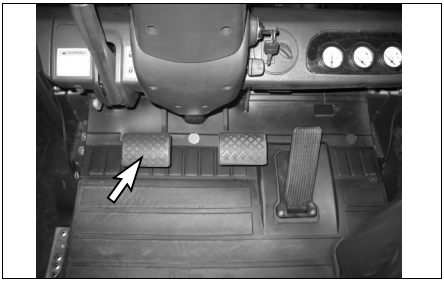


11. To stop the lift truck when traveling in either direction, release the accelerator pedal.

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

Inching

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



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

2. Vary the position of the inching pedal and the accelerator pedal to control the inching speed and distance.

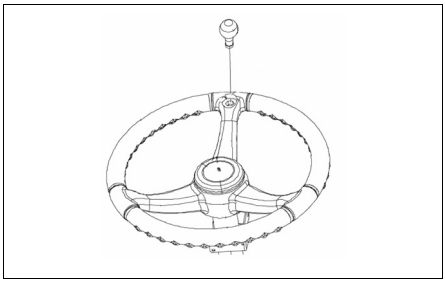
3. Pushing down further on the inching pedal will disengage the transmission completely and apply the service brakes fully to stop and hold the lift truck. This will provide full engine power for fast hydraulic lift.

4. Avoid overuse of the inching pedal as this may cause the automatic transmission oil to overheat or the clutch to slip. Do not use as a footrest or for long periods of time.

5. If user operates continuously pushing work or both brake pedal and accelerator pedal were depressed at the same time, it may cause the automatic transmission oil to overheat or the clutch to slip.

Steering Knob (If Equipped)

There is a steering knob available for inclusion with new truck deliveries. This option is solely intended for slow travel situations when two handed steering is not possible due to hydraulic operations.



⚠ WARNING

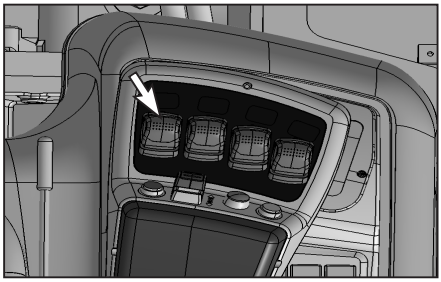
Loss of stability can occur when a lift truck steering wheel is rotated quickly while the truck is in motion. A steering knob will assist with easy rotation of the steering wheel, but if a steering knob is improperly used (e.g., rotating the steering wheel quickly while the truck is in motion), this can contribute to truck instability and a tip over. A steering knob is intended for slow travel maneuverability ONLY.

Finger Tip (Option)

Function of Knobs

If finger tip control option is equipped, the hall-effect type electric knobs replace conventional control valve levers.

Lift Control knob



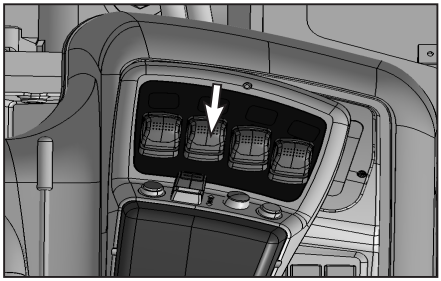
Lower - Push the knob forward smoothly to lower the lift forks.

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

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

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

Tilt Control knob



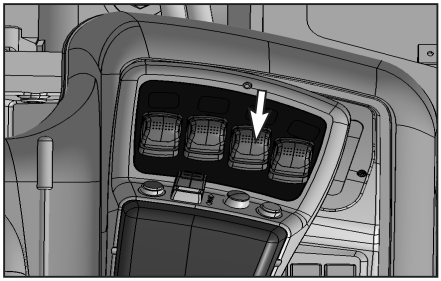
Tilt Forward - Push the knob forward smoothly to tilt the lift forks forward.

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

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

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

Sideshift Attachment Control



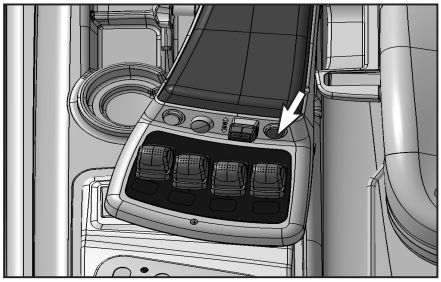
Sideshift Left - Push the knob forward smoothly to shift the carriage to the left.

Sideshift Hold - Release the sideshift attachment knob. The knob will return to the centre(hold) position and sideshifting action will stop.

Sideshift Right - Pull the knob back smoothly to shift the carriage to the right.

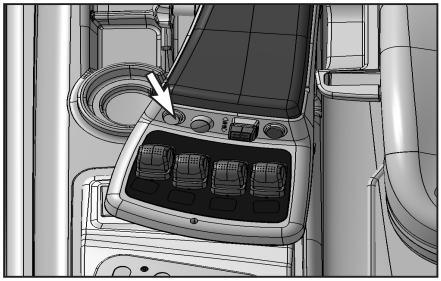
NOTE: To prevent a sudden change of position of the load, operate all lift, tilt and attachment knobs smoothly.

Emergency Switch



In case of emergency, push this button. Pushing button makes the finger tip system on and off alternately. So if the finger tip control dose not work, then press this button once.

Warning Lamp

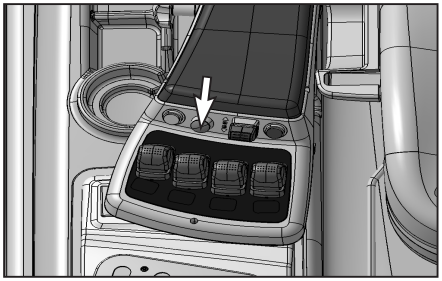


The state of the finger tip system can be checked by the external warning lamp blinking.

Blinking Lamp	State
No Lighting	Normal
Lighting	E-Stop Condition
Lamp Blinking	System Failure

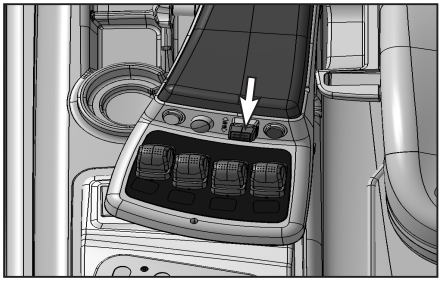
If the warning lamp is blinking, refer to "Diagnosis LED on finger tip ECU".

Auto Tilt Leveling Switch



In case of auto tilt leveling, push this button. Pushing button makes auto tilt leveling function on and off alternately. When the function is on, the mast stops at a vertical position while tilting forward and backward.

Forward and Reverse Lever



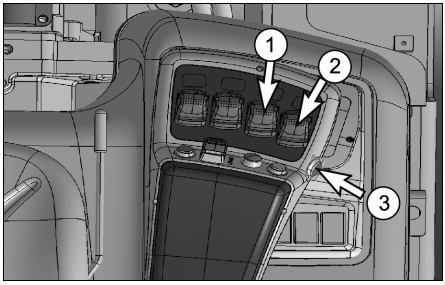
Forward - Push the lever forward. The lift truck will move forward.

Neutral - Move the lever to centre position. The lift truck should not move when lever is in neutral.

Reverse - Pull the lever toward the operator. The lift truck will move in reverse.

NOTE: On leaving the seat or turning the key switch off, make sure that all knobs and Forward & Reverse lever are in the neutral position. Otherwise, the whole finger tip system won't work on returning to the seat or turning a key on.

[Aux2] Optional Selector Switch for SAFETY Operating a Rotating Cramp Attachment



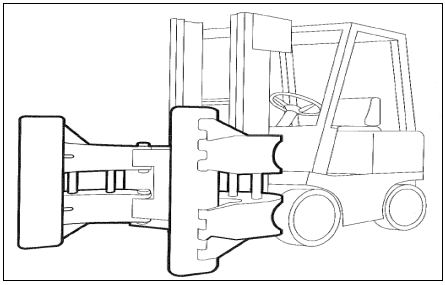
NOTICE

In case that the rotating cramp attachment is installed on the finger tip truck, the optional selector switch(3) (momentary type) is installed on the right side of edge face in the arm rest to prevent the operator from unintentionally removing and dropping a load in the cramping position.

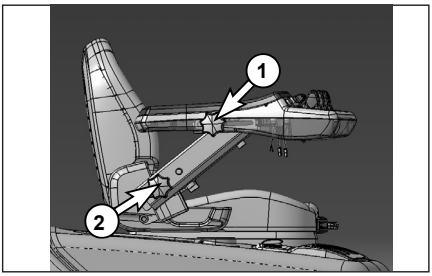
AUX1(1) knob is assigned to a rotation of attachment and AUX2(2) knob is assigned to a cramping motion (removing and cramping a load) of attachment.

When working a cramping motion is necessary, please push or pull AUX2(2) knob within 3 seconds after pushing a selector switch(3). Otherwise, the cramping doesn't work any longer.

In case that the AUX2(2) knob is not again used within 10 seconds after pushing or pulling AUX2(2) knob, the cramping motion is disable. In order to make it possible to do it, push a selector switch(3) again to activate a cramping motion.



Adjustment of Armrest

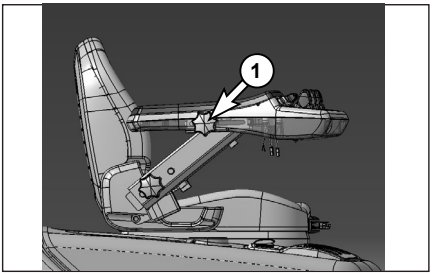


By using 2 knobs, adjust the position of the armrest to give the operator the best comfortable position of arm.

knob #1 - Forward and backward adjustment

knob #2 - Up and down adjustment.

Forward and Backward Adjustment

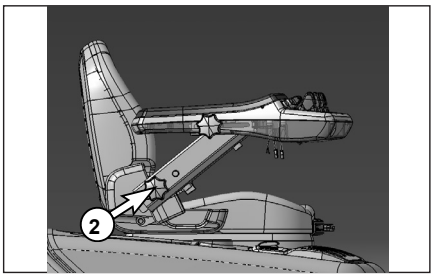


1. Loosen the knob bolt(1).

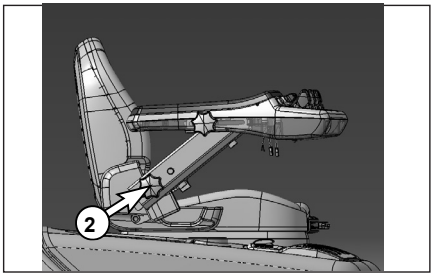
2. Adjust the position of armrest forward or backward.

3. Tighten the knob bolt(1) to be locked tightly

Up and Down Adjustment



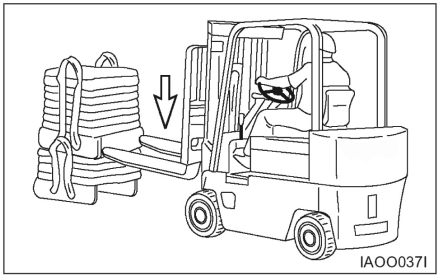
To move the armrest down, turn the knob(2) counterclockwise



To move the armrest up, turn the knob(2) clockwise.

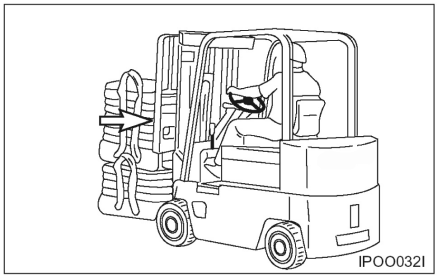
Operating Techniques

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.

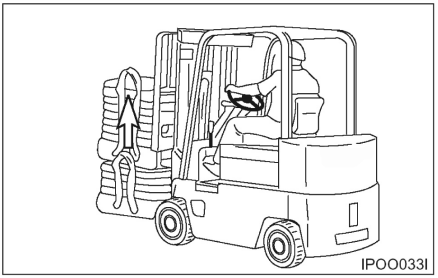


Typical Example

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

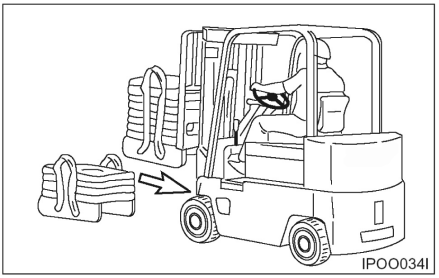
Lifting the Load

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

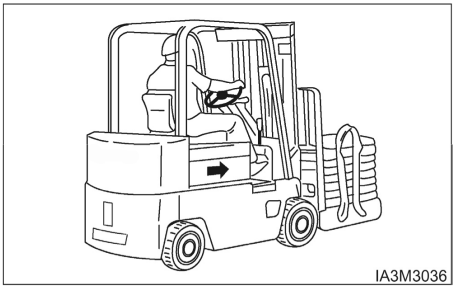
3. Operate the lift truck in reverse until the load is clear of the other material.
4. Lower the cradled load to the travel position.

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

Traveling with the Load

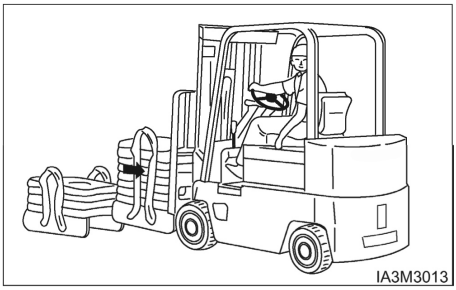
NOTICE

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



Typical Example

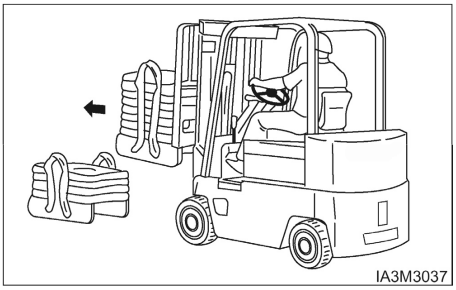
1. Travel with the load uphill on upgrades and downgrades.



Typical Example

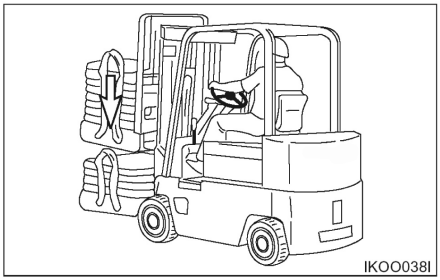
2. For better vision, travel in reverse with bulky loads.

Unloading



Typical Example

1. Move the lift truck into the unloading position.

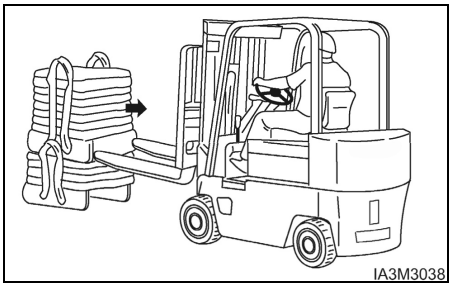


Typical Example

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

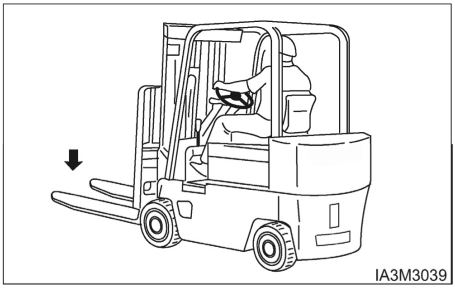
⚠ WARNING

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



Typical Example

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

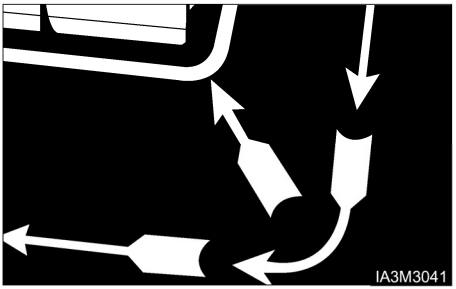


Typical Example

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

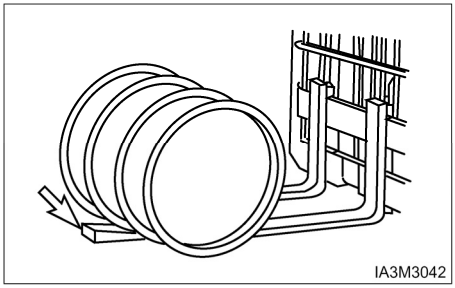
Turning

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

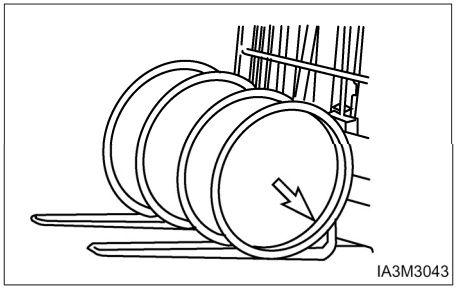


2. In narrow aisles, keep away from the stockpile when turning into the aisle. Allow for counterweight swing.

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

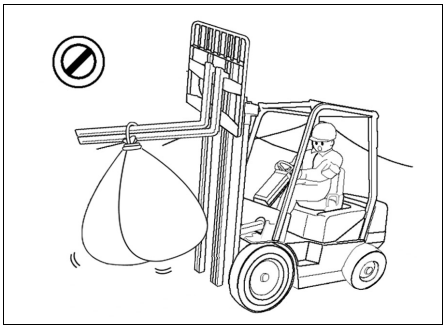
Keep the following points in mind when you operate the lift truck in hot weather.

