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SB2346E00

# Operation & Maintenance Manual

## LIFT TRUCKS

## BC20S-5, BC25S-5, BC25SE-5

## BC30S-5, BC32S-5

## B20S-5, B25S-5, B30S-5, B32S-5

0609

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**⚠ WARNING**

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

The following warning is provided pursuant to California Health & Safety Code Sections 25247.5 et, seq,

**⚠ WARNING**

**California Proposition 65**

Engine Exhaust, some of its constituents, and certain vehicle components contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.
WASH HANDS AFTER HANDLING.

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# Foreword

## Literature Information

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

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

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

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

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

## Safety

The Safety Section lists basic safety precautions. In addition, this section identifies the text and locations of warning signs and labels used on the lift truck. Read and understand the basic precautions listed in the Safety Section before operating or performing lubrication, maintenance and repair on this lift truck.

### Operator Restraint System (If Equipped)

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

**⚠ WARNING**

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

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

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

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

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

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

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## Operation

The Operation Section is a reference for the new operator and a refresher for the experienced one.
This section includes a discussion of gauges, switches, lift truck controls, attachment controls, transportation and towing information.
Photographs and illustrations guide the operator through correct procedures of checking, starting, operating and stopping the lift truck.

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

## Maintenance

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

## Maintenance Intervals

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

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

Perform service on items at multiples of the original requirement. For example, at "Every 500 Service Hours or 3 Months", also service those items listed under "Every 250 Service Hours or Monthly" and "Every 10 Service Hours or Daily".

## Environment Management

Note that *DOOSAN* Infracore BG is ISO 14001 certified which is harmonized with ISO 9001. Periodic ENVIRONMENTAL AUDITS & ENVIRONMENTAL PERFORMANCE EVALUATIONS have been made by internal and external inspection entities. LIFECYCLE ANALYSIS has also been made 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.

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# Important Safety Information

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

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

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

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

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

**⚠ WARNING**

The meaning of this safety alert symbol is as follows:

**Attention! Become Alert! Your Safety is Involved.**

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

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

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

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

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# Safety

The safety rules and regulations in this section are representative of some, but not all rules and regulations noted under the Occupational Safety and Health Act (OSHA) and are paraphrased without representation that the OSHA rules and regulations have been reproduced verbatim.

Please refer to 1910. 178 in Federal Register Vol. 37, No. 202, the National Fire Protection Association No. 505 (NFPA), American National Standard, ANSI B56. 1 Safety Standard for Low lift and High Lift Trucks and subsequent revisions for a complete list of OSHA rules and regulations as to the safe operation of powered industrial lift trucks. Since regulations vary from country to country outside in U.S.A., operate this lift truck in accordance with local regulations.

*DOOSAN* lift trucks are manufactured according to the regulations and standards laid down in EU Machinery Directive 98/37/EC and EMC directive 89/336/EC. Please refer to the Directives 89/655/EC and 89/391/EC and its amendments for the safe use of *DOOSAN* lift trucks.

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

Do not operate a lift truck if in need of repair, defective or in any way unsafe. Report all defects and unsafe conditions immediately. Do not attempt any adjustments or repairs unless trained and authorized to do so.

## Warning Signs and Labels

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

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

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

### Training Required To Operate or Service Warning

Located on the right side of the steering wheel.

**⚠ WARNING**

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

This label also provides allowable lift truck capacity information.

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## General Warnings to Operator

**⚠ WARNING**

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

1. Before starting machine. Check all controls and warning devices for proper operation.
2. Refer to machine identification plate for allowable machine capacity. Do not overload. Operate machines equipped with attachments as partially loaded machines when not handling a load.
3. Put directional control or shift lever in neutral before "ON-OFF" switch is turned on.
4. Start, turn and brake smoothly. Slow down for turns, slippery or uneven surfaces. Extremely poor surfaces should be repaired. Avoid running over loose objects or holes in the roadway surfaces. Use extreme caution when turning on inclines.
5. Travel with load as low as possible and tilted back. If load interferes with visibility, travel with load trailing.
6. On grade operations travel with load up grade.
7. Watch out for pedestrians and obstructions. Check overhead clearances.
8. Do not permit riders on forks or machine at any time.
9. Do not allow anyone to stand or pass under the elevated portion of any machine.
10. Be sure operating surface can safely support machine.
11. Operate machine and attachments only from operator's position.
12. Do not handle unstable or loosely stacked loads.
13. Use minimum tilt when picking up or depositing a load.
14. Use extreme care when handling long, high, or wide loads.
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. The emergency switch uses in emergency really. When you use often emergency switch by key switch, you can cause fatal mistake to your machine.
20. If user operates continuously pushing work or both brake pedal and accelerator pedal were depressed at the same time, main electric parts were able to damage.

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## Hand Placement Warning

**⚠ WARNING**

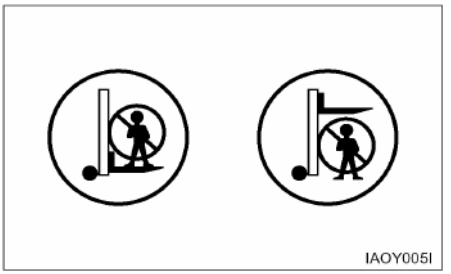
**No hands. Do not place hands in this area. Do not touch, lean on, or reach through the mast or permit others to do so.**

Located on the mast.

## No Standing On Forks Warning, No Standing Under Forks Warning

**⚠ WARNING**

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

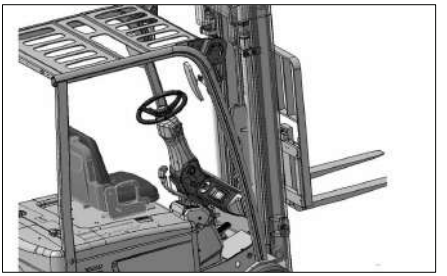



Located on the lift cylinder.

## Load Backrest Must Be In Place Warning

**⚠ WARNING**

**Operation without this device in place may be hazardous.**

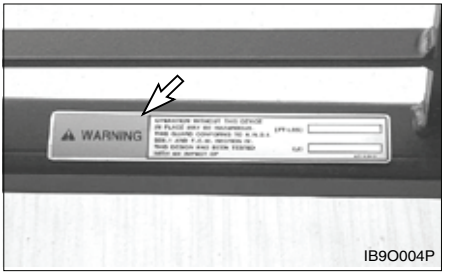


Located on the load backrest.

## Overhead Guard Must Be In Place Warning

**⚠ WARNING**

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




Located on the Overhead Guard.

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## No Riders Warning

**⚠ WARNING**

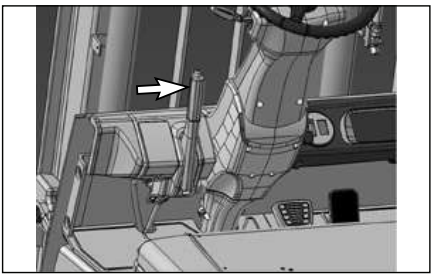
**To avoid personal injury, allow no riders. A lift truck is designed for only one operator and no riders.**

Located beside the operator's station.

## Parking Brake Warning

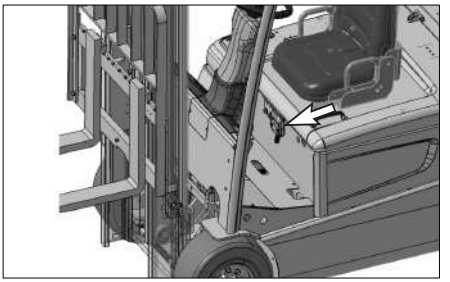
**⚠ WARNING**

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



Located on the top left side of the cowl.