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 loads



⚠ WARNING

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

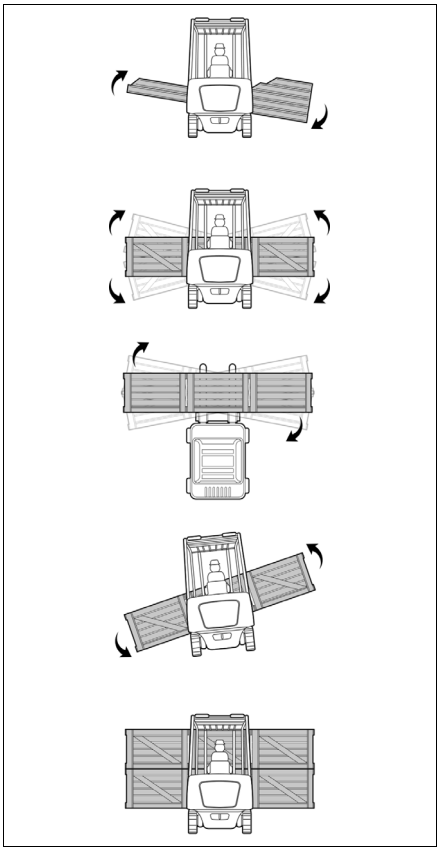
Adapt the travel speed to the load, less than walking pace.

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

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

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

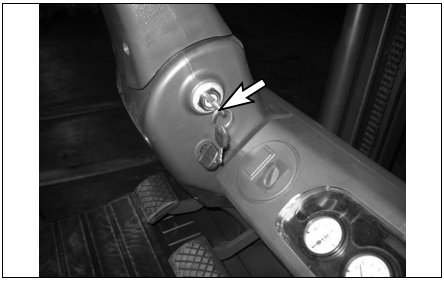
2. Place the transmission controls in NEUTRAL.

3. Engage the parking brake.

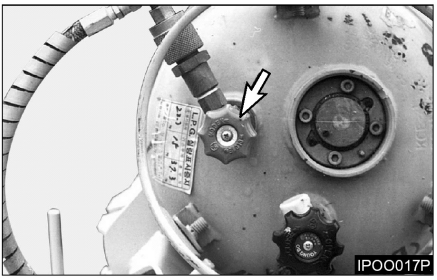
4. Lower the forks to the ground.

⚠ WARNING

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



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



NOTE : If an LP- Gas equipped lift truck is stopped or parked for an indefinite or prolonged period of time, shut off the LP-Gas fuel tank valve.

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

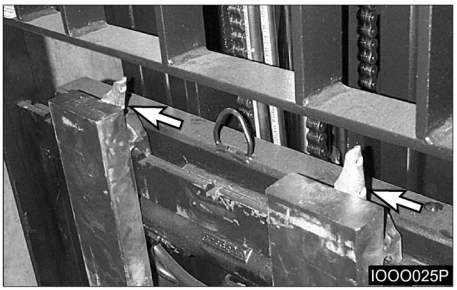
7. Block the drive wheels if parking on an incline.

Lift Fork Adjustment

⚠ WARNING

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

Hook-on type Fork



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

⚠ WARNING

Make sure the forks are locked before carrying a load.

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

Storage Information

Before Storage

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

Long Time Storage

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

To Operate the Lift Truck After a Long Time Storage

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

Transportation Hints

Lift Truck Shipping

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

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

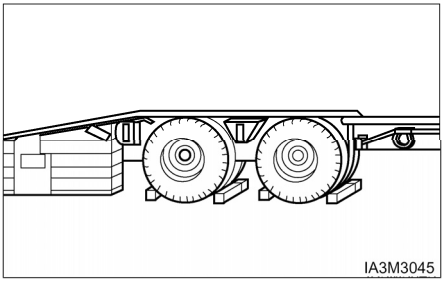
NOTICE

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

Observe all regulations governing wide loads.

NOTICE

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



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

Position the lift truck on the truck bed or the rail car. Apply the parking brake and place the transmission control in NEUTRAL.

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

Block the wheels and secure lift truck with tiedowns.

Machine Lifting and Tiedown Information

NOTICE

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

1. Weight and instructions given herein apply to lift trucks as manufactured by CROWN.
2. Use proper rated cables and slings for lifting. Position the crane for level lift truck lift.
3. Spreader bar widths should be sufficient to prevent contact with the lift truck
4. Use the tiedown locations provided for lift truck tiedown.

Check the state and local laws governing weight, width and length of a load.

Contact your CROWN Lift Truck branch for shipping instructions for your lift truck.

Lifting a Forklift using a Crane

⚠ WARNING

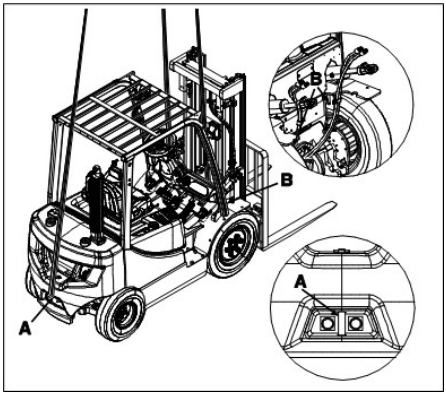
1. **If lifting rope breaks, serious injury/damage may occur.**
2. **The lifting wire rope and stay must be long enough to avoid contact with the forklift. Short rope/stay can damage the vehicle. If it's too long, it may cause interference.**

   If sling and LP tank contact happens during refloatation operation, you should get rid of tank of vehicle with LP tank first, and then proceed.

   Cover the rope/chain with rubber or cloth to prevent damage to the vehicle, as necessary.
3. **Rope/chain and other lifting tools must have sufficient strength, and free of any defect or wear.**
4. **Avoid impact load to the lifting devices/tools.**

---

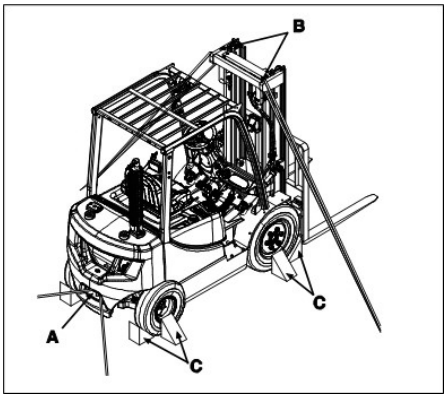
1. Check the weight, length, width and height of the vehicle before lifting.
2. Park the crane at an appropriate position.
3. Connect the rope/chain to the points A and B of the figure below.
4. If the wire rope/chain contacts the vehicle, insert a rubber plate between the rope/chain and the vehicle to protect the vehicle.

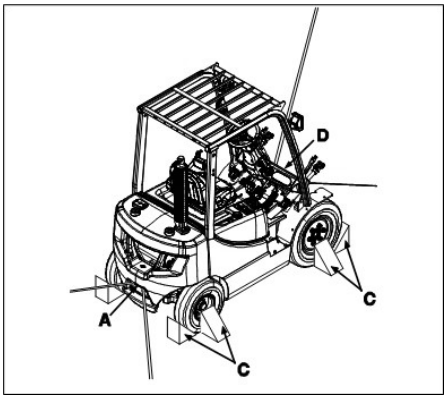


5. Lift up the vehicle slowly.

How to Fix Forklift to a Carrier

1. The rope/chain must have sufficient length for fixing.
2. Park the vehicle on a level ground.
3. Set the mast vertically. Lower the fork or attachment to the lowest position.
4. Set all the operating devices to Neutral Position. Turn OFF the start switch.
5. Apply the parking brake. Stop the tyres with blocks (C).
6. Connect towing hooks to the mast top B (if without mast, front drive axle fix frame or front fender bottom fixing hole D) and rear tow pin A, as shown in the figure below.





Towing Information

⚠ WARNING

Personal injury or death could result when towing a disabled lift truck incorrectly.

Block the lift truck wheels to prevent movement before releasing the brakes. The lift truck can roll free if it is not blocked.

Follow the recommendations below, to properly perform the towing procedure.

These towing instructions are for moving a disabled lift truck a short distance, at low speed, no faster than 2 km/h (1.2 mph), to a convenient location for repair. These instructions are for emergencies only. Always haul the lift truck if long distance moving is required.

Shield must be provided on the towing lift truck to protect the operator if the tow line or bar should break.

Do not allow riders on the lift truck being towed unless the operator can control the steering and/or braking.

Before towing, make sure the tow line or bar is in good condition and has enough strength for the towing situation involved. Use a towing line or bar with a strength of at least 1.5 times the gross weight of the towing lift truck for a disabled lift truck stuck in the mud or when towing on a grade.

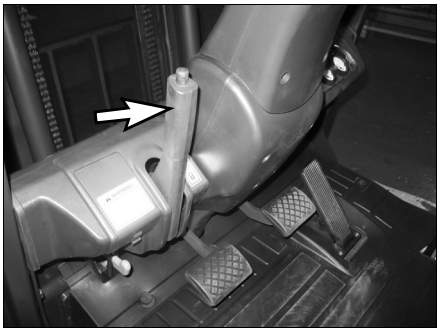
Keep the tow line angle to a minimum. Do not exceed a 30° angle from the straight ahead position. Connect the tow line as low as possible on the lift truck that is being towed.

Quick lift truck movement could overload the tow line or bar and cause it to break. Gradual and smooth lift truck movement will 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 CROWN Lift Tuck branch for towing a disabled lift truck.



1. Release the parking brake.

NOTICE

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

2. Check that the service brake pedal is released.

3. Key switch is in the OFF position.

4. Direction control lever is in neutral.

5. Fasten the tow bar to the lift truck.

6. Remove the wheel blocks. Tow the lift truck slowly. Do not tow any faster than 2 km/h (1.2 mph).

⚠ WARNING

Be sure all necessary repairs and adjustments have been made before a lift truck that has been towed to a service area is put back into operation.

Jacking Information

⚠ WARNING

Jacking up Truck can be dangerous and should be done only by trained personnel using proper tools and procedures.

Block the lift truck wheels to prevent movement while lifting the wheels. The lift truck can roll free if it is not blocked.

Follow the recommendations below, to properly perform the jacking procedure.

NOTICE

Move Trucks to a Secure Non Traffic Maintenance Area with a Level Floor. No Load on Forks.
Remove key from ignition switch.

Hydraulic Jack & Jack Stand Capacity

Hydraulic Jack Capacity

	Model	Height Minimum*	Minimum Requirement	
1 ton class	CGC15/18S-5, CGC15/18S-5, CGC20SC-5	100mm	2000Kg	4400lbs
	CD15/18S-5, CD20SC-5, CG15/18S-5, CG20SC-5	150mm		
2 ton class	CD20/25/ 30/33S-5/7, CD35C-5/7, CG20/25/30E-5, CG20/25 /30/33P-5, CG35C-5	150mm	3000Kg	6600lbs
	CGC20/25/30/ 33E-5, CGC20/25/30/ 33P-5	120mm		
4 ton class	CD35/40/45S-5, CD50/55C-5, CD40/45/50/ 55SC-5, CG35/40/45S-5, CG50/55C-5, CG40/45/50/ 55SC-5	180mm	3900Kg	8600lbs
6 ton class	CD50/60/70S-5/7, CG50/60/70S-5/7	250mm	5800Kg	12800lbs
8 ton class	CD80/90S-5/7	250mm	7500Kg	16500lbs
11 ton class	CD110/130 /160S-5	300mm	10000 Kg	22050lbs
18/20 ton class	CDV180/200S-7	350 mm	14000 Kg	30900lbs
25 ton class	CDV250S-7	400 mm	19000 Kg	42000lbs

• The height of lift truck with a flat tyre is lower than with an inflated tyre. So Height Minimum of Jack must be less than the value of the above chart.

Stand Capacity should be more than the minimum requirement of Hydraulic Jack Capacity.
Hydraulic Jack & Jack Stand are commercially available and should be especially designed for forklift trucks.

Jacking Procedure

Steering Wheel

1. Raise Forks 3 to 6 in (76 to 152 mm) from Floor.
2. Place Wheel Chocks under Both Drive Wheels.
3. Locate Hydraulic Jack under Steering Axle as Shown in Figure A.
4. Jack Up Truck with Hydraulic Jack.
5. Set Jack Stand Height as Required Not to Exceed 16 in (405mm).

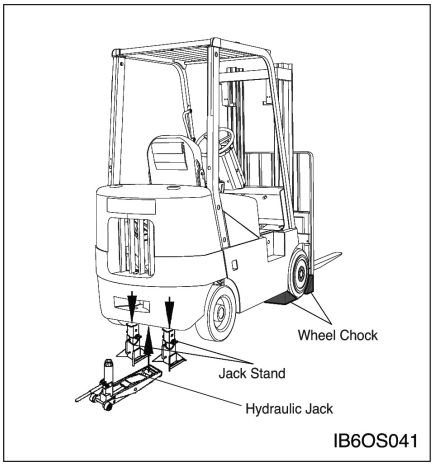


Figure A

Side

1. Lower Forks Completely.
2. Locate Hydraulic Jack under Frame as Shown in Figure B.
3. Jack Up One Side of Truck.
4. Place Hard Wood Block directly under First Stage Mast.

   1ton/2ton class - Use 6X6 in (150X150mm) Block
   3ton/5ton class - Use 8X8 in (200X200mm) Block
   11ton class - Use 12X12 in (300X300mm) Block

5. Jack Up Opposite Side of Truck.
6. Place Second Hard Wood Block under Other Side of First Stage Mast.
7. Do Not Tilt Mast after Blocked.

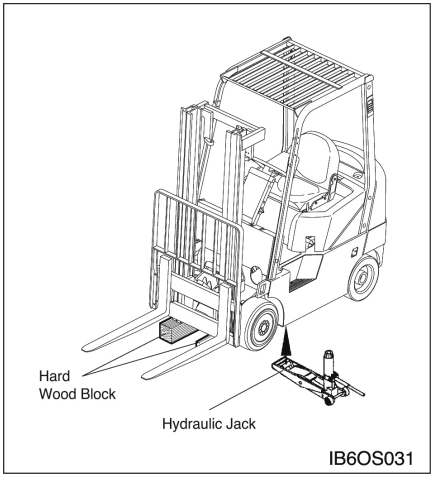


Figure B

⚠ WARNING

Locate Hydraulic Jack under Frame. Do NOT locate on side panel. Do NOT raise side of truck any more than required to insert hard wood block.

⚠ WARNING

Locate Hydraulic Jack and Jack Stands under steer axle. Do NOT locate Hydraulic Jack or Jack Stands on Counter Weight.

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 centre will be stamped 1500B24.

- A fork rated at 2000 kg at 600 mm load centre will be stamped 2000B600.

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 authorised 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 authorised place and container. When cleaning the lift truck, be sure to use an authorised 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.

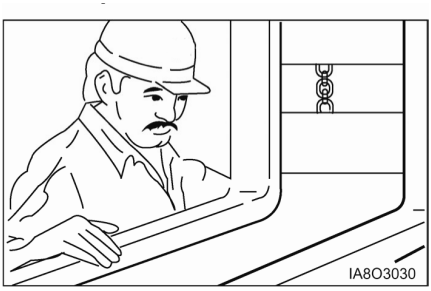
- Stress Risers

  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 or 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 authorised 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 centre 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.

Tyre Inflation Information

The tyre inflation pressures shown in the following [1] chart are cold inflation shipping pressures.

Size	Ply Rating or Strength Index	Shipping Pressure	
		kPa	psi
6.5X10	12	900	130
5.0X8	8	800	115

[1]Standard tyre, 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 tyre supplier.

NOTE : Fill tyres to the recommended pressures listed ± 35 kPa (5 psi). Tyres can be filled with nitrogen.

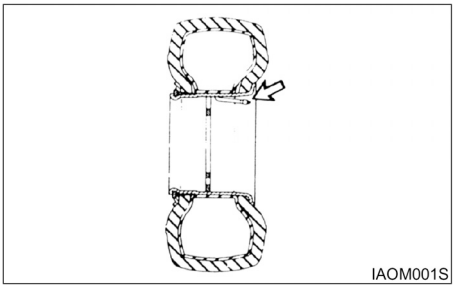
⚠ WARNING

Deflate tyre before removing wheel nuts at tyre change.

Tyre Inflation Pressures Adjustment

A tyre 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 tyre.

Tyre Inflation



Typical Example

⚠ WARNING

Personal injury or death could result when tyres are inflated incorrectly.

Use a self - attaching inflation chuck and stand behind the tread when inflating a tyre.

Proper inflation equipment, and training in using the equipment, are necessary to avoid overinflation. A tyre blowout or rim failure can result from improper or misused equipment.

NOTICE

Set the tyre inflation equipment regulator at no more than 140 kPa (20 psi) over the recommended tyre pressure.