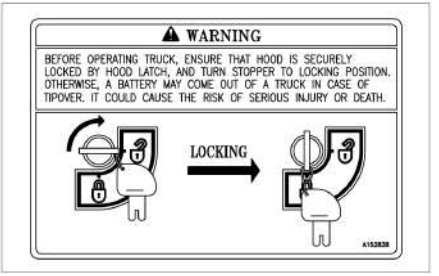
## Battery Restraint Warning



Located on front of battery cover.

**⚠ WARNING**

**Before operating truck, ensure that hood is securely locked by hood latch, and turn stopper to locking position. Otherwise, a battery may come out of a truck in case of tipover. It could cause the risk of serious injury or death.**



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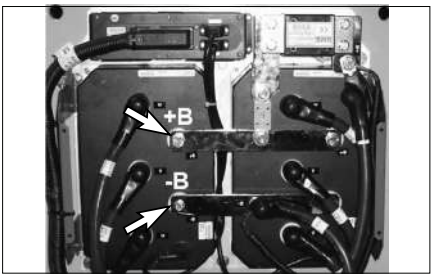
## Battery Disconnect Before Servicing Warning

### AC

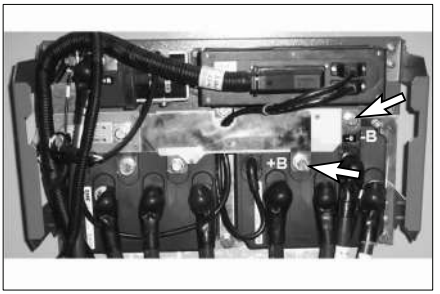
**⚠ WARNING**

**Disconnect battery from truck and also discharge high voltages from capacitor banks with a 150 ohm, 25 watt Resistor before attempting to service this truck.(B+, B-)**

**(36V/48V)**



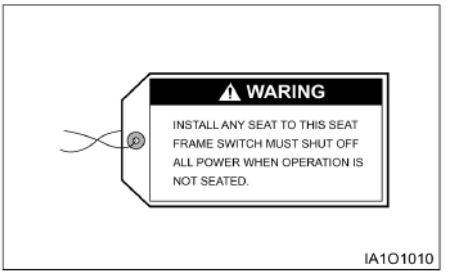

**(80V)**




## Seat Switch Warning

**⚠ WARNING**

**Install any seat to this seat frame. Switch must shut off all power when operator is not seated.**



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## General Hazard Information

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Obey all traffic rules and warning signs.

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

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

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

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.

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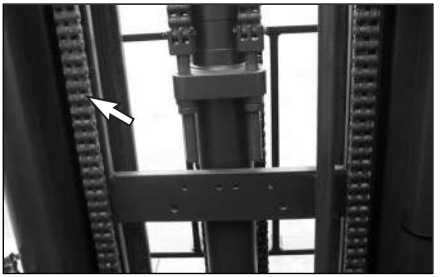
## Lift Chains



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 *DOOSAN* dealer. We would like to draw your attention to the fact that any secondary damages due to improper handling, insufficient maintenance, wrong repairs or the use of other than original *DOOSAN* spare parts waive any liability by *DOOSAN*.

## Operation Information

### Mounting and Dismounting

Mount and dismount the lift truck carefully.

Clean your shoes and wipe your hands before mounting.

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

Use the handgrips for mounting and dismounting.

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

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

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

Keep hands and steering wheel free of slippery material.

### Before Starting the Lift Truck

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

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

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

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

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

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

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

## Starting the Lift Truck

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

## Before Operating the Lift Truck

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

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

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

## Operating the Lift Truck

Always keep the lift truck under control.

Obey all traffic rules and warning signs.
Never leave the lift truck with the engine operating, or with the parking brake disengaged.

Operate the engine only in a well ventilated area.
Lower the mast, with or without load, before turning or traveling. Tip over could result. Watch out for overhead obstructions.

Always observe floor load limits and overhead clearance.

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

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

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

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

Do not stunt ride or indulge in horseplay.

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

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

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

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

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

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

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

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

### Loading or Unloading Trucks/Trailers

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

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

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

### Lift Truck Parking

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

- Park the lift truck level, with the forks lowered and the mast tilted forward until the fork tips touch the floor.
- Move the direction control lever to NEUTRAL.
- Engage the parking brake.
- Turn the key switch off and remove the key.
- Turn the disconnect switch to OFF (if equipped).
- Block the drive wheels when parking on an incline.

## Maintenance Information

Perform all maintenance unless otherwise specified as follows :

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

### Pressure Air

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

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

### Fluid Penetration

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

### Crushing or Cutting Prevention

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

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

Where there are attachment linkages, the clearance in the linkage area will increase or decrease with movement of the attachment.
Stay clear of all rotating and moving parts.

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Keep objects away from moving fan blades. They will throw or cut any object or tool that falls or is pushed into them.

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

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

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

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

**Falling Objects Protective Structure (FOPS)**

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

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

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

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

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

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

## Burn Prevention

**Oils**

Hot oil and components can cause personal injury. Do not allow hot oil or components to contact the skin.
At operation temperature, the hydraulic tank is hot and can be under pressure.

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

Remove the hydraulic tank filter cap slowly to relieve pressure.

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

**Batteries**

Only trained and designated personnel should inspect, recharge or exchange batteries.

Always wear protective glasses when working with batteries.

Service, exchange and handle batteries only in authorized areas when proper safety and ventilation facilities are provided.

Do not smoke, or expose battery to sparks or flame when checking, charging or servicing battery. Keep chains and metallic tools away from top of battery.

Batteries give off flammable fumes which can explode.

Highly explosive gases are especially hazardous toward the end of the charging period as the battery approaches a full charge condition.

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

Service batteries in accordance with battery manufacture instructions.

Refer to the topic "Batteries" in the "Maintenance Section" of this manual.

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## Fire or Explosion Prevention

All fuels, most lubricants and some coolant mixtures are flammable.
Do not smoke in areas where batteries are charged, or where flammable materials are stored.

Clean and tighten all electrical connections. Check daily for loose or frayed electrical wires. Have all loose or frayed electrical wires tightened, repaired or replaced before operating the lift truck.
Keep all fuels and lubricants stored in properly marked containers and away from all unauthorized persons.

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

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

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

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

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.

### Lines, Tubes and Hoses

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

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

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

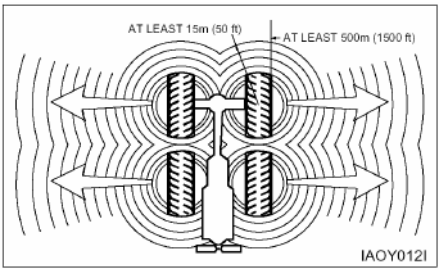
- End fittings damaged or leaking.
- Outer covering chafed or cut and wire reinforcing exposed.
- Outer covering ballooning locally.
- Evidence of kinking or crushing of the flexible part of hose.
- Armoring embedded in the outer cover.
- End fittings displaced.

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

### Tire Information

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

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




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

Dry nitrogen (N2) gas is recommended for inflation of tires. If the tires were originally inflated with air, nitrogen is still preferred for adjusting the pressure. Nitrogen mixes properly with air.

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

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

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

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

## Operator Restraint System (If Equipped)

### Warning Signs and Labels

Your *DOOSAN* 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 *DOOSAN* Lift Truck dealer for new labels.

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

**⚠ WARNING**

**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

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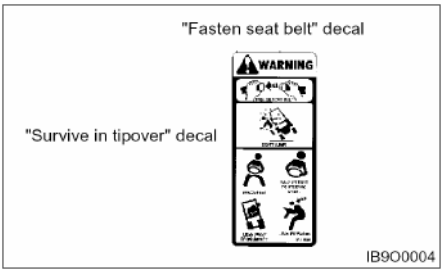
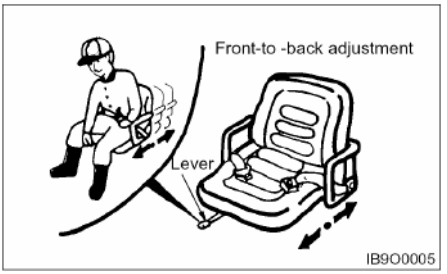



The "Survive in tipover" warning is located on the overhead guard. It shows the proper use of the operator restraint system.

## 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.**

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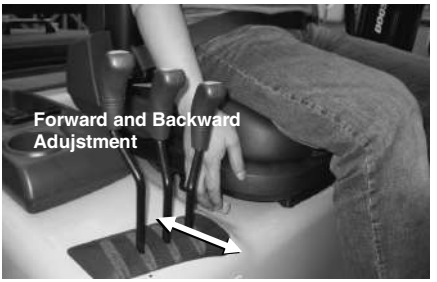
## If Optional Suspension Seat Equipped

### Forward and Backward Adujstment

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



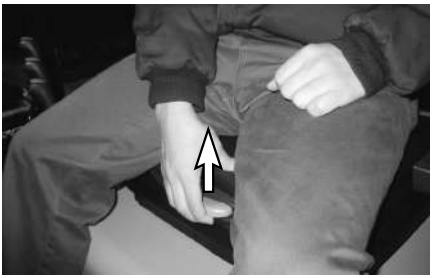
Adjust the seat before operating the lift truck. After adjusting, set the seat to make sure it is properly locked. DO NOT adjust the seat while the truck is in motion.

### Weight adjustment

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

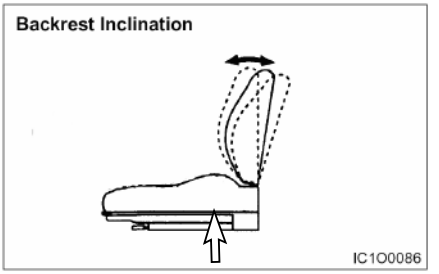
**NOTICE**

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



### Backrest Inclination

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



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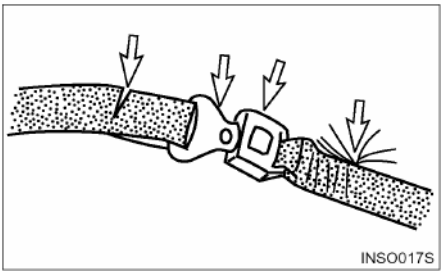
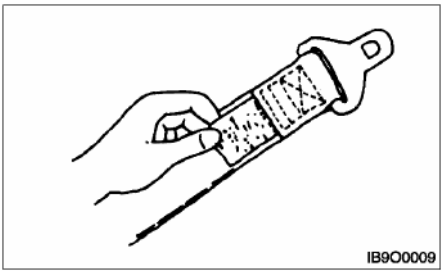
**Seat Belt**

The Operator Restraint System, Prevents the operator from jumping from the operator's compartment in the event of 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 tipover.

**Inspection**




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




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

**⚠ WARNING**

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

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

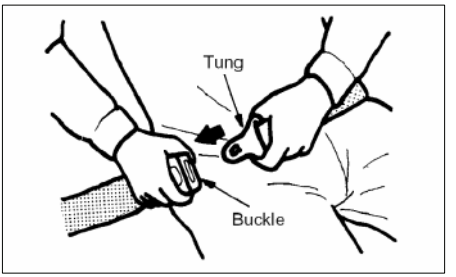
**NOTE:** Operator restraints shall be examined at the regular truck service intervals. It is recommended that they be replaced if any of the following conditions are found:

- 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.

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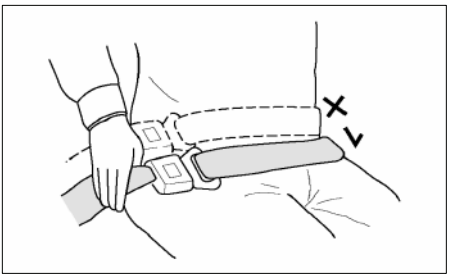
**⚠ WARNING**

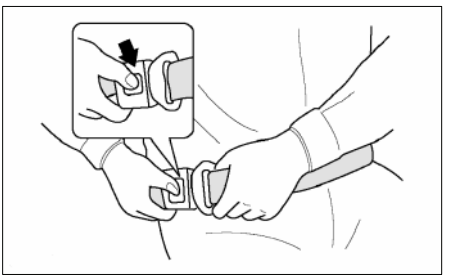
**If you fasten the belt across your abdomen, the belt may injure your abdomen in an accident.**



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.

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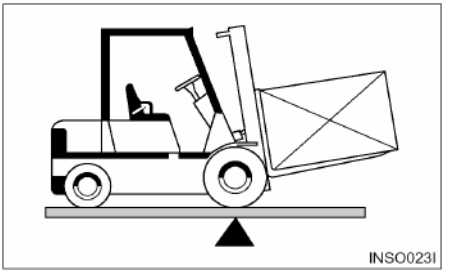
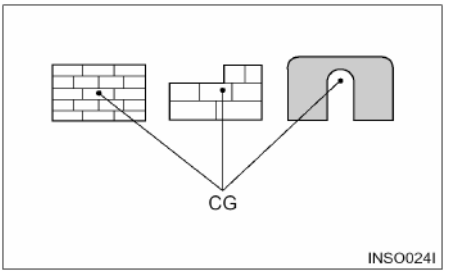
# Avoiding Lift Truck Tipover

## Lift Truck Stability



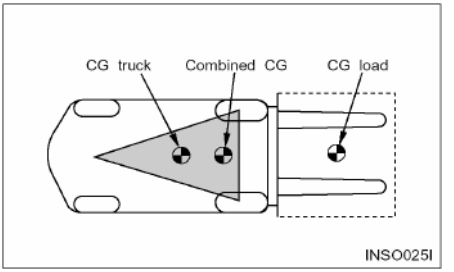

Counterbalanced lift truck design is based on the balance of two weights on opposite sides of a fulcrum (the front axle). The load on the forks must be balanced by the weight of the lift truck.
The location of the center of gravity of both the truck and the load is also a factor. This basic principle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

## Center of Gravity (CG)



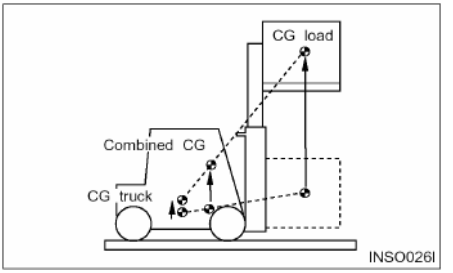

The point within an object, at which the whole weight of the object may be regarded as being concentrated, is called the center of gravity or CG. If the object is uniform, its geometric center will coincide with its CG. If it is not uniform, the CG could be at a point outside of the object. When the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

## Stability and Center of Gravity




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

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




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

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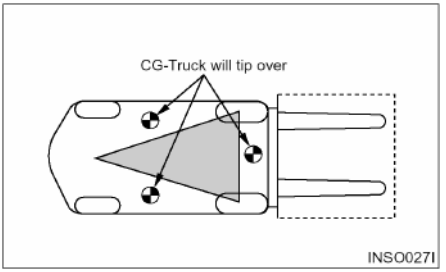
## Lift Truck Stability Base