Torque Specifications

Metric Hardware

Most of the nuts, bolts, studs, and threaded holes in your lift truck are metric. In this manual we provide specifications in both metric and U.S. customary measurement. Always replace metric hardware with metric hardware. See the parts books for proper replacement.

NOTE : For proper fit, use only metric tools on metric hardware. Non-metric tools might slip and cause injury.

Torque for Standard Hose Clamps - Worm Drive

NOTICE

The chart below gives the torques for initial installation of hose clamps on new hose and for reassembly or retightening of hose clamps on existing hose.

Clamp Width	Initial Installation Torque On New Hose	
	N·m[1]	lb·in
16 mm (.625 in)	7.5 ± 0.5	65 ± 5
13.5 mm (.531 in)	4.5 ± 0.5	40 ± 5
8 mm (.312 in)	0.9 ± 0.2	8 ± 2
Clamp Width	**Reassembly Or Retightening Torque**	
	N·m[1]	lb·in
16 mm (.625 in)	4.5 ± 0.5	40 ± 5
13.5 mm (.531 in)	3.0 ± 0.5	25 ± 5
8 mm (.312 in)	0.7 ± 0.2	6 ± 2

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

Torque for Standard Bolts, Nuts, and Taperlock Studs

NOTICE

The two charts below give general torques for bolts, nuts, and taperlock studs of SAE Grade 5 or better quality.

Torques for Bolts and Nuts With Standard Threads

Thread Size Inch	Standard Nut and Bolt Torque	
	N·m[1]	lb·ft
1/4	12 ± 4	9 ± 3
5/16	25 ± 7	18 ± 5
3/8	45 ± 7	33 ± 5
7/16	70 ± 15	50 ± 11
1/2	100 ± 15	75 ± 11
9/16	150 ± 20	110 ± 15
5/8	200 ± 25	150 ± 18
3/4	360 ± 50	270 ± 37
7/8	570 ± 80	420 ± 60
1	875 ± 100	640 ± 75
1 1/8	1100 ± 150	820 ± 110
1 1/4	1350 ± 175	1000 ± 130
1 3/8	1600 ± 200	1180 ± 150
1 1/2	2000 ± 275	1480 ± 200

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

Torques for Taperlock Studs

Thread Size Inch	Standard Taperlock Stud Torque	
	N·m[1]	lb·ft
1/4	8 ± 3	6 ± 2
5/16	17 ± 5	13 ± 4
3/8	35 ± 5	26 ± 4
7/16	45 ± 10	33 ± 7
1/2	65 ± 10	48 ± 7
5/8	110 ± 20	80 ± 15
3/4	170 ± 30	125 ± 22
7/8	260 ± 40	190 ± 30
1	400 ± 60	300 ± 45
1 1/8	500 ± 70	370 ± 50
1 1/4	650 ± 80	480 ± 60
1 3/8	750 ± 90	550 ± 65
1 1/2	870 ± 100	640 ± 75

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

Torque for Metric Fasteners

NOTICE

Be very careful never to mix metric with U.S. customary (standard) fasteners. Mismatched or incorrect fasteners will cause lift truck damage or malfunction and may even result in personal injury.

Original fasteners removed from the lift truck should be checked for any damages and kept for reassembly whenever possible. If new fasteners are needed, they must be of the same size and grade as the ones that are being replaced.

The material strength identification is usually shown on the bolt head by numbers (8.8, 10.9, etc.). This chart gives standard torques for bolts and nuts with Grade 8.8.

For mounting torques of main parts, Please refer to Service manual for detail.

NOTE : Metric hardware must be replaced with metric hardware. Check parts book.

Thread Size Metric	Standard Torque	
	N·m[1]	lb·ft
M6	12 ± 4	9 ± 3
M8	25 ± 7	18 ± 5
M10	55 ± 10	41 ± 7
M12	95 ± 15	70 ± 11
M14	150 ± 20	110 ± 15
M16	220 ± 30	160 ± 22
M20	450 ± 70	330 ± 50
M24	775 ± 100	570 ± 75
M30	1600 ± 200	1180 ± 150
M36	2700 ± 400	2000 ± 300

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

Cooling System Specifications

Coolant Information

NOTE : The following information is generic and valid for lift trucks.

Engine operating temperatures have increased to improve engine efficiency. This means proper cooling system maintenance is especially important. Overheating, overcooling, pitting, cavitation erosion, cracked heads, piston seizures, and plugged radiators are classic cooling system failures. In fact, coolant is as important as the quality of fuel and lubricating oil.

NOTICE

CROWN recommends that the coolant mixture contain 50% commercially available automotive antifreeze, and 50% water.

The coolant mix with concentration of antifreeze smaller than 30% does not provide sufficient corrosion protection. Concentrations over 60% adversely affect freeze protection and heat transfer rates.

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

If the machine is to be stored in, or shipped to, an area with freezing temperatures, the cooling system must be protected to the lowest expected out- side (ambient) temperature.

The engine cooling system is normally protected to -28℃(-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.

Check the specific gravity of the coolant solution frequently in cold weather to ensure adequate protection.

Clean the cooling system if it is contaminated, the engine overheats or foaming is observed in the radiator.

Old coolant should be drained, the system cleaned and new coolant added every 2000 service hours or yearly.

Refer to topic, “Cooling System - Clean, Change” in Every 2000 Service Hours or Yearly section.

Filling at over 20 liters (5 U.S. gallons) per minute can cause air pockets in the cooling system.

After draining and refilling the cooling system, operate the engine with the radiator cap removed until the coolant reaches normal operating temperature and the coolant level stabilises. Add coolant as necessary to fill the system to the proper level.

Never operate without a thermostat in the cooling system. Cooling system problems can arise without a thermostat.

Coolant Water

Hard water, or water with high levels of calcium and magnesium ions, encourages the formation of insoluble chemical compounds by combining with cooling system additives such as silicates and phosphates.

The tendency of silicates and phosphates to precipitate out-of-solution increases with increasing water hardness. Hard water, or water with high levels of calcium and magnesium ions encourages the formation of insoluble chemicals, especially after a number of heating and cooling cycles.

CROWN prefers the use of distilled water or deionized water to reduce the potential and severity of chemical insolubility.

Acceptable Water	
Water Content	**Limits (PPM)**
Chlorides (Cl)	50 maximum
Sulfates (SO_4)	50 maximum
Total hardness	80mg/l
Total solids	250 maximum
PH	6.0 to 8.0

ppm = parts per million

Using water that meets the minimum acceptable water requirement may not prevent drop-out of these chemical compounds totally, but should minimise the rate to acceptable levels.

Antifreeze

NOTICE

CROWN 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.

CROWN recommends that the coolant mix contain 50% commercially available automotive antifreeze, or equivalent and acceptable water to maintain and adequate water pump cavitation temperature for efficient water pump performance.

Premix coolant solution to provide protection to the lowest expected outside (ambient) temperature. Pure undiluted antifreeze will freeze at -23°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 increase the concentration of dissolved solids and undissolved chemical inhibitors in the cooling system. Add antifreeze mixed with water to the same freeze protection as your cooling system.

Use the chart below to assist in determining the concentration of antifreeze to use.

Antifreeze Concentrations	
Protection Temperature	**Concentration**
Protection to -15°C (5°F)	30% antifreeze and 70% water
Protection to -23°C (-10°F)	40% antifreeze and 60% water
Protection to -37°C (-34°F)	50% antifreeze and 50% water
Protection to -51°C (-60°F)	60% antifreeze and 40% water

Fuel Specifications

General Fuel Information

Use only fuel as recommended in this section.

NOTICE

Fill the fuel tank at the end of each day of operation to drive out moisture laden air and to pre- vent condensation. Maintain a constant level near the top of the day tank to avoid drawing moisture into the tank as the level decreases.
Do not fill the tank to the top. Fuel expands as it gets warm and can overflow. Do not fill the fuel filters with fuel before installing them. Contaminated fuel will cause accelerated wear to the fuel system parts.

Drain the water and sediment from main fuel storage tank before it is refilled. This will help prevent water and/or sediment from being pumped from the fuel storage tank into the engine fuel tank.

Diesel Specifications

Diesel fuel should comply with the following specifications. The table lists several worldwide specifications for diesel fuels.

Diesel Fuel Specification	Location
ASTM D975 No.1D/2D	USA
EN590:96	EU
IS0 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No. 2	Japan
KSM-2610	Korea
GB252	China

Additional Technical Fuel Requirements

- The fuel cetane number should be equal to 45 or higher.
- The sulphur content must not exceed 0.5% by volume. Less than 0.05% is preferred.
- For electronically controlled engines, for example 4TNV98-ZSDF, it is mandatory to use fuel that does not contain 0.1 % or more sulphur content.
- In general, using a high sulphur fuel may possible result in corrosion inside the cylinder.
- Especially in U.S.A. and Canada, Low Sulphur (300-500mglkg sulphur content) or Ultra Low Sulphur fuel should be used.
- Bio-Diesel fuels. See Bio-Diesel Fuels on next page.
- NEVER mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- The water and sediment in the fuel should not exceed 0.05% by volume.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Poor quality fuel can reduce engine performance and / or cause engine damage.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance.
- Consult your Crown representative for more information.
- The ash content must not exceed 0.01% by volume.
- The carbon residue content must not exceed 0.35% by volume. Less than 0.1 % is preferred.
- The total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- The PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.
- The metal content of Na, Mg, Si, and Al should be equal to or lower than 1 mass ppm.
- Lubricity: The wear mark of WS1.4 should be Max. 0.01 8 in (460 pm) at HFRR test.

Bio - Diesel Fuels

In Europe and in the United States, as well as some other countries, non-mineral oil based fuel resources such as RME (Rapeseed Methyl Ester) and SOME (Soybean Methyl Ester), collectively known as FAME (Fatty Acid Methyl Esters), are being used as extenders for mineral oil derived diesel fuels.

Crown 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 authorised diesel fuel suppliers.

Precautions and concerns regarding the use of bio- fuels:

1. Free methanol in FAME may result in corrosion of aluminum and zinc FIE components.
2. Free water in FAME may result in plugging of fuel filters and increased bacterial growth.
3. High viscosity at low temperatures may result in fuel delivery problems, injection pump seizures, and poor injection nozzle spray atomization.
4. FAME may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.
5. Even bio-diesel fuels that comply with a suitable standard as delivered, will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and / or fuel storage containers, may be necessary.
6. The use of bio-diesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or biodiesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine.

Gasoline Specifications

Only unleaded gasoline should be used for CROWN forklift trucks. The gasoline in which methanol is contained, is not recommended. The gasoline in which ethanol is contained, is not recommended, either.

It is recommended to use gasoline fuel that has octane number 87, to prevent knocking trouble.

LP-Gas Specifications

LP-Gas is “Liquefied Petroleum Gas”. The exact composition of LP-Gas varies slightly between different parts of the country and different refineries. HD5 or HD10 is recommended for CROWN forklift trucks.

Composition of HD5	
Propane (C_3H_8)	90.0 %
Propylene	up to 5 %
Butane (C_4H_{10})	2.0 %
iso-Butane	1.5 %
Methane (CH_4)	1.5 %
Total	100 %

⚠ WARNING

Remember LP-Gas 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.

Lubricant Specifications

Lubricant Information

Certain abbreviations follow Society of Automotive Engineers (SAE) J754 nomenclature and some classifications follow SAE J183 abbreviations.

The MILspecifications are U.S.A. Military Specifications.

The recommended oil viscosities can be found in the Lubricant Viscosities chart in this publication.

Grease is classified by the National Lubricating Grease Institute (NLGI) based on ASTM D217-68 Worked Penetration characteristics which are given a defined consistency number.

Engine Oil (DEO and EO)

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

- Gasoline/LP-Gas Engine: API SL or higher

NOTE : Engine Oil Service hours can be extended to 500 hours by using Crown supplied specific oil. Please consult Crown branch about it.

• Diesel Engine: API CH-4 Grade or ACEA E5

NOTICE

Failure to follow the oil recommendations can cause shortened engine lift due to carbon deposits or excessive wear.

Consult the EMA Lubricating Oils Data Book for a listing of oil brands.

NOTE : The percentage of sulphur in the fuel will affect the engine oil recommendations. For fuel sulphur effects, the Infrared Analysis or the ASTM D2896 procedure can be used to evaluate the residual neutralization properties of an engine oil. The sulphur products formation depends on the fuel sulphur 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 antiwear, antifoam, antirust and antioxidation additives for heavy duty use as stated by the oil supplier. ISO viscosity grade of 32 would normally be selected.

NOTICE

Make-up oil added to the hydraulic tanks must mix with the oil already in the systems. Use only petroleum products unless the systems are equipped for use with special products. If the hydraulic oil becomes cloudy, water or air is entering the system. Water or air in the system will cause pump failure. Drain the fluid, retighten all hydraulic suction line clamps, purge and refill the system. Consult your CROWN Lift Truck branch for purging instructions.

Transmission Oil (TDTO)

NOTICE

This oil is 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 CROWN 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.

The API CD/TO - 4 specification or MIL - L 2104D or E oil could be used.

Drive Axle Oil

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

- **Shoe Brake**

Select oil that meets below specifications.

API GL-5

MIL-L-2105 C, D

Gear Oil offers maximum protection against the scoring and pitting of gear teeth and rolling element bearings.

Gear Oil can also provide excellent stability under high temperature conditions and has superior low temperature performance. It will also give protection against rust and corrosion.

- **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 authorised for use.

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

Brake Fluid

- **Shoe Brake**

Use heavy duty hydraulic brake fluid. It must be certified by the oil supplier to meet SAE J1703f latest revision, DOT 3 or 4 specifications.

- **Oil Cooled Disc Brake**

Use heavy duty hydraulic brake fluid certified by oil supplier to meet the latest version of following classifications.

• ISO 6743/4	HM
• AFNOR NFE 48-603	HM
• DIN 51524 TEIL2	H-LP
• HAGGLUNDS DENISON	HFO-HF2
• CINCINNATI	P68,69,70

Viscosity : ISO VG10

ISO Viscosity Grade of 10 would normally be selected. The following products are authorised for use.

Supplier	Product Name
TOTAL	AZOLLAZS 10
AGIP	ACER 10
BP	ENERGOLHP 10, HLP 10
CALTEX	SPINDURN 10
ELF	SPINELF 10
ESSO	NUTO H 10
	SPINESSO 10
FINA	HYDRAN 10
MOBIL	VELOCITE OILNO.5
	VELOCITE OILE

Lubricating Grease (MPGM)

Use Multipurpose Molybdenum Grease (MPGM) for all lubrication points. If MPGM grease can not be used, a multipurpose type grease which contains 3% to 5% molybdenum disulfide can be used.

NLGI No.2 grade is suitable for most temperatures.

Use NLGI No.1 or No.0 grade for extremely low temperature.

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 (Gasoline and LP) **API SL**		SAE 10W30	-20	40	-4	104
		SAE 5W30	-30	30	-22	86
Engine Crankcase (Diesel) **API CI4 or ACEA E5**		SAE 10W40	-15	+50	+5	+122
Power Shift Transmission **API CD/TO-4**		SAE 10W	-20	+22	-4	+72
		SAE 30	+10	+50	+50	+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	Shoe Brake **API GL-5**	SAE 80W90	-20	+50	-4	+122
	Disc Brake (OCDB) **API GL-4**	SAE 80W	-20	+50	-4	+122
Brake Reservoir (Only for OCDB)	Shoe Brake **DOT3 DOT4**	SAE J1703f	-30	+50	-22	+122
	Disc Brake (OCDB) **ISO 6743/4 HM**	ISO VG10	-20	+30	-4	+86

The SAE grade number indicates the viscosity of oil. A proper SAE grade number should be selected according to ambient temperature.

Refill Capacities

Refill Capacities (Approximate)		
Compartment or System	**Liters**	**U.S. Gal.**
Engine Crankcase w/Filter HMC2.4L&G424I LP	5.1	1.34
Engine Crankcase w/Filter V2403 Diesel	6.5	1.7
Cooling System w/Coolant Recovery HMC2.4L&G424I Gasoline & LP-Gas	8.5	2.25
Cooling System w/Coolant Recovery Bottle V2403 Diesel	9.8	2.55
Fuel Tank-G Series, D Series Gasoline, Diesel	42	11.0
LP-Gas-G-Series	15.2Kg	33.5 lb
Power Shift Transmission	11.2	3
Hydraulic & Power Steering System	30	7.9
Drive Axle	5.0	1.3
Brake System	0.6	0.16

Maintenance Intervals

NOTICE

Never exceed the Maintenance Intervals specified in the manual. Defects and/or damage to the important functional components may be resulted in.

NOTICE

All maintenance and repair, except every 10 service hours or daily, on the lift truck must be performed by qualified and authorised personnel only.

NOTICE

Careless disposal of waste oil can harm the environment and can be dangerous to persons. Always dispose of waste oil to an authorised personnel only.

When Required

Every 10 Service Hours or Daily

First 50-100 Service Hours or a Week

Every 250 Service Hours or Monthly

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

Environment Protection

Quick Reference to Maintenance Schedule			FIRST	EVERY							
ITEMS	SERVICES	PAGE	When Required	50-100 Service Hours or a Week	10 Service Hours or a Daily	250 Service Hours or a Monthly	500 Service Hours or 3 Months	1000 Service Hours or 6 Months	1500 Service Hours or 9 Months	2000 Service Hours or a Yearly	2500 Service Hours or 15 Months
Air Cleaner Indicator	Check	171		O							
Air Intake System	Check, Clean	160	O								
Air Intake System	Change	182					O				
Battery Terminal	Clean, Inspect	166	O								
Belts	Check, Adjust	183					O				
Brake Oil Level	Check	174		O							
Carriage Roller Extrusion	Adjust	168	O								
Checking the TMAP Sensor (HMC2.4L, G424I Engine Only)		203									O
Coolant Level	Check, Clean	170		O							
Cooling System	Clean, Change	198								O	
Crosshead Roller	Inspect	185					O				
Cylinder Rod Extension	Adjust	184					O				
Drive axle	Inspect	192						O			
Drive Axle Oil	Change	178			O						
Drive Axle Oil (OCDB)	Change	186					O				
Drive Axle Oil (Shoe Brake)	Change	194							O		
Drive Wheel Bearing	Reassemble	197								O	
Engine Oil & Filter	Change	181,182				O	O				
Engine Oil & Filter (Diesel Engine Only)	Change	175			O						
Engine Oil Level	Check	170		O							
Engine Valve Lash (Diesel Engine Only)	Check, Adjust	169	O								
Engine Valve Lash (Diesel Engine Only)	Check, Adjust	189						O			
Fork	Inspect	200								O	
Fuel Filter (Diesel Engine Only)	Change	183					O				
Fuel Lines & Fittings	Check	193						O			
Fuel Tank Filler Cap and Screen (If Equipped)	Clean	163	O								
Fuel Trim Valve(FTV) Inspection (HMC2.4L Engine Only)		187					O				
Fuse & Relay (HMC2.4L, G424I Only)		165	O								
Fuses, Bulbs and Circuit Breaker	Change, Reset	164	O								
Horn & Lights (If Equipped)	Check	186					O				
Hydraulic Oil	Change, Check, Clean	202									O
Hydraulic Oil Level	Check	174		O							
Hydraulic Return Filter, Breather & Strainer	Check, Change	189						O			
Inching & Braking Control Shaft	Lubricate	186					O				
Inspect Battery System		202									O

Quick Reference to Maintenance Schedule			FIRST	EVERY							
ITEMS	SERVICES	PAGE	When Required	50-100 Service Hours or a Week	10 Service Hours or a Daily	250 Service Hours or a Monthly	500 Service Hours or 3 Months	1000 Service Hours or 6 Months	1500 Service Hours or 9 Months	2000 Service Hours or a Yearly	2500 Service Hours or 15 Months
Inspect Coolant Hoses (LP, Dual Fuel Engines Only)		192						O			
Inspect Electrical System (LP, Dual Fuel Engine Only)		187					O				
Inspect Engine for Exhaust Leaks		171		O							
Inspect Engine for Fluid Leaks		170		O							
Inspect Foot Pedal Operation (HMC2.4L, G424I Only)		171		O							
Inspect for Intake Leaks (LP, Dual Fuel Engine Only)		204									O
Inspect Ignition System (LP-Gas, Gasoline & Dual Fuel Engines Only)		194							O		
Inspect Mixer Assembly (HMC2.4L,G424I Engine Only)		193						O			
Inspect Throttle Assembly (HMC2.4L,G424I Engine Only)		193						O			
Inspect Vacuum Lines and Fittings (HMC2.4L, G424I Engine Only)		187					O				
Lift Chains	Test, Check, Adjust	190						O			
LP Regulator/Converter Inspection (LP, Dual Fuel Engine Only)		192						O			
Mast Channels	Lubricate	173		O							
Mast Hinge Pin	Lubricate	185					O				
Mast, Carriage, Lift Chains & Attachments	Inspect, Lubricate	185					O				
Overhead Guard	Inspect	186					O				
Parking Brake	Test, Adjust	178,185			O		O				
PCV Valve System	Inspect, Clean	188					O				
Priming the Fuel System (Diesel Engine Only)		162	O								
Replace LP Fuel Filter Element (LP, Dual Fuel Engine Only)		194							O		
Replace Oxygen Sensor (HMC2.4L, G424I Engine Only)		203									O
Replace PCV Valve and breather element (LP-Gas, Gasoline and Dual Fuel Engines) - Change		204									O
Replace Spark Plugs (HMC2.4L, G424I Engine Only)		204									O
Seat, Hood Latch & Support Cylinder	Check, Lubricate	163	O								
Steer Wheel Bearings	Reassemble	196								O	
Steering Mechanism	Check, Lubricate	186					O				
Testing Fuel Lock-off Operation (LP-Gas Engine Only)		195							O		

Quick Reference to Maintenance Schedule			FIRST	EVERY								
ITEMS	SERVICES	PAGE	When Required	50-100 Service Hours or a Week	10 Service Hours or a Daily	250 Service Hours or a Monthly	500 Service Hours or 3 Months	1000 Service Hours or 6 Months	1500 Service Hours or 9 Months	2000 Service Hours or a Yearly	2500 Service Hours or 15 Months
Tilt Cylinders	Check, Adjust, Lubricate	184					O				
Tyres and Wheels	Inspect, Check	167	O								
Transmission Oil & Strainer	Clean, Change	192						O			
Transmission Oil Level	Check	173		O							
Transmission Oil, Oil Filter & Strainer	Check, Clean, Change	176			O						
Universal Joint	Inspect, Lubricate	187					O				

When Required

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

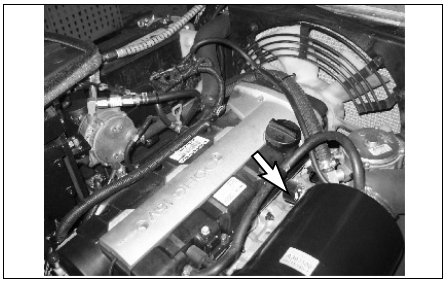
When required indicates no set schedule for review or replacement. This should be done based on operational conditions and operational environment. The Air filtration system should be kept as clean as possible and checked as often as the operational conditions demand. The harsher the application the more frequently the air filter should be checked. In some applications daily inspection may be required.

Air Intake System - Check, Clean

Servicing Filter Element

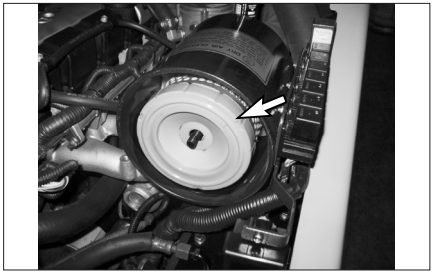
NOTICE

Never service filter with the engine running.



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 hood and seat assembly. Make certain the support cylinder securely holds the hood open. Loosen the cover latches and remove the cover.



2. Rotate the element slightly to separate it from its base and remove it from the air cleaner housing.
3. Clean and inspect the element or replace with a new element. See topic, “Cleaning Primary Filter Element”.
4. Clean the inside of air cleaner housing and the cover. Inspect all connections between the air cleaner and carburetor. Check intake hose for cracks, damage necessary to prevent leakage.

NOTICE

Do not allow dirty air to enter the intake hose when cleaning the inside of the cleaner housing.

5. Check the air cleaner housing for loose retaining bolts.
6. Reset the air cleaner service indicator.
7. Install the air filter element.
8. Install the cover and tighten the cover latches.
9. Start the engine and observe the position of the indicator. If the indicator shows RED after the installation of the primary element, install another clean or a new element or, replace the secondary element. See topic, “Air Intake System - Change” in Every 500 Service Hours or 3 months section.
10. Stop the engine and close the hood and seat assembly.

Cleaning Primary Filter Elements

⚠ WARNING

Pressure air can cause personal injury.

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

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

NOTICE

Do not clean the elements by bumping or tapping them.

Inspect filter elements after cleaning. Do not use a filter with damaged pleats, gaskets or seals.

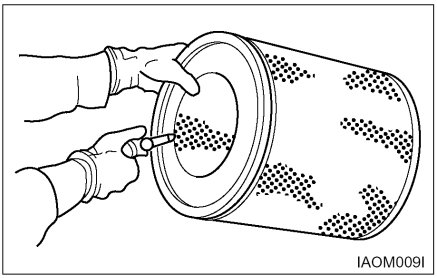
When cleaning with pressure air, use 205 kPa (30 psi) maximum pressure to prevent filter element damage.

When cleaning with pressure water, use 280 kPa (40 psi) maximum pressure to prevent filter element damage.

Have spare elements on hand to use while cleaning used elements.

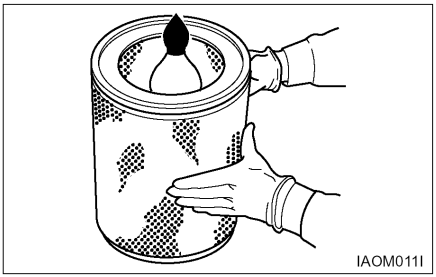
The primary element should be replaced after 3 months service. In case of harsh application having lots of dirt, please clean and replace the primary element more often.

Air-205 kPa (30 psi) Maximum Pressure



Direct air on the inside and outside of the element along the length of the pleats. Check the element for any tears, rips or damage.

Checking Element

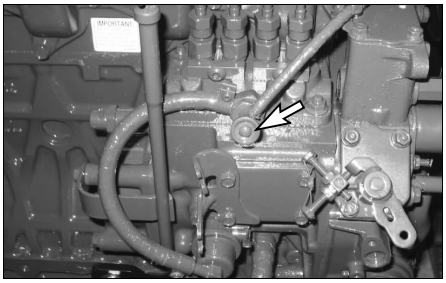


1. Insert a light inside the clean dry element and examine it. Discard the element if tears, rips or damage are found.
2. Wrap and store good elements in a clean, dry place.

Priming the Fuel System (Diesel Engine Only)

Bleeding the Fuel System

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

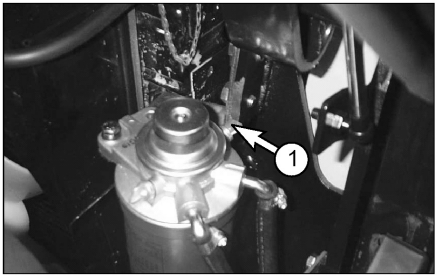


1. Open the air vent cock on top of the fuel injection pump.

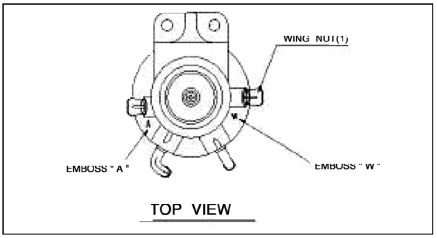
2. Push the priming pump on top of the fuel filter housing against the spring to allow air mixed with fuel to escape through the bleeding screw. Ensure that excess fuel is collected in a container or rag to prevent fuel from getting onto engine parts.
3. Repeat the pumping action until no bubbles are visible in the flowing fuel.
4. Tighten the bleed screw and the air rent cock.
5. Start the engine and check fuel system for leaks.

Draining the Water From the Fuel Filter

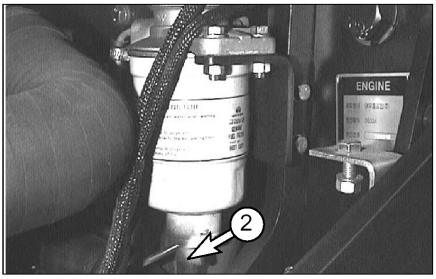
1. Check "Diesel Engine Water in fuel filter indicator light" in instrument panel. Refer to, "Diesel Engine Water in Fuel Filter Indicator Light" in Operator's Station and Monitoring Systems section.



2. Turn the wing nut (1) counter clockwise more than two turns. The wing nut (1) is located near fuel's inlet side. Sometimes later, "w" marking will be added as illustrated in Top View below.



3. Turn the wing nut (2) counter clockwise more than six turns to open the drain valve on the bottom of the fuel filter.



4. Drain some fuel (and any water) until the clean fuel flows out from the filter.

Fuel Tank Filler Cap and Screen (If Equipped) - Clean

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

1. Remove the filler cap assembly. Clean in clean, nonflammable solvent.
2. Dry cap assembly.
3. Install filler cap assembly.

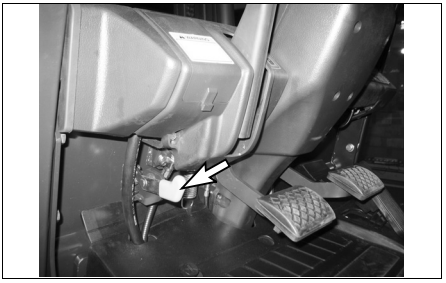
⚠ WARNING

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

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

Seat, Hood Latch & Support Cylinder - Check, Lubricate

1. 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.



2. Pull the latch to raise the hood and seat assembly. Make certain the support cylinder will hold the hood open.

Fuses, Bulbs and Circuit Breaker - Change, Reset

Fuses

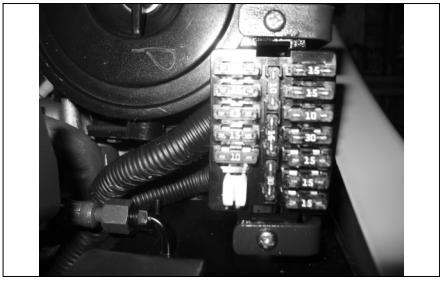
NOTE : If a fuse filament separates, use only the same type and size fuses for replacement, If the filament in a new fuse separates, have the circuits and instruments checked.

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.

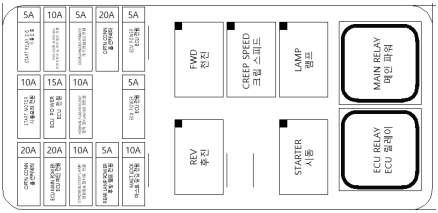
Fuse - Protects an electrical circuit from an overload. Opens (filament separates) if an overload occurs.



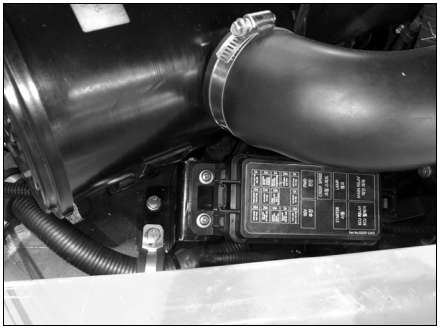
Fuses are identified as follows :

1. Horn - 10 amp.
2. Head Lamp, Clearance Lamp, Tail Lamp. - 15 amp.
3. Lamp Relay Coil, Fwd/Rev Solenoid, Rear Lamp /Alarm - 10 amp
4. Instrument Panel, Hour Meter, Preheat Controller, Fuel Shut-off Solenoid - 15 amp
5. Stop Lamp, Turn Signal Lamp, Strobe Lamp - 15 amp
6. Starter Relay - 10 amp

Relays are identified as follows:
1. FWD
2. C/SPEED
3. LAMP
4. REV
5. STARTER
6. MAIN RELAY
7. ECU RELAY



Check the fuses. Use a flashlight, if necessary



Remove the cover from the fuse box located under the air filter

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

Relay – Electrically operated switch.

Bulbs

Bulbs are identified as follows :

1. Bulb-head lamp halogen (12V-35W)

***2.** Bulb-back up (12V-8W)

***3.** Bulb-turn signal (12V-23W)

***4.** Bulb-stop & tail (12V-23/8W)

* OPTIONAL LAMP OR LIGHT

Fuse & Relay (HMC2.4L, G424I Only)

Fuse

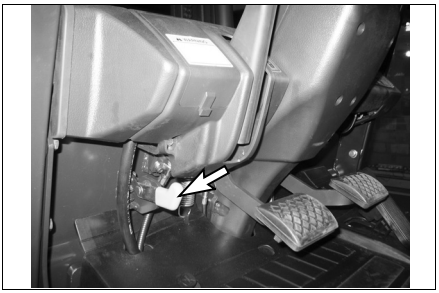
G15/18S-5, G20SC-5

Located on the top of Engine

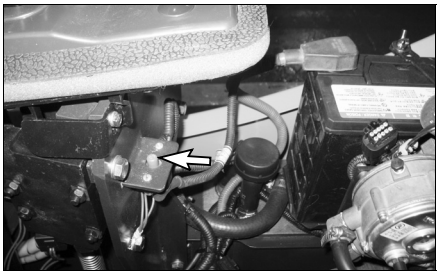
Relay

Located rear side of valve mounting bracket

Circuit Breaker



1. Raise the hood and seat assembly. Make sure the support cylinder securely holds the hood open.



Typical Example

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

NOTE : To reset circuit breakers push in on the button. The button should stay in if the breaker is reset. If the button will not stay in, or comes out shortly after reset, have the circuits checked.

Battery Terminal - Clean, Inspect

⚠ WARNING

Batteries give off flammable fumes that can explode.

Do not smoke when observing the battery electrolyte levels.

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

Always wear protective glasses when working with batteries.