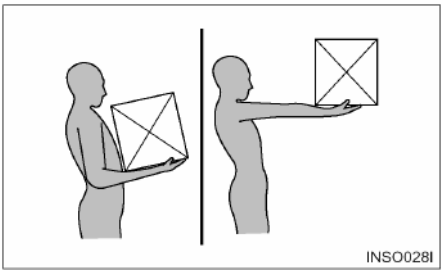



For the lift truck to be stable (not tip over forward or to the side), the CG must stay within the area of the lift truck stability base – a triangular area between the front wheels and the pivot of the steer wheels. If the CG moves forward of the front axle, the lift truck will tip forward. If the CG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

**⚠ WARNING**

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

### Capacity Load (Weight and Load Center)




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

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

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

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

**NOTICE**

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

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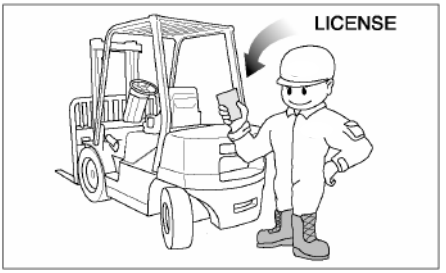
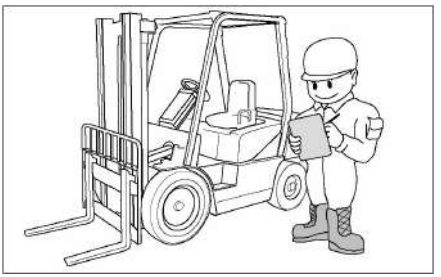
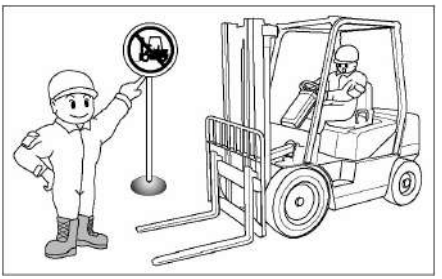
## Safety Rules



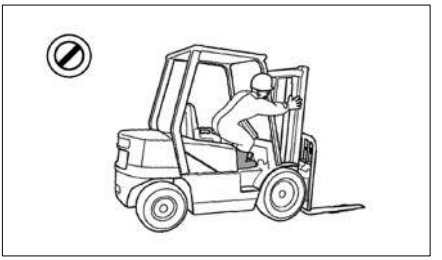

Only properly trained and authorized personnel should operate forklift trucks. Wear a hard hat and safety shoes when operating a lift truck. Do not wear loose clothing.



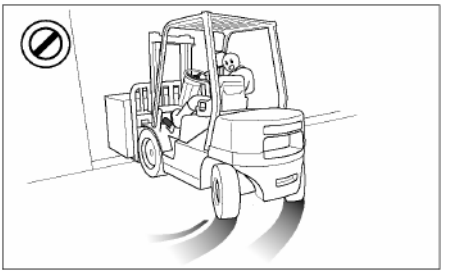
Inspect and check the condition of your forklift truck using the operator's check list before starting work. Immediately report to your supervisor any obvious defects or required repairs.



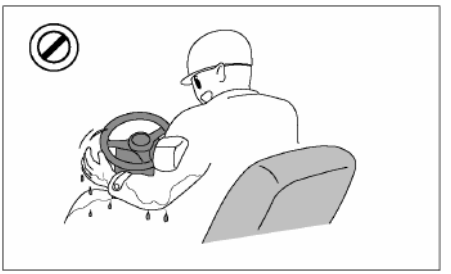
Do not operate your truck in unauthorized areas.
Know your forklift truck and think safety.
Do not compromise safety.
Follow all safety rules and read all warning signs.



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



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



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.

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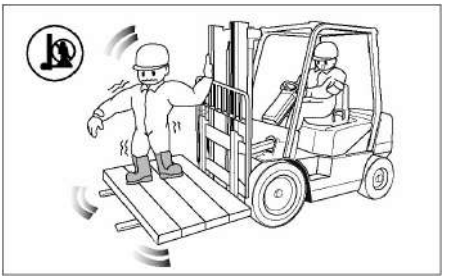
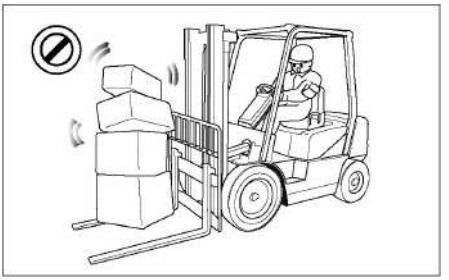
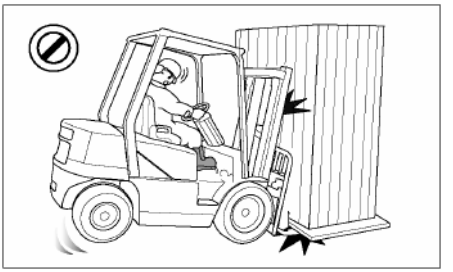


Do not raise anyone on the forks of your lift truck unless using an approved safety cage. Do not let other people ride on the truck. Lift trucks are designed to carry loads, not people.

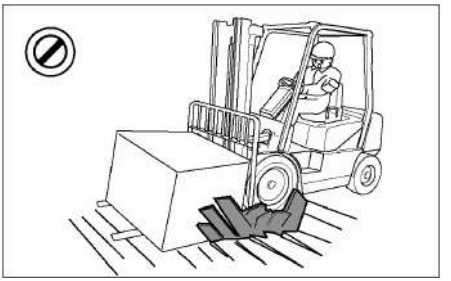
Do not operate your truck without the load backrest extension and overhead guard. Keep the load against the backrest with the mast tilted backward.



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



Do not overload. Always handle loads within the rated capacity shown on the capacity plate.
Do not add extra counterweight to the truck. An overload can cause the truck to roll over and cause injury to personnel and damage to the lift truck.



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

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

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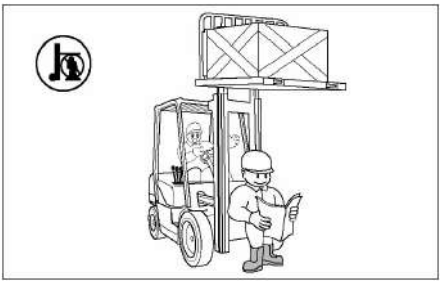
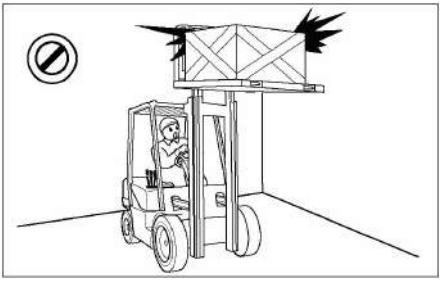
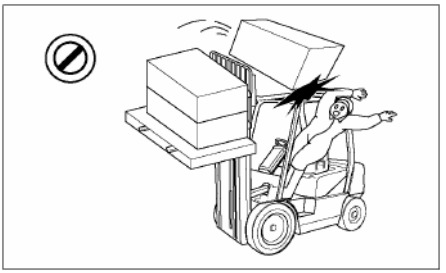


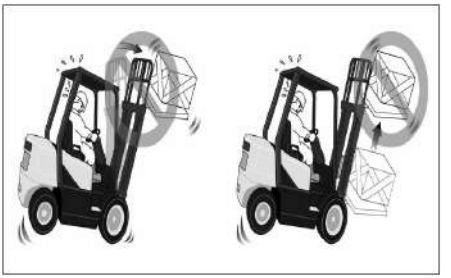
Do not permit anyone to stand or walk under the load or lifting mechanism. The load can fall and cause injury or death to anyone standing below.