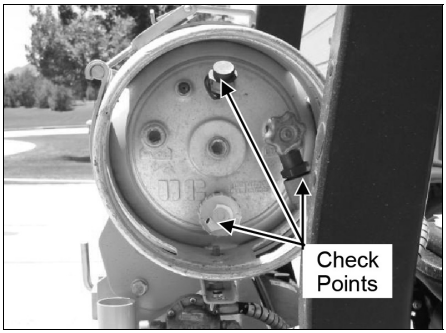
Typical Example

1. Clean the top of the battery and terminals.

2. Check terminals for corrosion. Coat terminals with heavy grease.

3. Ensure the battery terminal is firmly tightened and rubber cap is installed.

Test Fuel System for Leaks (LP and Dual Fuel Engines Only)



1. Obtain a leak check squirt bottle or pump spray bottle.
2. Fill the bottle with an approved leak check solution.
3. Spray a generous amount of the solution on the fuel system fuel lines and connections, starting at the storage container.
4. Wait approximately 15-60 seconds then perform a visual inspection of the fuel system. Leaks will cause the solution to bubble.
5. Repair any leaks before continuing.
6. 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.
7. Repair any fuel leaks before continuing.

⚠ WARNING

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

Tyres and Wheels - Inspect, Check

⚠ WARNING

Servicing and changing tyres and rims can be dangerous and should be done only by trained personnel using proper tools and procedures.

Deflate tyre before removing wheel nuts from the truck.

If correct procedures are not followed while servicing tyres and rims, the assemblies could burst with explosive force and cause serious physical injury or death.

Follow carefully the specific information provided by your tyre servicing man or branch.

Check Inflation and Damage

Inspect tyres for wear, cuts, gouges and foreign objects. Look for bent rims and correct seating of locking ring.

Check tyres for proper inflation. See “Tyre Inflation Pressures”.

To inflate tyres 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 tyre. NOT in front of the rim.

Do not reinflate a tyre 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.

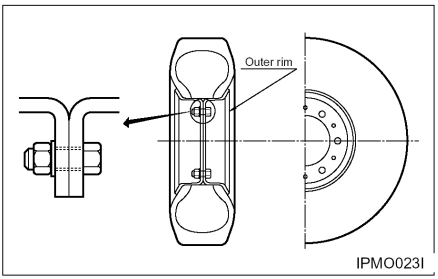
When tyres are changed, be sure to clean all rim parts and, if necessary, repaint to stop detrimental effects of corrosion. Sand blasting is recommended for removal of rust.

⚠ WARNING

Deflate tyre before removing wheel nuts from the truck.

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.

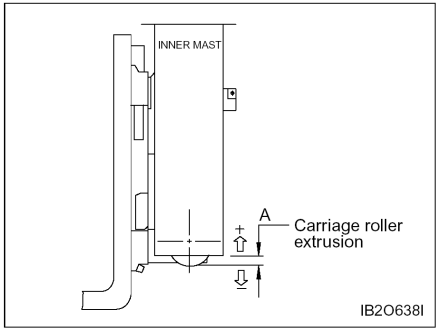
Do NOT, under any circumstances, attempt to rework, weld, heat or braze any rim components.



The safety disc wheel has designed to prevent loosening of the rim bolt on the two-piece rim where the tyre is attached to the truck. The rim nut is attached to the inner side. The bolt head is rounded. For that reason, the tyre must first be removed from the truck when the rim is taken apart.

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**
22	36	36

Engine Valve Lash (Diesel Engine 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 Clearances” chart shown below.

Valve Clearances		
Engine	**Valve**	**Clearance**
2.3 Liter (V2403)Diesel	Exhaust Valves	0.2 mm(0.008 in)
	Intake Valves	0.2 mm(0.008 in)

Refer to the “Service Manual” for the complete valve adjustment procedure.

NOTE : In case of Gasoline or LPG engine, no valve adjustment is necessary.

Every 10 Service Hours or Daily

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

Inspect Engine for Fluid Leaks

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

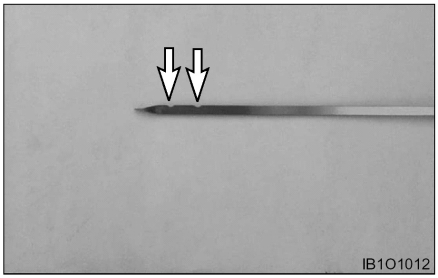
Engine Oil Level - Check

1. Raise the hood and seat assembly.

⚠ WARNING

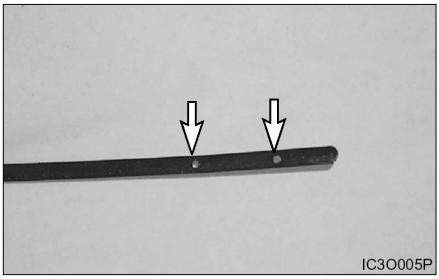
Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

Gasoline and LP-Gas Engines



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

Diesel Engines



Coolant Level - Check, Clean

Checking Coolant Level

⚠ WARNING

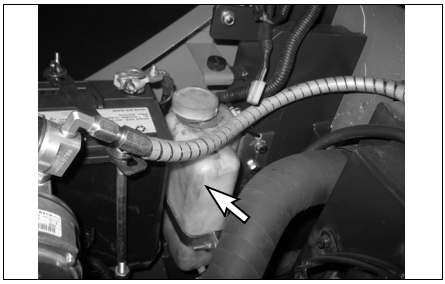
At operating temperature, the engine coolant is hot and under pressure.

Steam can cause personal injury.

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

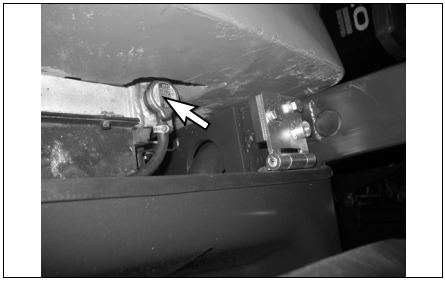
Remove the fill cap slowly to relieve pressure.

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 filler neck.
2. Remove the radiator cap. Fill radiator to the top of the filler neck. Inspect radiator cap. Replace if damaged. Install the radiator cap.



3. Start and run the engine to stabilise the coolant level in the filler neck. If low add coolant until it reaches the top of the filler 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.

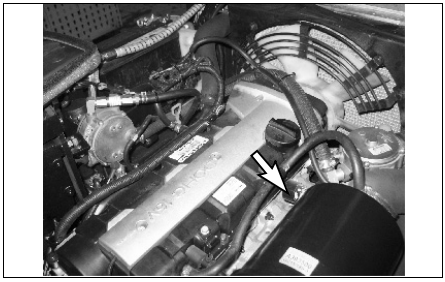
When using pressure air for cleaning, wear a protective face shield, protective clothing and protective shoes.

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

Checking Service Indicator



1. Observe the air cleaner service indicator.
2. Service the air cleaner when the RED band in the service indicator, lock in the visible position. See topic, “Air Intake System - Check, Clean” in “When Required”.

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.

Inspect Foot Pedal Operation (HMC2.4L, G424I Only)

1. Verify foot pedal travel is smooth without sticking.

⚠ WARNING

When the acceleration pedal harness is connected or disconnected, should be worked KEY OFF condition.

If not, occurred malfunction, can cause the personal injury.

Inspect Engine for Exhaust Leaks

1. Start the engine and allow it to reach operating temperatures.
2. Perform visual inspection of exhaust system. Repair any/all leaks found.

Walk-Around Inspection - Inspect

For maximum service lift 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 gouged tyres.

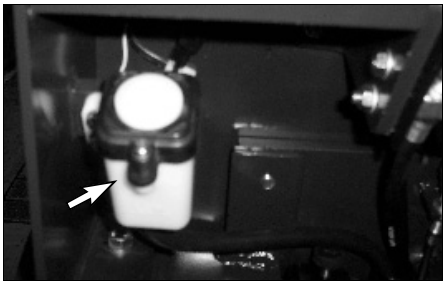
Have any repairs made and debris removed, as needed.

1. Inspect the tyres 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.



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.

Typical Example

8. Inspect the cooling system for leaks, worn hoses and debris buildup.

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

10. Inspect the forks.

- Visually inspect forks for cracks, especially in the heel section, around the mounting brackets, and all weld areas.
- Inspect for broken or jagged fork tips, bent or twisted blades and shanks. Make sure positioning lock is in place and working. Lock the forks in position before using the truck. See “Every 2000 Service Hours or Yearly.
- Remove all defective forks from service.

Mast Channels - Lubricate

The channels on the roller-type mast require a break-in period. Apply a light film of lubricant on the channels where the rollers ride. This will prevent metal peel until the rollers set a pattern.

Transmission Oil Level - Check

Checking Oil Level

⚠ WARNING

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

1. Start and operate the lift truck until the engine reaches normal operating temperature.
2. Park the lift truck level with the forks lowered, parking brake applied and the transmission controls in NEUTRAL.
3. With the service brake applied and the engine at low idle, shift the directional control lever to forward and then to reverse, to fill the clutches.
4. Shift the direction control lever to the NEUTRAL position.
5. Open the floor plate.

6. Remove the dip stick. Observe the oil level.
7. Maintain the oil level between the MIN and MAX marks on the dip stick.

Hydraulic Oil Level - Check

⚠ WARNING

At operating temperature, the hydraulic tank is hot and under pressure.

Hot oil can cause burns.

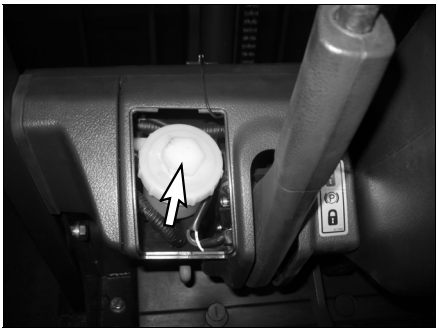
Remove the fill cap only when the engine is

stopped, and the cap is cool enough to touch with your bare hand. Remove the fill 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. Pull the latch and raise the hood and seat assembly. Make sure the air lift cylinder securely holds the hood open.

3. Remove the breather/dip stick. Maintain the oil level to the FULL mark on the breather/dip stick.

Brake Oil Level - Check



The brake reservoir is located on the left side of the steering column.

1. Remove the filler cap.
2. Maintain the brake fluid level to the fluid level mark on the brake system reservoir.
3. Clean and install the filler cap.

First 50-100 Service Hours or a Week

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

Engine Oil & Filter (Diesel Engine Only) - Change

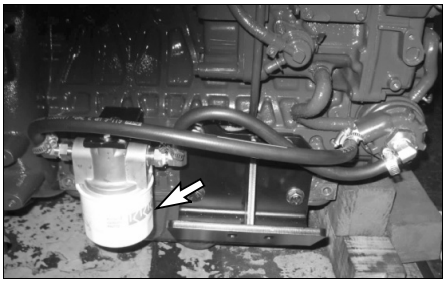
Diesel Engine Crankcase

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

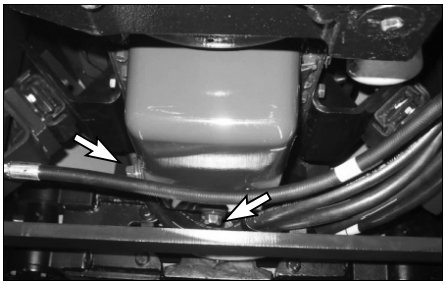
1. Operate lift truck a few minutes to warm oil. Park the lift truck with the forks lowered, parking brake applied, Transmission in neutral and the engine stopped.
2. Raise rear of lift truck off ground and block securely.

⚠ WARNING

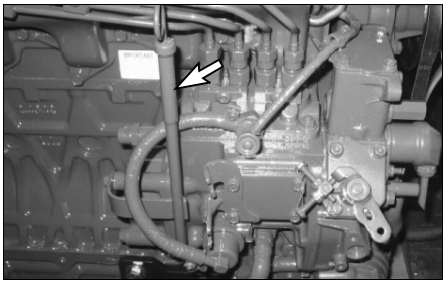
Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.



3. Remove the crankcase drain plug and allow oil to drain. Clean and install drain plug.



4. Remove and discard oil filter element.
5. Wipe sealing surface of oil filter element mounting base. Make sure the entire old gasket is removed.
6. Before installing a new filter element, apply a small amount of clean engine oil to the filter element gasket.
7. Install the new filter element. When the gasket contacts the base, tighten it 11/4 of a turn more. Do not overtighten.
8. Raise the lift truck, remove the blocking and lower the lift truck.
9. Raise the hood and seat assembly.
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 between the MAX. and MIN. marks on dip stick.
14. Close hood and seat assembly.

NOTICE

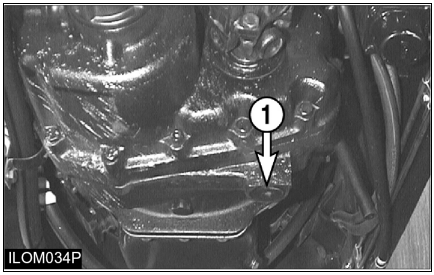
Servicing of the engine oil and oil filter element will largely affect on the engine performance as well as the engine life. Engine oil and filter element must be changed initially 50 hours.

Transmission Oil, Oil Filter & Strainer - Check, Clean, Change

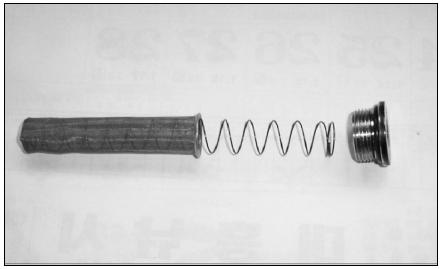
⚠ WARNING

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

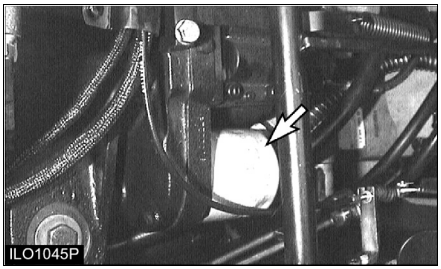
Park the lift truck level, with the forks lowered, parking brake engaged, direction control lever in NEUTRAL and the engine stopped.



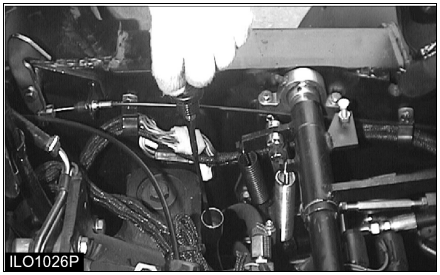
1. Remove drain plug (1). Allow the oil to drain into a suitable container. Clean the magnetic drain plug. Check O-ring seal and replace if necessary. Remove the spring and the strainer.



2. Wash the strainer assembly in clean, nonflammable solvent and dry it. Install the strainer assembly.



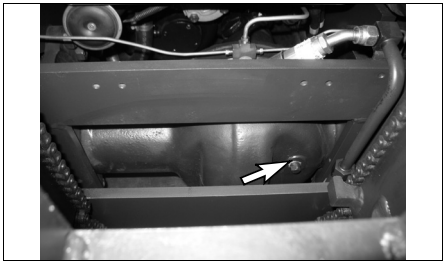
3. Remove the floor mat and the floor plate. Remove and discard the oil filter.
4. Wipe off the filter base. Make certain that all of the old seal is removed.
5. Apply a small amount of clean oil on the seal of the new filter.
6. Install the filter by hand. When the filter contacts the base, tighten an additional 3/4 turn.



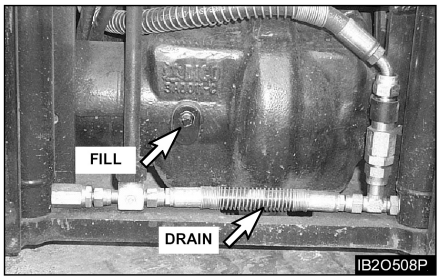
7. Remove the dip stick/filter cap. Fill the compartment with oil. See “Refill Capacities”.
8. Install the dip stick/filter cap.
9. Start the engine.
10. With the service brake applied and engine at low idle, shift the direction control lever to forward and reverse to fill the clutches.
11. Shift the direction control lever into NEUTRAL. Engage the parking brake.
12. Remove the dip stick/filter cap. Observe the oil level.
13. Maintain the oil level between the Min and Max marks on the dip stick/filter cap.
    When the oil temperature is 40°C approximately, the cold side mark on the dipstick is applicable.
    When the oil temperature is 80°C approximately, the hot side mark on the dipstick is applicable.
14. Check for oil leaks at the filters and drain plug”.
15. Stop the engine. Install the floor mat and floor plate.

Drive Axle Oil - Change

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



1. Raise the carriage high enough to access the drain plug and level/fill plug.
2. Block the bottom of the mast with a block of wood to hold the carriage in the raised position.
3. Turn the ignition switch OFF.
4. Place an appropriate container under the axle to catch the oil as it drains. Remove the drain plug and the level/fill plug.



5. Allow the oil to drain completely out. Discard the old oil according to federal, state, and local regulations.
6. Clean and reinstall the drain plug.
7. Add sufficient fresh oil through the level/fill opening until it reaches the bottom of the hole. See the section **Lubricant Viscosities and Refill Capacities** for the type and amount of oil to use.
8. Clean and reinstall the level/fill plug.
9. Remove the wood blocking and lower the carriage.
10. Operate the lift truck for a few minutes and check oil level again. See the topic, “Drive Axle Oil Level - Check” in “Every 250 Service Hours or Monthly” section.

Parking Brake - Test, Adjust

Parking Brake Testing

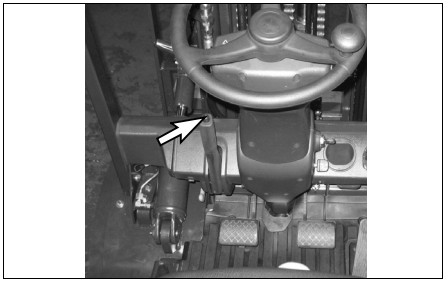
NOTICE

OSHA requires the parking brake to hold the lift truck, with capacity load, on a 15% grade.

Testing requires a test load equal to the capacity of the truck and a 15% grade.

If the maximum grade in the workplace is less than its capacity, use the Parking Brake inspection procedure covered in ‘Inspection from Operator’s Seat, Engine On’ in “Every 10 Service Hours or Daily” section.

1. Pick up capacity load and drive over to a 15% grade.
2. Remove your thumb from the release button.
3. The lever should resist movement when pulled fully back and a clicking sound should be heard. The lever should remain fully back until you press the release button with your thumb.
4. Engage the parking brake and slowly release the service brake.



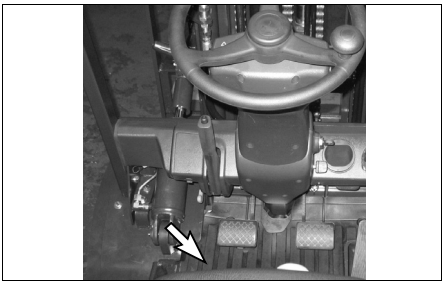
5. Engage the parking brake and shift the transmission to NEUTRAL. Slowly release the service brakes.
6. The parking brake adjustment is proper if it holds the lift truck on the grade. The parking brake needs adjusting if it does not hold the lift truck on the grade.
7. If the lift truck starts to move in reverse down the grade with the parking brake engaged, stop it with the service brakes, disengage the parking brake and reverse slowly down the grade controlling your speed with the service brakes.

⚠ WARNING

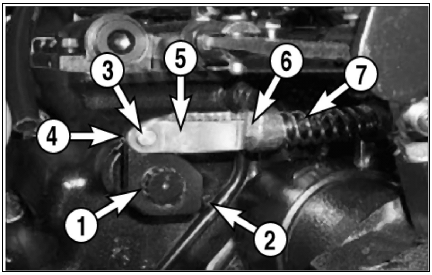
To prevent personal injury, the operator MUST be ready to use the service brake if the parking brake is not adjusted correctly and the lift truck starts to move.

Parking Brake Adjusting

1. Park the lift truck on a level surface, lowered the forks, shift the transmission to NEUTRAL and shut OFF the engine and block the wheels securely.
2. Chock the lift truck's tyres to prevent unintentional movement.



3. Remove the floor mat and floor plate.
4. Make sure the parking brake lever is released.



5. Make sure the brake lever (1) is held against stop pin (2). If the brake lever (1) is held against the stop pin (2), go to step 7. If the brake lever (1) is NOT held against the stop pin (2), go to step 6.
6. Remove the pin (3) and the cotter pin (4). Tighten the nut (6) to compress the spring (7) further and pull downward and turn the clevis (5) until the pin (3) fits into the brake lever when the lever (1) is held against the stop pin (2). Then install the pin (3) and the cotter pin (4) and return the nut (6) to the clevis (5).

7. Loosen lock nut (5). Tighten screw (6) to 6 to 7 N·m (50 to 60 lb·in). Loosen the screw (6) 1 1/6 turns and tighten the lock nut (5).

NOTICE

Turn the adjustment screw (6) clockwise to tighten. Turning the screw (6) too far counterclockwise could allow parts to fall into the bottom of the transmission.

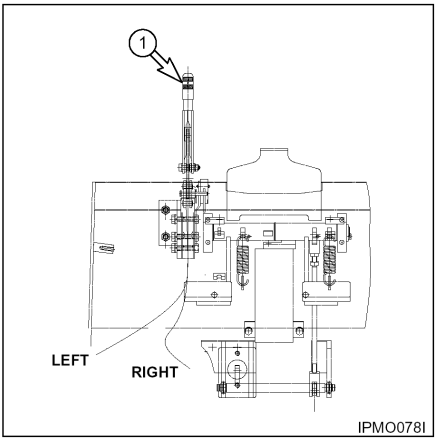
The transmission would than require disassembly to remove the parts.

8. Reinstall the floor plate and floor mat.
9. Engage the parking brake, remove the tyre chocks and test the parking brake. Refer to 'Parking Brake Testing' in the preceding section.

To Adjust (Oil Cooled Disc Brake Only)

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

1. Turn the knob(1) clockwise to increase the lever's tension or counterclockwise to decrease it Adjustment is correct when the lever requires an effort 196 to 245 N·m (20 to 25 kgf·m) [142 to 178 lbf.ft].



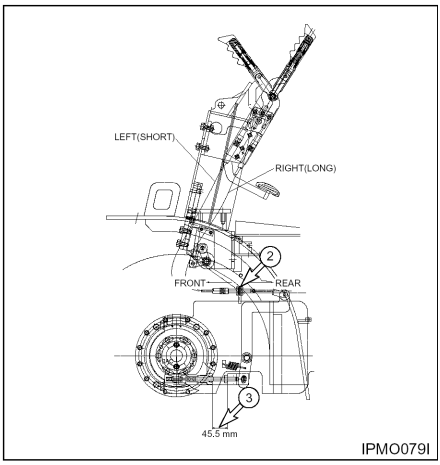
2. If it is difficult to get the desired lever's tension by the knob control, you can get it by locating the middle of the cable bolt thread.

At the front of the bracket(2)

: increase the lever's tension.

At the rear of the bracket(2)

: decrease the lever's tension.



3. The distance(3) must be sustained. Do not adjust it freely. If you cannot get the sufficient performance of parking by above two steps, please contact CROWN lift truck service personnel.

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.

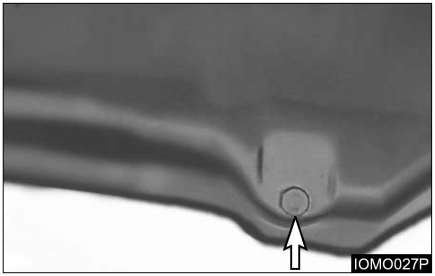
Engine Oil & Filter - Change

Gasoline, LP-Gas Engine Crankcase

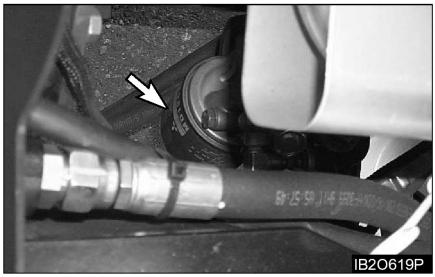
1. Operate lift truck a few minutes to warm oil. Park the lift truck with the forks lowered, parking brake applied, transmission in neutral and the engine stopped.
2. Raise rear of lift truck off ground and black securely.

⚠ WARNING

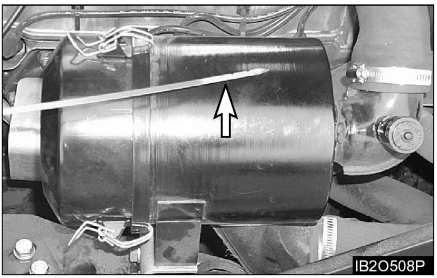
Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.



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 the entire 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 Crown supplied specific oil. Please consult Crown branch 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.

Engine Oil & Filter - Change

Diesel Engine Crankcase

See topic, “Engine Oil & Filter (Diesel Engine Only) - Change” in “First 50 - 100 Service Hours”

Air Intake System - Change

Changing Primary Element

See topic, “Air Intake System - Check, Clean” in “When Required”.

Changing Secondary Element

Replace the secondary element after the primary element has been cleaned three times or 6 months.

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.

Fuel Filter (Diesel Engine Only) - Change

Diesel Engine (V2403)

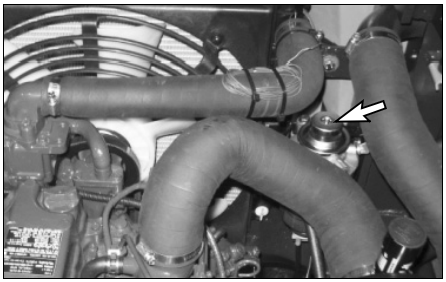
Park lift truck with the forks lowered, parking brake applied, transmission in neutral, engine stopped and cool.

1. Raise the hood and seat assembly.

⚠ WARNING

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

Turn the disconnect switch OFF if fitted or disconnect the battery when changing fuel filters.



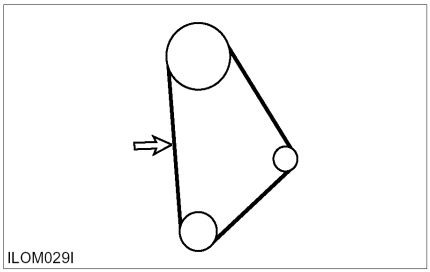
2. Remove fuel filter cartridge assembly.
3. Remove sensor assembly from cartridge assembly.
4. Before installing a new cartridge assembly, assemble existing sensor assembly, apply a small amount.

NOTICE

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

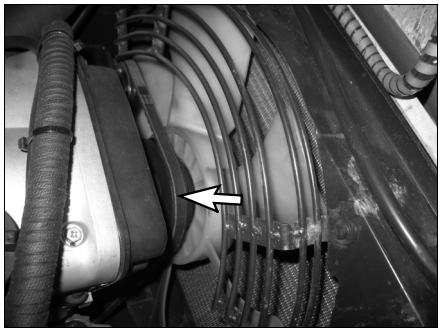
5. Install the new fuel filter cartridge assembly.
6. Turn the new fuel filter cartridge assembly until the filter gasket is fitted against the sealing face.
7. Turn the fuel filter cartridge assembly an additional 2/3 of turn.

Belts - Check, Adjust



Typical Example

1. Check the condition and adjustment of the belt. Correct adjustment allows 12mm (0.47 inch) deflection under 98N(22lb) of force.



Typical Example

NOTICE

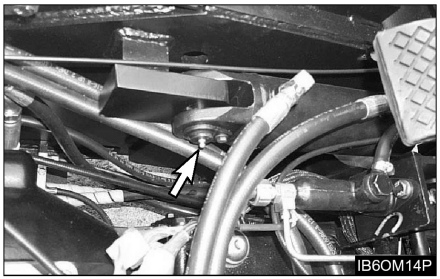
Failure to loosen the alternator mounting bolt will cause excessive stress and break the alternator mounting ear.

2. To adjust the alternator drive belt, loosen adjusting bracket bolt and mounting bolt. Move the alternator in or out as required. Tighten bolts.

Tilt Cylinders - Check, Adjust, Lubricate

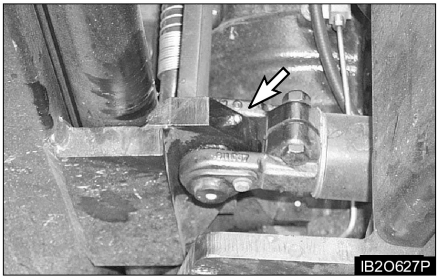
Chassis Pivot Eyebolts - Lubricate

1. Remove floor plates.



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

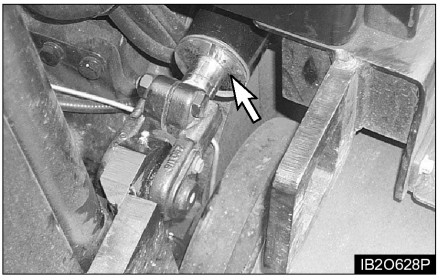
Mast Pivot Eyes - Lubricate



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.

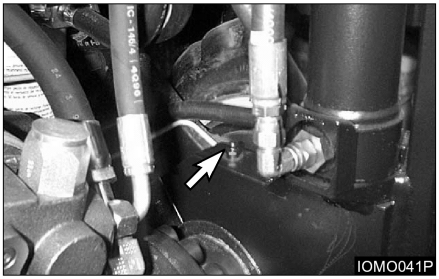
Cylinder Rod Extension - Adjust

NOTE : The following description is for forward tilt. For cylinder rod back tilt, the collar should be stationary by the tilt eye. If it is not, the O-ring inside the collar may need to be replaced. To adjust back tilt, spacers must be added or removed.



1. Check to make sure the tilt cylinders extend and retract evenly.
2. If one cylinder continues to move after the other cylinder has stopped in full forward or backward tilt, an adjustment must be made to one cylinder.
3. To adjust the cylinder rod extension, move the spacer to the rear and loosen the pinch bolt on the clevis.
4. Turn the cylinder rod in or out of the clevis to obtain the proper adjustment. Turning the rod into the clevis shortens the stroke. Turning the rod out of the clevis lengthens the stroke.
5. Tighten the pinch bolts to a torque of 95±15 N·m (70±10 lb·ft). Check the cylinder rods again for even travel.

Mast Hinge Pin - Lubricate



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.

Crosshead Roller - Inspect

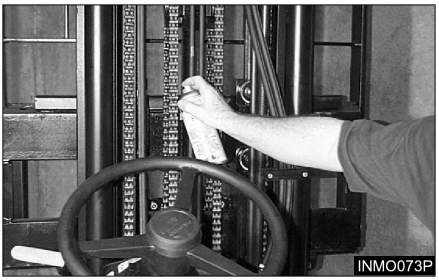
1. Operate the mast through a lift cycle. Watch the chains move over the crosshead rollers. Make sure the chain is tracking over the rollers properly.

Typical Example

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

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. Inspect for loose bolts and nuts on the carriage. Remove any debris from the carriage and mast.
3. Inspect the forks and attachments for free operation and damage. Have repairs made if necessary.



4. Brush a film of oil on all links of the chain.
5. Raise and lower the carriage a few times to work lubricant into the chain links.

NOTICE

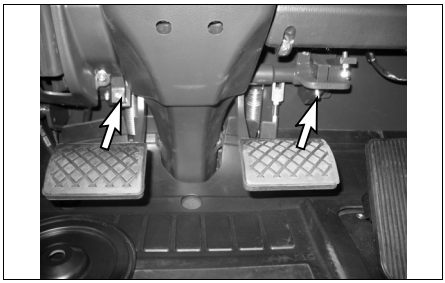
Lubricate chains more frequently than normal in applications where the lift truck is operating in a atmosphere which could cause corrosion of components or when lift truck must work in rapid lift cycles.

6. Inspect the chain anchors and individual links for wear, loose pins or cracked leaves.

Parking Brake - Test, Adjust

See topic, “Parking Brake - Test, Adjust” in “First 50 -100 Service Hours.”

Inching & Braking Control Shaft - Lubricate

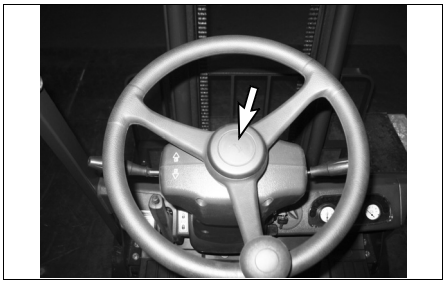


1. Lubricate three fittings for the inching and brake pedal control shaft.

Drive Axle Oil (OCDB) - Change

See topic, “Drive Axle Oil - Change” in the “First 50 - 100 Service Hours”.

Horn & Lights (If Equipped) - Check

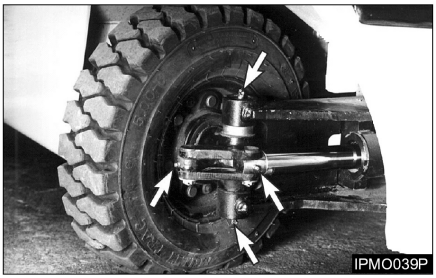


1. Press horn button, to determine if horn is operational.
2. Check and replace all defective gauges.
3. Check all lights such as warning, directional, backup, driving and flood lights for correct operation. Replace all burned out bulbs. Have repairs made if needed.

Overhead Guard - Inspect

1. Check tightness of overhead guard mounting bolts at 105 N·m (77 lb·ft)(1) & 60 N·m (44 lb·ft)(2).
2. Check overhead guard for bent or cracked sections. Have repairs made if needed.

Steering Mechanism - Check, Lubricate



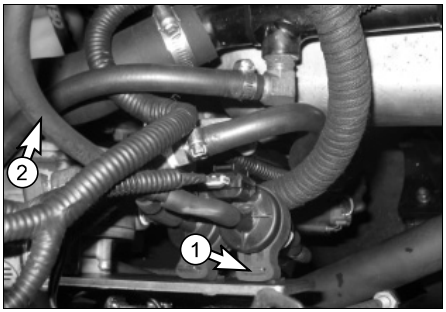
1. Lubricate the steer axle king pins, total of four fittings. Two on the right side and two on the left side.
2. Lubricate the steering link bearings, total of four fittings. Two on the right side and two on the left side.
3. Check for any worn or loose components of the steering mechanism. Remove any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

Inspect Vacuum Lines and Fittings (HMC2.4L, G424I Engine Only)

Visually inspect vacuum lines and fittings for physical damage such as bittleness, cracks and kinks. Repair/replace as required.