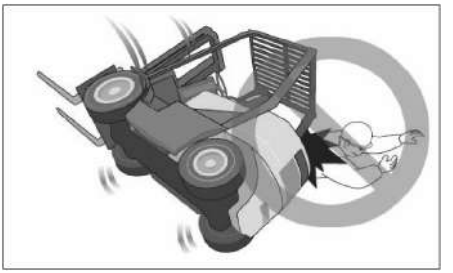
Look out for overhead obstructions when raising or stacking loads. Do not travel with a raised load. Do not travel with the mast raised. The lift truck can roll over and cause injury or death to you or other personnel.



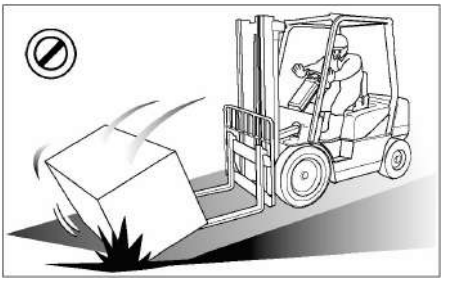
Do not move loose loads that are higher than the load backrest.
Be alert for falling loads when stacking.
Travel with the load tilted back and the forks as low as possible.
This will increase stability to the truck and load and permit better visibility for you.



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.

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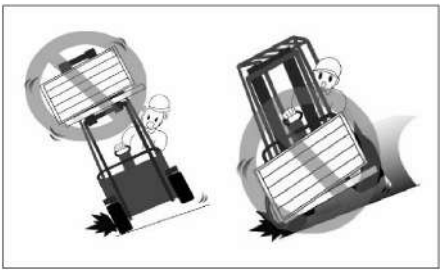
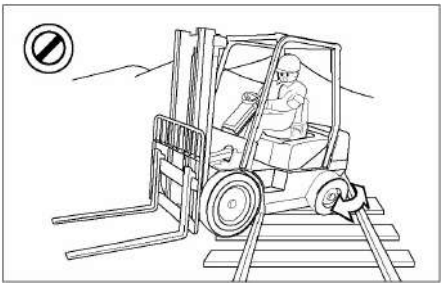


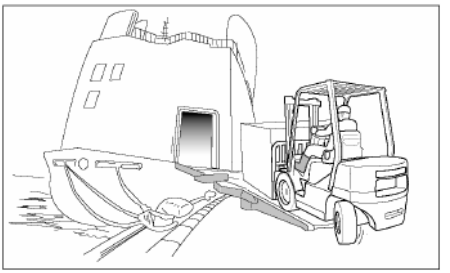
Do not stack or turn on ramps.
Do not attempt to pick-up or deposit a load unless the lift truck is level. Do not turn on or drive across an incline.



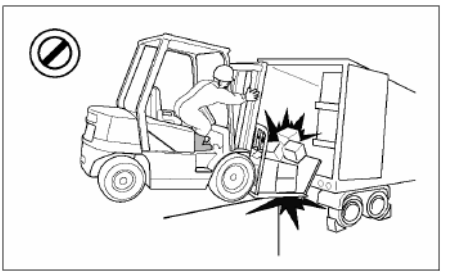
Do not go over rough terrain. If unavoidable, slow down.
Cross railroad tracks slowly and diagonally whenever possible. A railroad crossing can give a loaded forklift truck a real jolt. For smoother crossing, cross the railroad diagonally so one wheel crosses at a time.

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.

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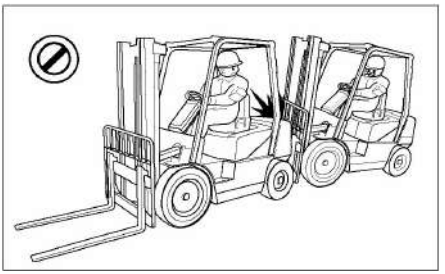
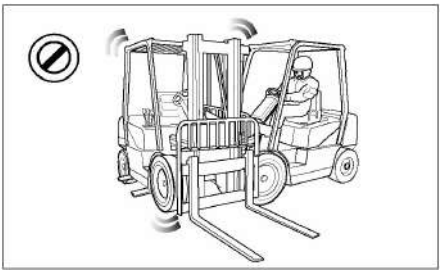
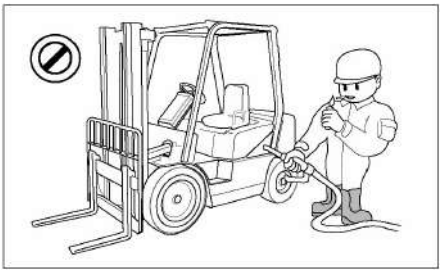


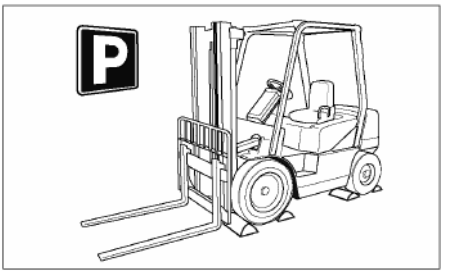
Do not operate your truck close to another truck. Always keep a safe distance from other trucks and make sure there is enough distance to stop safely. Never overtake other vehicles.



Do not use your lift truck to push or tow another truck.
Do not let another push or tow your truck.
If a truck will not move, call a service technician.



Forklift trucks may only be refueled at specially reserved locations. Switch off the engine when refueling.
Smoking and handling of naked flames during refueling are strictly prohibited. This prohibition also applies during the changing of the LPG (liquefied propane gas) tank.
Mop up spilt fuel and do not forget to close the fuel tank before restarting the engine.




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

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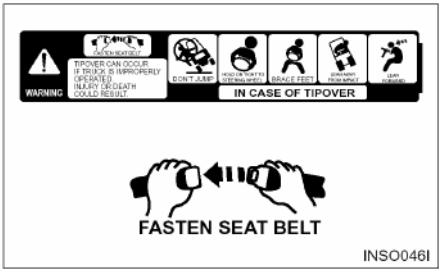
## How to Survive in a Tipover (If Operator Restraint System Equipped)

**⚠ WARNING**

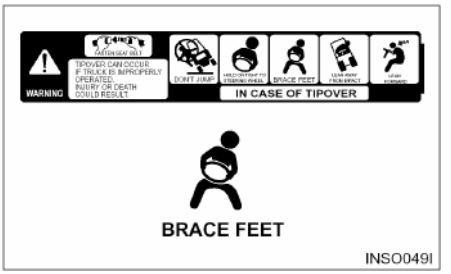
**In the event of a tip over, the risk of serious injury or death will be reduced if the operator is using the operator restraint system and follows the instructions provided.**



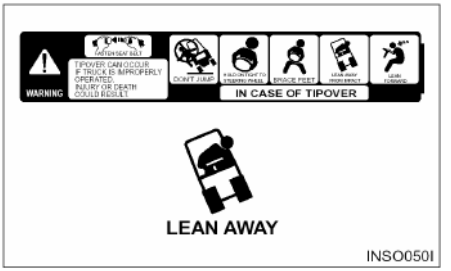

Always use operator restraint system.

Don’t jump.

Hold on tight.




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




Lean away from the direction of fall.

Lean forward

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# Specifications

| | | | |
|---|---|---|---|
| | | **CHARACTERISTICS** | |
| 1 | Manufacturer | | |
| 2 | Model | | |
| 3 | Capacity | at rated load center | lb(kg) |
| 4 | Load center | distance | in(mm) |
| 5 | Power type | eletric,diesel,gas,Lp-gas | |
| 6 | Operator type | stand-on, driver seated | |
| 7 | Tire | P=pneumatic,E=elastic,C=cushion | |
| 8 | Wheels(x=driven) | number of front/rear | |
| | | **DIMENSIONS** | |
| 9 | Lift with STD | maximum fork height with rated load | in(mm) |
| 10 | two-stage mast | free lift | in(mm) |
| 11 | Fork carriage | ISO Class | |
| 12 | Fork | lengthXwidthXthickness | in(mm) |
| 13 | | spacing (minimumXmaximum) | in(mm) |
| 14 | Tilt of mast | forward/backward | deg |
| 15 | Overall dimensions | length to fork face | 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 center of front wheel to fork face) | in(mm) |
| 23 | Aisle 90 degree stacking(add load length & clearance) | | in(mm) |
| | | | |
| | | **PERFORMANCE** | |
| 24 | Speeds | travel,loaded/unloaded 36V | mph(km/h) |
| | | 48V | mph(km/h) |
| 25 | | lift,loaded/unloaded 36V | fpm(mm/s) |
| | | 48V | fpm(mm/s) |
| 26 | | lowering,loaded/unloaded | fpm(mm/s) |
| 28 | Max. drawbar pull | loaded/unloaded (5 min. rating) | lb(kgf) |
| 30 | Max. gradeability | loaded/unloaded (5 min. rating) | % |
| 31 | Steering | manual/power assisted/full power | |
| | | **WEIGHT** | |
| 32 | Total weight(with minimum weight of battery) | | lb(kg) |
| 33 | Axle load | with load(front/rear) | lb(kg) |
| 34 | | without load(front/rear) | lb(kg) |
| | | **CHASSIS** | |
| 35 | Tire Size | number of front/rear | |
| 36 | | front | |
| 37 | | rear | |
| 38 | Wheelbase | | in(mm) |
| 39 | Tread | front/rear | in(mm) |
| 40 | Ground clearance | at the lowest point | in(mm) |
| 41 | (unloaded) | at center of wheelbase | in(mm) |
| 42 | Service brake | | |
| 43 | Parking brake | | |
| | | **DRIVE** | |
| 44 | Battery | Type | |
| 45 | (36/48V) | Max capacity/5 hours | Ah |
| 46 | | Weight (Minimun) | lb(kg) |
| 47 | Electric motor | Drive motor(1 HR Rating) | hp(kw) |
| 48 | (36/48V) | Hyd. motor(15% Duty) | hp(kw) |
| 50 | Speed control | with electric drive | Type |
| 51 | Relief pressure | system/attachment | kg/㎠ |
| 52 | Noise level | Leq | dB(A) |

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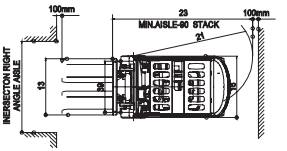
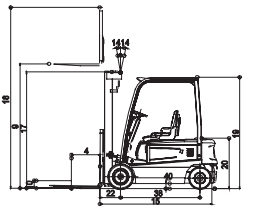
| 36/48V | | | | | |
|---|---|---|---|---|---|
| DOOSAN | DOOSAN | DOOSAN | DOOSAN | DOOSAN | 1 |
| BC20S-5 | BC25S-5 | BC25SE-5 | BC30S-5 | BC32S-5 | 2 |
| 4000(2000) | 5000(2500) | 5000(2500) | 6000(3000) | 6500(3000) | 3 |
| 24(500) | 24(500) | 24(500) | 24(500) | 24(600) | 4 |
| AC electric | AC electric | AC electric | AC electric | AC electric | 5 |
| driver seated | driver seated | driver seated | driver seated | driver seated | 6 |
| C | C | C | C | C | 7 |
| x 2/2 | x 2/2 | x 2/2 | x 2/2 | x 2/2 | 8 |
| | | | | | |
| 127(3230) | 127(3230) | 127(3230) | 127(3230) | 127(3230) | 9 |
| 6.0(152) | 6.0(152) | 6.0(152) | 6.0(152) | 6.0(152) | 10 |
| II | II | II | III | III | 11 |
| 41x3.9x1.6 (1050x100x40) | 41x3.9x1.6 (1050x100x40) | 41x3.9x1.6 (1050x100x40) | 41.3x4.9x1.8 (1050x125x45) | 41.3x4.9x1.8 (1050x125x45) | 12 |
| 11.7x35.6 (297x905) | 11.7x35.6 (297x905) | 11.7x35.6 (297x905) | 11.1x37.6 (282x954) | 11.1x37.6 (282x954) | 13 |
| 6/10 | 6/10 | 6/10 | 6/10 | 6/10 | 14 |
| 81.3(2065) | 82.5(2095) | 85.2(2165) | 88.6(2250) | 90.7(2305) | 15 |
| 43.7(1110) | 43.7(1110) | 43.7(1110) | 43.7(1110) | 43.7(1110) | 16 |
| 83.3(2115) | 83.3(2115) | 83.3(2115) | 83.3(2115) | 83.3(2115) | 17 |
| 176.4(4480) | 176.4(4480) | 176.4(4480) | 176.4(4480) | 176.4(4480) | 18 |
| 87.0(2210) | 87.0(2210) | 87.0(2210) | 87.0(2210) | 87.0(2210) | 19 |
| 43.9(1115) | 43.9(1115) | 43.9(1115) | 43.9(1115) | 43.9(1115) | 20 |
| 74.2(1885) | 75.4(1915) | 78.1(1985) | 80.9(2055) | 82.5(2095) | 21 |
| 15.7(400) | 15.7(400) | 15.7(400) | 16.0(406) | 16.0(406) | 22 |
| 89.9(2285) | 91.1(2315) | 93.9(2385) | 96.9(2461) | 98.5(2501) | 23 |
| | | | | | 23a |
| | | | | | |
| 9.0/10.6(14.5/17.0) | 9.0/10.6(14.5/17.0) | 9.0/10.6(14.5/17.0) | 9.0/10.6(14.5/17.0) | 9.0/10.6(14.5/17.0) | 24 |
| 11.2/11.2(18.0/18.0) | 11.2/11.2(18.0/18.0) | 11.2/11.2(18.0/18.0) | 11.2/11.2(18.0/18.0) | 11.2/11.2(18.0/18.0) | |
| 66.9/104(340/530) | 57/104(290/530) | 57/104(290/530) | 53/102(270/520) | 53/102(270/520) | 25 |
| 90.5/126(460/640) | 78.7/126(400/640) | 78.7/126(400/640) | 69/124(350/630) | 69/124(350/630) | |
| 98.4/91(500/460) | 98.4/91(500/460) | 98.4/91(500/460) | 98.4/91(500/460) | 98.4/91(500/460) | 26 |
| 3208/2121 (1455/962) | 3329/2169 (1510/984) | 3329/2169 (1510/984) | 3307/2335 (1500/1059) | 3307/2335 (1500/1059) | 28 |
| 25.0/20.5 | 22.0/18.5 | 22.0/18.5 | 19.0/20.0 | 18.0/19.0 | 30 |
| full power | full power | full power | full power | full power | 31 |
| | | | | | |
| 8710(3950) | 9580(4345) | 9305(4220) | 10460(4745) | 11010(4995) | 32 |
| 11275/1840 (5115/835) | 13160/1930 (5970/875) | 13085/1730 (5935/785) | 14945/2125 (6780/965) | 15255/2370 (6920/1075) | 33 |
| 3770/4940 (1710/2240) | 3770/5810 (1710/2635) | 3980/5325 (1805/2415) | 3990/6470 (1810/2935) | 3825/7185 (1735/3260) | 34 |
| | | | | | |
| 2/2 | 2/2 | 2/2 | 2/2 | 2/2 | 35 |
| 21x7-15 | 21x7-15 | 21x7-15 | 21x8-15 | 21x8-15 | 36 |
| 16x6-10.5 | 16x6-10.5 | 16x6-10.5 | 16x6-10.5 | 16x6-10.5 | 37 |
| 50.4(1280) | 50.4(1280) | 54.3(1380) | 54.3(1380) | 54.3(1380) | 38 |
| 36.7/35.5(932/902) | 36.7/35.5(932/902) | 36.7/35.5(932/902) | 35.7/35.5(907/902) | 35.7/35.5(907/902) | 39 |
| 3.1(80) | 3.1(80) | 3.1(80) | 3.1(80) | 3.1(80) | 40 |
| 4.1(103) | 4.1(103) | 4.1(103) | 4.1(103) | 4.1(103) | 41 |
| foot/hydraulic | foot/hydraulic | foot/hydraulic | foot/hydraulic | foot/hydraulic | 42 |
| hand | hand | hand | hand | hand | 43 |
| | | | | | |
| lead-acid | lead-acid | lead-acid | lead-acid | lead-acid | 44 |
| 1200/900 | 1300/1000 | 1400/1000 | 1400/1000 | 1400/1000 | 45 |
| 2300(1040) | 2800(1270) | 2800(1270) | 3000(1360) | 3000(1360) | 46 |
| 15.4/21.5(11.5/16) | 15.4/21.5(11.5/16) | 15.4/21.5(11.5/16) | 15.4/21.5(11.5/16) | 15.4/21.5(11.5/16) | 47 |
| 19.0/28.2(14/21) | 19.0/28.2(14/21) | 19.0/28.2(14/21) | 19.0/28.2(14/21) | 19.0/28.2(14/21) | 48 |
| mosfet | mosfet | mosfet | mosfet | mosfet | 50 |
| 169/158 | 197/158 | 197/158 | 211/158 | 211/158 | 51 |
| 70 | 70 | 70 | 70 | 70 | 52 |