Slovent 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) Fuel Trim Valve(FTV) (2) Vacuum lines

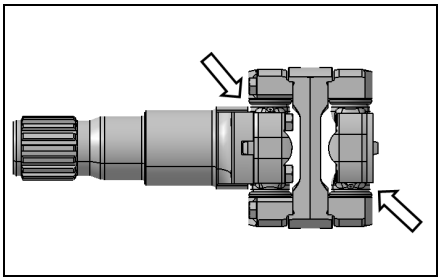
Fuel Trim Valve(FTV) Inspection (HMC2.4L Engine Only)

1. Visually inspect the Fuel trim valve for abrasions or cracking. Replace as necessary.
2. To ensure the valve is not leaking a blow-by test can be performed.
3. With the engine off, disconnect the electrical connector to the FTV.
4. Disconnect the vacuum lines form the FTV to the pressure regulator/converter, at the converter's tee connection.
5. 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.

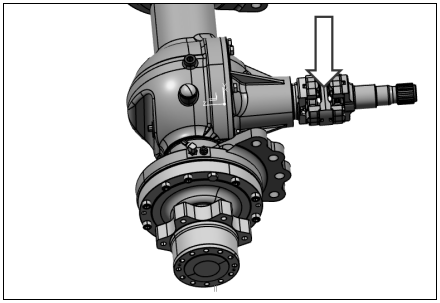
Inspect Electrical System (LP, Dual Fuel Engine Only)

1. 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 crank sensor.
2. Repair and/or replace as necessary.

Universal Joint - Inspect, Lubricate



Typical Example



Typical Example

1. 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 crank sensor.

PCV Valve System - Inspect, Clean

HMC2.4L LP, G424I LP and Dual Fuel Engines

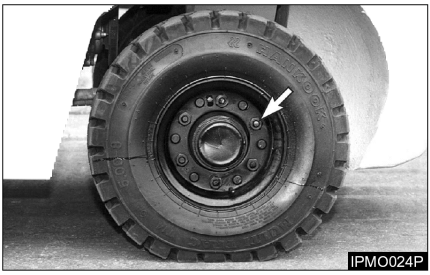
G424I(E)

1. Loosen the hose clamps and remove the PCV valve.
2. Shake the PCV valve. If it rattles, reinstall it. If it does not rattle, replace it.
3. Tighten the hose clamps.

Wheel Bolts & Nuts – Inspect

Inspect Tightness

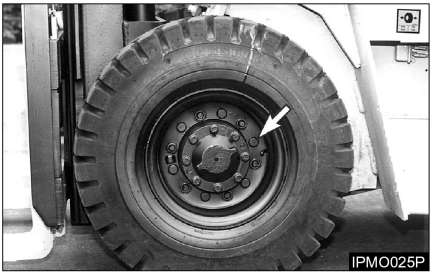
Steer Wheels



Typical Example

1. Inspect tightness of wheel bolts in a sequence opposite each other 110 N·m (81 lb·ft).

Drive Wheels



2. Inspect tightness of wheel nuts in a sequence opposite each other to 180 N·m (133 lb·ft).

Every 1000 Service Hours or 6 Months

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

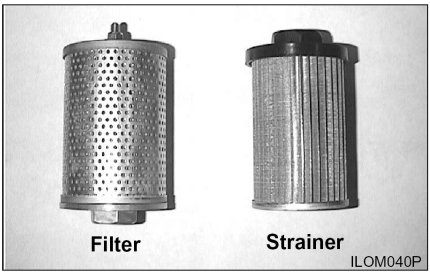
Hydraulic Return Filter, Breather & Strainer - Check, Change

⚠ WARNING

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

Park the lift truck level with the forks lowered, parking brake engaged, transmission in NEUTRAL and the engine stopped.

1. Remove and discard the air breather.
2. Install a new air breather.
3. Loosen the bolts of the hydraulic tank top plate assembly.



4. Remove the return filter from tank top plate assembly.
5. Change the return filter.
6. Remove the suction strainer from the tank.
7. Install a new strainer by hand.
8. Install the tank top plate assembly and fasten the bolt.
9. Start the engine and operate the hydraulic controls, and the steering system, through a few cycles to fill the lines. Look for oil leaks.
10. Stop the engine and check the oil level. With all cylinders retracted, maintain the oil level to the FULL mark on the dip stick/filler cap assembly.

Engine Valve Lash (Diesel Engine Only) - Check, Adjust

See topic, “Engine Valve Lash (Diesel Engine Only) – Check, Adjust” in “When Required”.

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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 centre of pins in millimeter.
3. Calculate chain wear rate*.
4. If the chain wear rate is 2% or more, replace the lift chain.

*Chain wear rate (%)

$$= \left(\frac{\text{Actual measurement - Pitch}^{**} \text{ X } 10}{\text{Pitch}^{**} \text{ X } 10} \right) \text{ X } 100$$

**Chain Pitch for G15/18S-5, G20SC-5, D15/18S-5, D20SC-5 = 15.88mm(0.63 in)

Check for Equal Tension

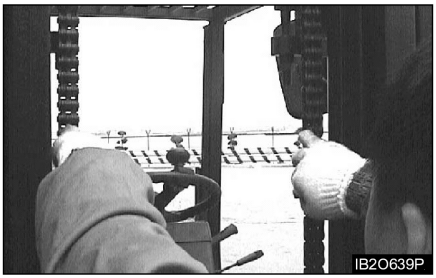
Typical example

Lift the carriage and the mast high enough for getting tension on lift chains. Check the chains, and make sure the tension is the same. Lift chains are required to check for equal tension about every 1,000 service hours or 6 months.

⚠ WARNING

Personal injury can be caused by sudden movement of the mast and carriage. Keep hands and feet clear of any parts that can move.

Lift Chain Adjustment



Typical example for carriage equal tension

If the tension is not the same on both chains, take the procedure as follows.

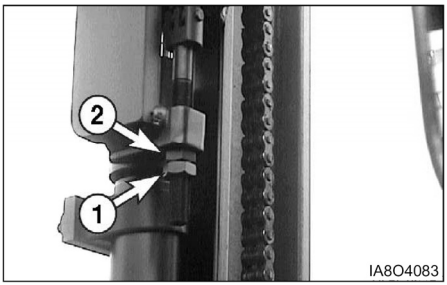
NOTE : If carriage height is not correct, make adjustments by following procedures.

Carriage Chain Adjustment

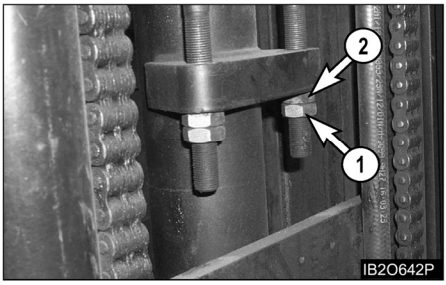
Make sure that carriage height is correct. If correct, adjust the chain for equal tension. If not, adjust the chain for correct carriage height by adjusting anchor nuts(1), (2).

NOTE : See the previous section, “Carriage Roller Extrusion” in “When Required”. for proper height of carriage.

1. Fully lower the carriage and tilt mast forward or lift the carriage and put blocks under the carriage to release the tension from the lift chains.
2. Loosen nut(1) and adjust nut(2) to get proper distance from bottom of inner upright to the bottom of carriage bearing.



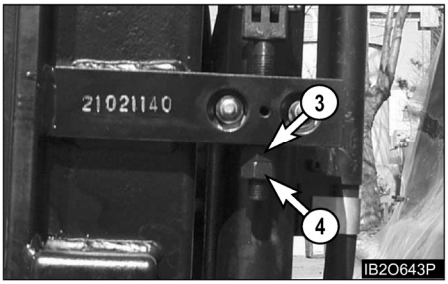
Typical example for carriage chain of STD mast



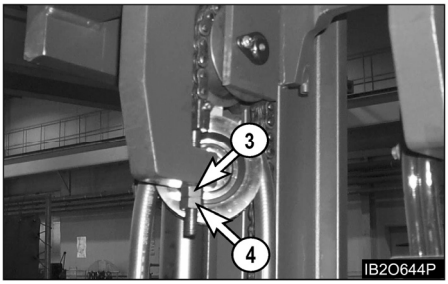
Typical example for carriage chain of FF, FFT mast

3. Make adjustment anchor nut(1),(2) for equal chain tension.
4. Set the mast vertical and raise the carriage and check equal chain tension. If not equal, repeat the same procedure as step 1 through step 3.
5. Put LOCTITE No. 242 Tread lock on the threads of the anchor nuts(1),(2) after the adjustment is completed.

Mast Chain Adjustment - FF,FFT Mast



Typical example for FF mast



Typical example for FFT mast

Make sure that mast height is correct. If correct, adjust chain for equal tension. If not, adjust mast chain for correct mast height by adjusting anchor nuts(3), (4).

NOTE : See the previous section, “Carriage Roller Extrusion” in “When Required”. for proper inner mast height.

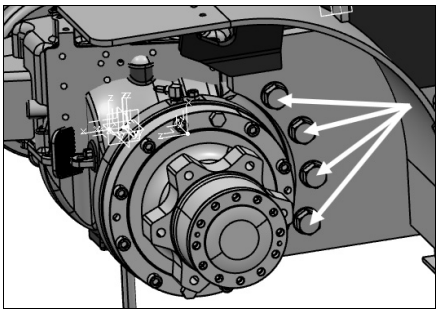
1. Lift the inner mast and put blocks under the inner mast to release the tension from the lift chains.
2. Loosen nut (3) and adjust nut (4) to make inner mast rail flush with outer mast rail bottom.
3. Make adjustment anchor nuts(3), (4) for equal chain tension.
4. Raise the inner mast and check equal chain tension. If not equal, repeat the same procedure as step 1 through step 3.
5. Put LOCTITE No. 242 tread lock on the threads of the anchor nuts(3), (4) after the adjustment is completed.

Transmission Oil & Strainer- Clean, Change

See topic, “Transmission Oil & Strainer - Clean, Change” in “First 50-100 Service Hours”.

Drive axle - Inspect

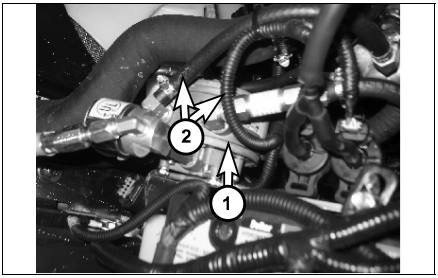
Inspect Tightness



Tighten bolts and nuts if necessary (460+/-60 N.m or 340 ft lbs) remark bolts with marker. If replacing bolts apply small amount of Loctite to the threads.

Inspect Coolant Hoses (LP, Dual Fuel Engines Only)

1. Visually inspect coolant hoses and clamps. Remember to check the two coolant lines that connect to the pressure regulator/converter.
2. Replace any hose that shows signs of swelling, cracking, abrasion or deterioration.



(1) LP Regulator/Converter
(2) Coolant hose

LP Regulator/Converter Inspection (LP, Dual Fuel Engine Only)

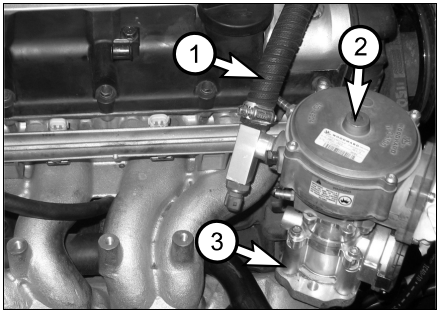
1. Visually inspect the pressure regulator/converter housing for coolant leaks and detect the fuel pipe joints, LP mixer and regulator/converter for LP fuel leaks.

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 Crown service.

Fuel Lines & Fittings - Check

Visually inspect fuel lines and fittings for physical damage. Replace as required.



(1) Fuel line
(2) LP mixer
(3) Throttle Assembly

Inspect Mixer Assembly (HMC2.4L,G424I Engine Only)

Refer to the LP mixer section of the engine service manual for procedures.

Inspect Throttle Assembly (HMC2.4L,G424I Engine Only)

1. 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.

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.

Drive Axle Oil (Shoe Brake) - Change

See topic, “Drive Axle Oil - Change” in “First 50 - 100 Service Hours”

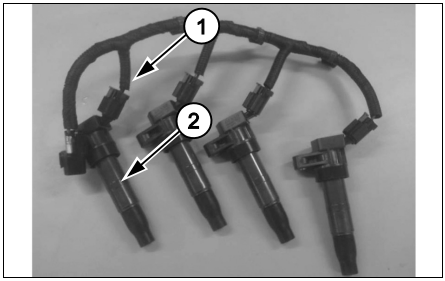
Inspect Ignition System (LP-Gas, Gasoline & Dual Fuel Engines Only)

1. Disconnect Battery Cables.

2. Remove and inspect the spark plugs. Replace as required.

3. Inspect the ignition coil for cracks and heat deterioration. Visually inspect the coil heat sink fins. If any fins are broken replace as required.

HMC2.4L, G424I Engine



(1) Spark Plug Cables
(2) Ignition Coil

Replace LP Fuel Filter Element (LP, Dual Fuel Engine Only)

Park the lift truck in an authorised refueling area with the forks lowered, parking brake applied and the transmission in Neutral.

Before servicing the filter:

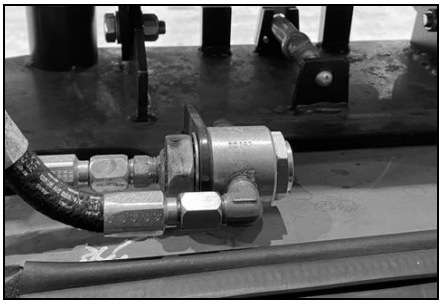
1. Always turn off the manual tank shut-off valve and relieve the pressure from the system.

2. Make sure the filter is appropriate for your application.

3. Always hold the filter stationary, only the fitting should be rotated. (All ports are 1/4-18 MPTF connections)

4. Maximum torque for fitting is 24.8 N-m.

5. Loosen connections by rotating fittings counter clockwise.



To service filter:

1. Secure filter in vise or pipe wrench.

2. Rotate filter service nut cap counter clockwise.

3. Remove & discard filter element & O-ring.

4. Maximum torque for fitting is 24.8 N-m.

5. Loosen connections by rotating fittings counter clockwise.

6. Screw the filter service nut cap with magnet, back into filter body.

7. Torque the service nut cap to 35 N-m.

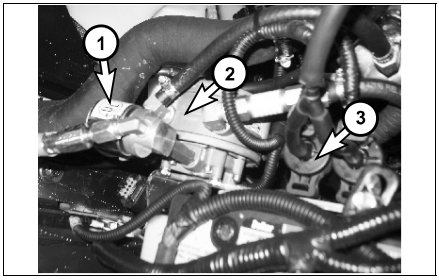
After Filter Service:

1. Check all connections for leaks with proper leak solution before use.
2. Mounting torque for assembly nut is 54 - 67.8 N-m.
3. Smell for propane and listen for hissing sound which can also indicate a potential leak.

Testing Fuel Lock-off Operation (LP-Gas Engine Only)

1. Start engine.
2. Locate the electrical connector for the fuel lock
3. Disconnect the electrical connector.
4. The engine should run out of fuel and stop within a short period of time.
5. 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.



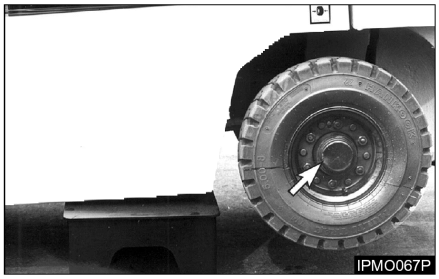
(1) LP fuel lock-off
(2) Regulator / converter
(3) Fuel Trim valve (FTV)

Every 2000 Service Hours or Yearly

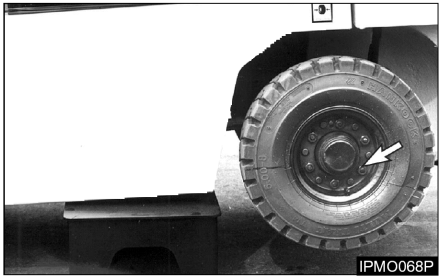
You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

Steer Wheel Bearings – Reassemble

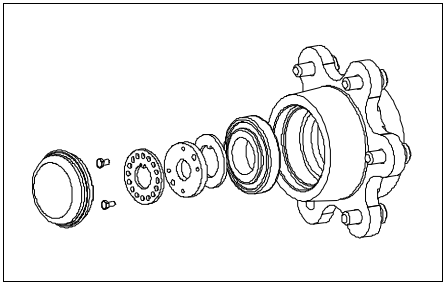
Park the lift truck level with the forks lowered, parking brake engaged, transmission in NEUTRAL and the engine stopped.



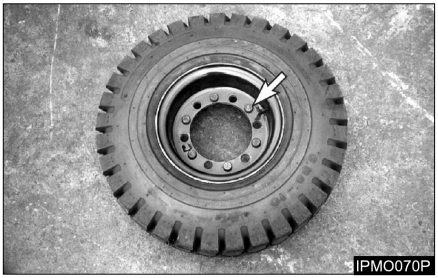
1. Lift the steer wheels off the ground. Place stands or blocking under the frame and steer axle to support the lift truck.
2. Remove the hub cap which is pressed into the wheel hub.



3. Straighten the lockwasher tangs.



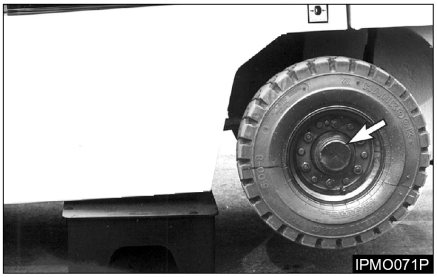
4. Remove the locknut, lockwasher and flat washer. Remove the outer wheel bearing.



5. Remove the wheel assembly. Examine the wheel for damage and wear. Replace the wheel if necessary.

NOTE : Deflate tire before removing wheel nuts from the truck.

6. Remove the inner bearing. Clean and lubricate the steering knuckle. Reassemble both the inner and outer bearing cones.
7. Install the inner bearing. Lubricate the seal and install the wheel assembly on the knuckle.
8. Install the outer wheel bearing and the outer washer. Install the lockwasher and locknut.



9. Tighten the locknut to 135 N·m (100 lb·ft), while turning wheel hub to seat the bearing.

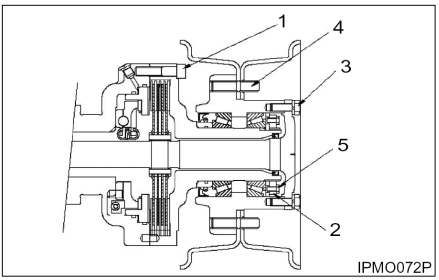
10. Loosen the locknut. Retorque it to 50±5 N·m (37±4 lb·ft). Tighten bolts (M6) at two points where holes are aligned between the locknut and lockwasher.

11. Install the hub cap.

12. Raise the lift truck and remove the blocking Lower the lift truck to the ground.

Drive Wheel Bearing - Reassemble

Consult your CROWN lift truck branch for the proper wheel bearing reassembling procedure. Reassembling of bearings and adjustment procedure must be made by a trained mechanic or branch personnel.



1. Apply Loctite No.271 Thread Lock to threads of spindle bolts. Torque for bolts that hold spindle to drive axle housing is 100.5 ±12.3 N·m (74.2 ±9.1 lb·ft).

2. Tighten nut slowly until torque required to turn bearings is 10.8 ± 2.0 N·m (8.0 ± 1.5 lb·ft).

3. Apply Loctite No.271 Thread Lock to threads of drive shaft bolts. Torque for bolts that hold drive shaft to hub is 71 ± 12 N·m (52.5 ± 9 lb·ft).

4. Apply Loctite No.271 Thread Lock to threads of stud bolts. Torque for stud bolts is 88 ± 10 N·m (65 ± 7.4 lb·ft).

5. Apply Loctite No.271 Thread Lock to threads of stopping bolts. Torque for bolts that hold nut and plate is 9.8 ± 2.0 N·m (7.2 ± 1.5 lb·ft).

Cooling System – Clean, Change

⚠ WARNING

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

Steam can cause personal injury.

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

Remove the filler cap slowly to relieve pressure.

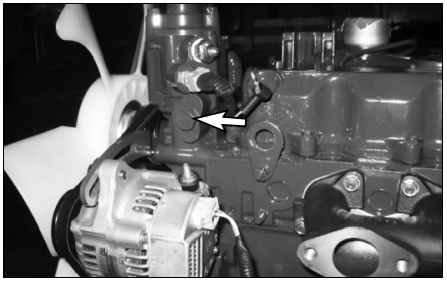
Coolant is included antifreeze for forbidding corrosion. Avoid contact with the skin and eyes to prevent personal injury.

Use all cleaning solution with care.

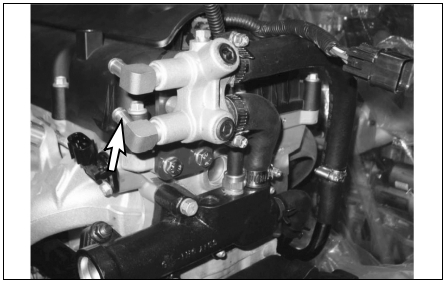
The Lift truck must be level, the forks lowered, the parking brake engaged, the transmission in NEUTRAL and the engine stopped and cool.

1. Turn the radiator cap slowly to relieve the pressure, and then remove the cap.

2. Remove the drain plug or water hose on engine block.



V2403 Diesel Engine

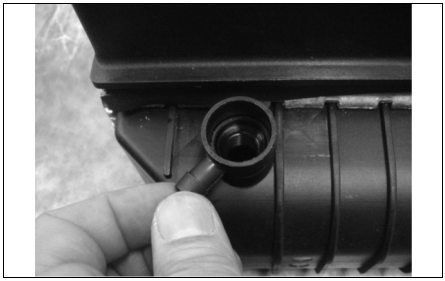


G424I(E) 2.4L LPG/Gasoline Engine

3. Open the radiator drain valve. Allow the coolant to drain into a suitable container.
Drain the recovery bottle.

NOTICE

Hold the drain port when the radiator drain valve is turned because the tank and the drain port are separated.



4. After draining the coolant completely, close the radiator drain valve and the block drain plug, fill the engine and the radiator full with a radiator cleaner, and clean the engine and the radiator.

5. Start and run the engine for 30 minutes.

6. Stop the engine and drain the cleaning solution into a suitable container.

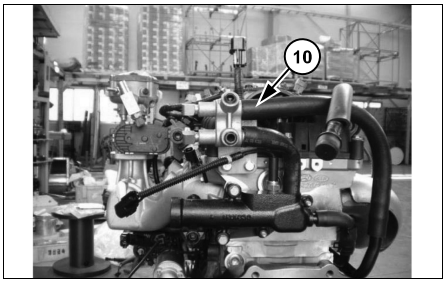
7. Flush the system with clean water, until draining water is clear.

8. Close the drain valve and install the block drain plug. Fill coolant to top of the filler neck.

9. Start and run the engine to stabilise the coolant level. See topic, “Coolant Level – Check” in “Every 10 Service hours or Daily”.

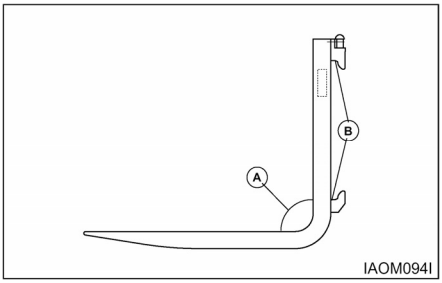
NOTICE

Inject the coolant additionally into below specific port of G424I(E) engine besides the radiator if needs more coolant while clean & change the cooling system.



10. Remove the indicated coolant hose above picture and then, add the coolant to hose as much as needed.

Fork - Inspect



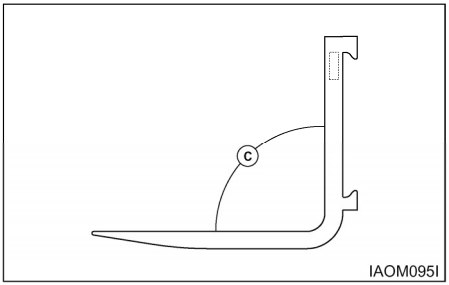
Forks should be inspected, at a minimum, every 12 months. If the truck is being used in a multi-shift or heavy duty operation, they should be checked every six months.

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.

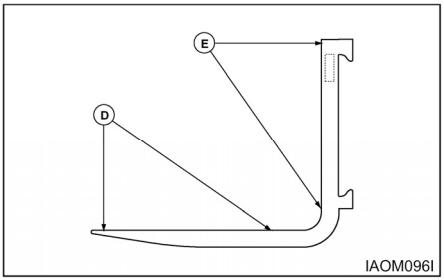
   Forks with cracks should be removed from service.

   "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.

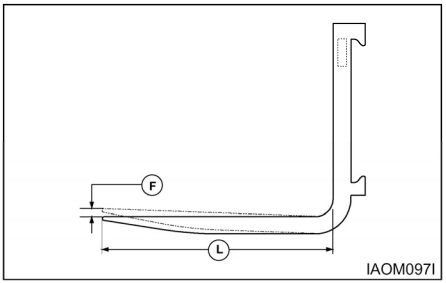


2. Check the angle between the upper face of the blade and the front face of the shank. The fork should be withdrawn from service if angle (C) exceeds 93 degrees or deviates by more than 3 degrees from an original angle other than 90 degrees, as may be found in some special application forks.



3. Check the straightness of the upper face of blade (D) and the front face of shank (E) with a straight edge.

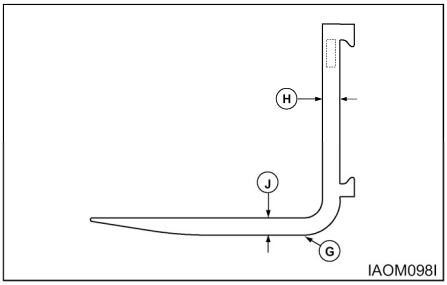
   The fork should be withdrawn from service if the deviation from straightness exceeds 0.5 percent of the length of the blade and/or the height of the shank respectively 5 mm/1000 mm (0.18"/36").



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.

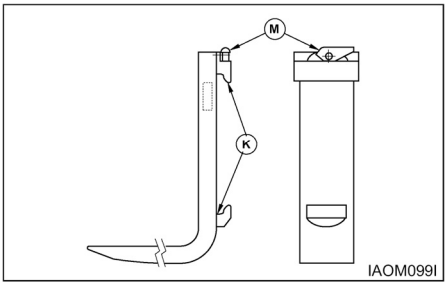
   The maximum recommended difference in fork tip elevation (F) is 6.5 mm (0.25") for pallet forks and 3 mm (0.125") for fully tapered forks. The maximum allowable difference in fork tip elevation between the two or more forks is 3 percent of blade length (L).

   Replace one or both forks when the difference in fork tip height exceeds the maximum allowable difference. Contact your local CROWN Lift Truck Branch for further information.



5. Check the fork blade (J) and shank (H) for wear with special attention to the heel (G). The fork should be withdrawn from service if the thickness is reduced to 90 percent or less of the original thickness.

Fork blade length may also be reduced by wear, especially on tapered forks and platens. Remove the forks from service when the blade length is no longer adequate for the intended loads.



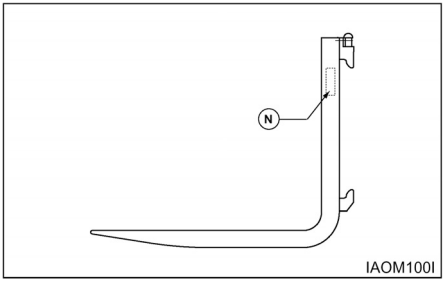
6. Check the fork mountings (K) for wear, crushing and other local deformation, which can cause excessive side to side wobble of the forks. Excessive clearance on hook type forks may allow them to fall from the carrier. Forks which show visible signs of such damage should be removed from service.

7. Check the positioning lock and other fork retention devices to make sure they are in place and working.

Hook type forks use a spring loaded pin (M), located in the top hook, to engage notches in the top carriage bar to hold the fork in place.

When adjusting the fork spacing, the forks are prevented from sliding off the end of the carriage by stop blocks. These stop blocks are at both ends of the carriage and in the path of the bottom fork hook. The load backrest extension may be used in place of the stop blocks in some cases.

Shaft mounted forks may use set collars or spacers on the shaft to either side of the fork. They may also use U bolts, pins, or similar devices which engage the fork through the top structure of the carriage.



8. Check fork markings (N) for legibility. Renew markings as required to retain legibility.

9. a. Lift the mast and operate the tilt control lever, until the top surface of the forks is parallel with the floor. Place two straight bars that are the same width as the carriage, across the forks as shown.

b. Measure the distance from the bottom of each end of the two bars to the floor. The forks must be parallel within 3 mm (.12 in) for Full Tapered and Polished (FTP) forks, all other forks 6.4 mm (.25 in), for their complete length.

c. Put one fork, one third from the tip, under a fixture that will not move. Then operate the tilt control with caution until the rear of the truck lifts just off the floor.
Follow the same procedure with the second fork. Repeat Step a.

Every 2500 Service Hours or 15 Months

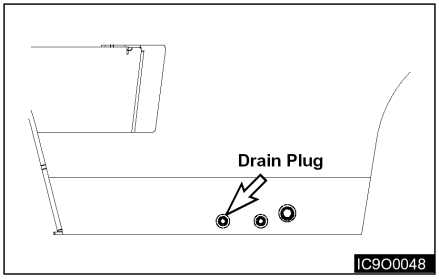
You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

Hydraulic Oil - Change, Check, Clean

⚠ WARNING

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

Park the lift truck level with the forks lowered, parking brake engaged, transmission in NEUTRAL and the engine stopped.



1. Remove the hydraulic tank drain plug. Allow the oil to drain. Clean and install the plug.

2. Remove the breather/dip stick.

3. Remove the strainer. Wash the breather and strainer in clean, nonflammable solvent and dry.

4. Install the strainer. Fill the hydraulic tank. See topic **Refill Capacities.** Install the breather/dip stick.

5. Start the engine and operate the hydraulic controls, and the steering system, through a few cycles to fill the lines. Look for oil leaks.

6. Stop the engine and check the oil level. With all cylinders retracted, maintain the oil level to the FULL mark on the breather/dip stick.

Inspect Battery System

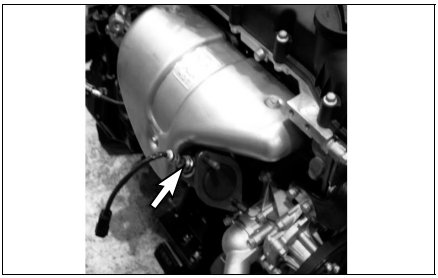
1. Clean battery outer surfaces with a mixture of baking soda and water.

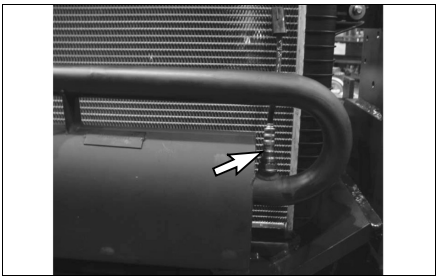
2. Inspect battery outer surfaces for damage and replace as necessary.

3. Remove battery cable and clean, repair and/or replace as necessary.

Replace Oxygen Sensor (HMC2.4L, G424I Engine Only)

HMC2.4L Engine





When indicated by MIL, replace oxygen sensor on the exhaust manifold and oxygen sensor on 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

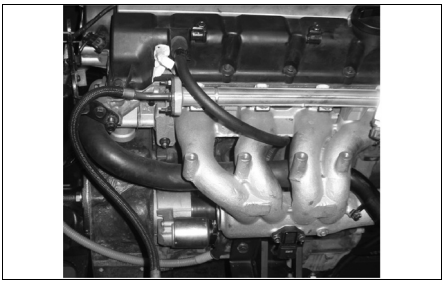
⚠ WARNING

When assembling the filters, check the arrow mark on the filter surface.

The arrow mark position is same as fuel flow direction.

Checking the TMAP Sensor (HMC2.4L, G424I Engine Only)

1. Verify that the TMAP sensor (F) is mounted tightly into the manifold adapter (E), 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.



Inspect for Intake Leaks (LP, Dual Fuel Engine Only)

1. Visually inspect the intake manifold, throttle assembly (2), and manifold adapters (3), for looseness and leaks. Repair as necessary.

Replace PCV Valve and breather element (LP-Gas, Gasoline and Dual Fuel Engines) - Change

G424I(E)

1. Loosen the hose clamps and remove the PCV valve.

2. Assemble new PCV valve and hose.

3. Tighten the hose clamps

Replace Spark Plugs (HMC2.4L, G424I Engine Only)

1. Disconnect Battery Cables.

2. Remove the ignition wiring harness.

3. Remove the ignition coil assy.

4. Remove spark plugs.

5. Gap the new spark plugs to the proper specifications.

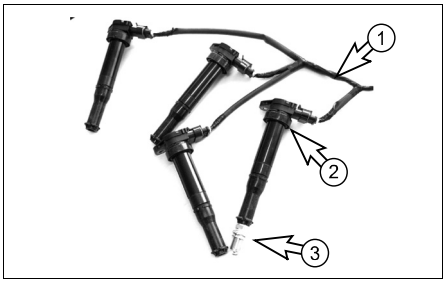
HMC2.4L, G424I Engine: 0.8 ~ 0.9mm

6. Apply anti-seize compound to the spark plug threads and install.

HMC2.4L, G424I Engine : 25 N·m (18 lb·ft)

⚠ WARNING

DO NOT OVERTIGHTEN THE SPARK PLUGS.



(1) Ignition wiring harness
(2) Ignition Coil Assy
(3) Spark plug

Environment Protection

When servicing this lift truck, use an authorised 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 authorised place and container. When cleaning the lift truck, be sure to use an authorised area.

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