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# Specifications

| | | | |
|---|---|---|---|
| | | **CHARACTERISTICS** | |
| 1 | Manufacturer | | |
| 2 | Model | | |
| 3 | Capacity | at rated load center | kg |
| 4 | Load center | distance | mm |
| 5 | Power type | eletric,diesel,gas,Lp-gas | |
| 6 | Operator type | stand-on, driver seated | |
| 7 | Tire | P=pneumatic,E=elastic,C=cushion | |
| 8 | Wheels(x=driven) | number of front/rear | |
| | | **DIMENSIONS** | |
| 9 | Lift with STD | maximum fork height with rated load | mm |
| 10 | two-stage mast | free lift | mm |
| 11 | Fork carriage | ISO Class | |
| 12 | Fork | lengthXwidthXthickness | mm |
| 13 | | spacing (minimumXmaximum) | mm |
| 14 | Tilt of mast | forward/backward | deg |
| 15 | Overall dimensions | length to fork face | mm |
| 16 | | width | mm |
| 17 | | mast lowered height | mm |
| 18 | | mast extended height | mm |
| 19 | | overhead guard height | mm |
| 20 | | seat height | mm |
| 21 | Outside turning radius | | mm |
| 22 | LMC | (from center of front wheel to fork face) | mm |
| 23 | Aisle 90 degree stacking(add load length & clearance) | | mm |
| 23a | Aisle 90 degree intersecting | | mm |
| | | **PERFORMANCE** | |
| 24 | Speeds | travel,loaded/unloaded 80V | km/h |
| 25 | | lift,loaded/unloaded 80V | mm/s |
| 26 | | lowering,loaded/unloaded | mm/s |
| 28 | Max. drawbar pull | loaded/unloaded (5 min. rating) | kgf |
| 30 | Max. gradeability | loaded/unloaded (5 min. rating) | % |
| 31 | Steering | manual/power assisted/full power | |
| | | **WEIGHT** | |
| 32 | Total weight(with minimum weight of battery) | | kg |
| 33 | Axle load | with load(front/rear) | kg |
| 34 | | without load(front/rear) | kg |
| | | **CHASSIS** | |
| 35 | Tire Size | number of front/rear | |
| 36 | | front | |
| 37 | | rear | |
| 38 | Wheelbase | | mm |
| 39 | Tread | front/rear | mm |
| 40 | Ground clearance | at the lowest point | mm |
| 41 | (unloaded) | at center of wheelbase | mm |
| 42 | Service brake | | |
| 43 | Parking brake | | |
| | | **DRIVE** | |
| 44 | Battery | Type | |
| 45 | (80V) | Max capacity/5 hours | Ah |
| 46 | | Weight (Minimun) | kg |
| 47 | Electric motor | Drive motor(1 HR Rating) | kw |
| 48 | (80V) | Hyd. motor(15% Duty) | kw |
| 49 | Speed control | with electric drive | Type |
| 50 | Relief pressure | system/attachment | kg/㎠ |
| 51 | Noise level | Leq | dB(A) |

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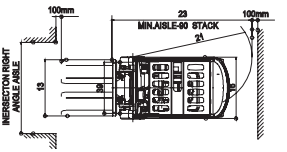
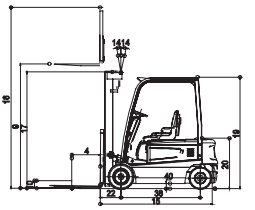
| 80V | | | |
|---|---|---|---|
| DOOSAN | DOOSAN | DOOSAN | 1 |
| BC20S-5 | BC25S-5 | BC30S-5 | 2 |
| 2000 | 2500 | 3000 | 3 |
| 500 | 500 | 500 | 4 |
| AC electric | AC electric | AC electric | 5 |
| driver seated | driver seated | driver seated | 6 |
| C | C | C | 7 |
| x 2/2 | x 2/2 | x 2/2 | 8 |
| | | | |
| 3230 | 3230 | 3230 | 9 |
| 152 | 152 | 152 | 10 |
| II | II | III | 11 |
| 1050x100x40 | 1050x100x40 | 1050x125x45 | 12 |
| 297x905 | 297x905 | 282x954 | 13 |
| 6/10 | 6/10 | 6/10 | 14 |
| 2065 | 2095 | 2250 | 15 |
| 1110 | 1110 | 1110 | 16 |
| 2115 | 2115 | 2115 | 17 |
| 4480 | 4480 | 4480 | 18 |
| 2210 | 2210 | 2210 | 19 |
| 1115 | 1115 | 1115 | 20 |
| 1885 | 1915 | 2055 | 21 |
| 400 | 400 | 406 | 22 |
| 2285 | 2315 | 2461 | 23 |
| | | | 23a |
| | | | |
| 18.5/19.5 | 17.5/19.0 | 16.5/18.5 | 24 |
| 480/610 | 440/610 | 410/600 | 25 |
| 500/600 | 500/460 | 500/460 | 26 |
| 1455/962 | 1510/984 | 1500/1059 | 28 |
| 25.0/20.5 | 22.0/18.5 | 19.0/20.0 | 30 |
| full power | full power | full power | 31 |
| | | | |
| 3950 | 4345 | 4745 | 32 |
| 5115/835 | 5970/875 | 6780/965 | 33 |
| 1710/2240 | 1710/2635 | 1810/2935 | 34 |
| | | | |
| 2/2 | 2/2 | 2/2 | 35 |
| 21x7-15 | 21x7-15 | 21x8-15 | 36 |
| 16x6-10.5 | 16x6-10.5 | 16x6-10.5 | 37 |
| 1280 | 1280 | 1380 | 38 |
| 932/902 | 932/902 | 907/902 | 39 |
| 80 | 80 | 80 | 40 |
| 103 | 103 | 103 | 41 |
| foot/hydraulic | foot/hydraulic | foot/hydraulic | 42 |
| hand | hand | hand | 43 |
| | | | |
| lead-acid | lead-acid | lead-acid | 44 |
| 600 | 600 | 600 | 45 |
| 1040 | 1270 | 1360 | 46 |
| 16.0 | 16.0 | 16.0 | 47 |
| 21.0 | 21.0 | 21.0 | 48 |
| mosfet | mosfet | mosfet | 49 |
| 169/158 | 197/158 | 211/158 | 50 |
| 70 | 70 | 70 | 51 |



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# Specifications

| | | | | |
|---|---|---|---|---|
| | | **CHARACTERISTICS** | | |
| 1 | Manufacturer | | | |
| 2 | Model | | | |
| 3 | Capacity | at rated load center | | Kg (lb) |
| 4 | Load center | distance | | mm (in) |
| 5 | Power type | eletric,diesel,gas,Lp-gas | | |
| 6 | Operator type | stand-on, rider seated | | |
| 7 | Tire | P=pneumatic,E=elastic,C=cushion | | |
| 8 | Wheels(x=driven) | number of front/rear | | |
| | | **DIMENSIONS** | | |
| 9 | Lift with STD two-stage mast | maximum fork height with rated load | | mm (in) |
| 10 | | free lift | | mm (in) |
| 12 | Fork carriage | ISO Class | | |
| 13 | Fork | thickiness X width X length | | mm (in) |
| | | Spacing (Min. X Max.) | | mm (in) |
| 14 | Tilt of mast | foreward/backward | | deg |
| 15 | Overall dimensions | length to fork face | | mm (in) |
| 16 | | width | | mm (in) |
| 17 | | mast lowered height | | mm (in) |
| 18 | | mast extended height | | mm (in) |
| 19 | | overhead guard height | | mm (in) |
| 20 | | seat height to SR (daewon new sus.) | | mm (in) |
| 21 | Outside turning radius | | | mm (in) |
| 22 | Load moment constant (from front wheel to fork face) | | | mm (in) |
| 23 | Aisle width with pallets 1000X1200 crosswise, w/clearance | | | mm (in) |
| 23a | Aisle width with pallets 800X1200 lengthwise, w/clearance | | | mm (in) |
| | | **PERFORMANCE** | | |
| 24 | Speeds | travel,loaded/unloaded | | km/h (mph) |
| 25 | | lift,loaded/unloaded | | mm/s (fpm) |
| 26 | | lowering,loaded/unloaded | | mm/s (fpm) |
| 28 | Max. Drawbar pull | loaded/unloaded | | kg (lb) |
| 30 | Max. gradeability | loaded/unloaded @1.6 km/h | | % (deg)) |
| | | **WEIGHT** | | |
| 32 | Total weight (with minimum weight of battery) | | | kg (lb) |
| 33 | Axle load | with load : front/rear | | kg (lb) |
| 34 | | without load : front/rear | | kg (lb) |
| | | **CHASSIS** | | |
| 35 | Tires | number of front/rear | | |
| 36 | | size, front | | |
| 37 | | size, rear | | |
| 38 | Wheelbase | | | mm (in) |
| 39 | Tread | front/rear | | mm (in) |
| 40 | Ground clearance | loaded,at mast lowest point | | mm (in) |
| 41 | | loaded,at center of wheel base | | mm (in) |
| 42 | Brake | Service brake | | |
| 43 | Parking brake | Parking brake | | |
| | | **DRIVE** | | |
| 45 | Battery | Volt/Capacity-5 HR Rating | | V/AH |
| | | Volt/Capacity-Max., 5 HR Rating | | V/AH |
| | | Weight (Minimun) | | kg (lb) |
| 47 | Electric Motors | Drive motor (1 HR Rating) | | Kw (hp) |
| | | Hydraulic motor (15% Duty) | | kw (hp) |
| 54 | Control type | | | Type |
| 55 | Axle | Brake type | | Type |
| 57 | System pressure | Lift | | Kpa (psi) (kgf/㎠) |
| | | Attachment | | Kpa (psi) (kgf/㎠) |

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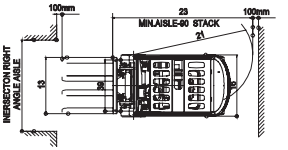
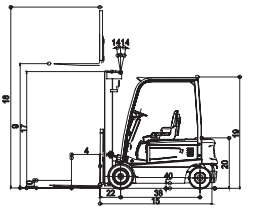
| 48V | | | | |
|---|---|---|---|---|
| **DOOSAN** | **DOOSAN** | **DOOSAN** | **DOOSAN** | 1 |
| B20S-5 | B25S-5 | B30S-5 | B32S-5 | 2 |
| 2000(4000) | 2500(5000) | 3000(6000) | 3200(6400) | 3 |
| 500(24) | 500(24) | 500(24) | 500(24) | 4 |
| electric<br>AC drive<br>AC hyd.<br>No steering | electric<br>AC drive<br>AC hyd.<br>No steering | electric<br>AC drive<br>AC hyd.<br>No steering | electric<br>AC drive<br>AC hyd.<br>No steering | 5 |
| rider seated | rider seated | rider seated | rider seated | 6 |
| P, E | P, E | P, E | P, E | 7 |
| 2x/2 | 2x/2 | 2x/2 | 2x/2 | 8 |
| | | | | |
| 3230(127.2) | 3230(127.2) | 3230(127.2) | 3230(127.2) | 9 |
| 147(5.8) | 147(5.8) | 152(6.0) | 152(6.0) | 10 |
| II | II | III | III | 12 |
| 0x100x1050<br>(1.6x3.9x41.3) | 40x100x1050<br>(1.6x3.9x41.3) | 45x125x1050<br>(1.8x4.9x41.3) | 45x125x1050<br>(1.8x4.9x41.3) | 13 |
| 275 x1035<br>(10.8 x 40.7) | 275x1035<br>(10.8 x 40.7) | 286 x1044<br>(11.3 x 41.1) | 286 x 1044<br>(11.3 x 41.1) | |
| 6/10 | 6/10 | 6/10 | 6/10 | 14 |
| 2196(86.5) | 2226(87.6) | 2377(93.6) | 2407(94.8) | 15 |
| 1200(47.2) | 1200(47.2) | 1200(47.2) | 1200(47.2) | 16 |
| 2140(84.3) | 2140(84.3) | 2140(84.3) | 2140(84.3) | 17 |
| 4470(176.0) | 4470(176.0) | 4470(176.0) | 4470(176.0) | 18 |
| 2220(87.4) | 2220(87.4) | 2220(87.4) | 2220(87.4) | 19 |
| 1098(43.2) | 1098(43.2) | 1098(43.2) | 1098(43.2) | 20 |
| 2040(80.3) | 2060(81.1) | 2190(86.2) | 2220(87.4) | 21 |
| 405(15.9) | 405(15.9) | 411(16.2) | 411(16.2) | 22 |
| 3652(143.8) | 3672(144.6) | 3801(149.6) | 3831(150.8) | 23 |
| 3950(155.5) | 3870(152.4) | 4001(157.5) | 4031(158.7) | 23a |
| | | | | |
| 18.0/18.0<br>(11.2/11.2) | 18.0/18.0<br>(11.2/11.2) | 18.0/18.0<br>(11.2/11.2) | 18.0/18.0<br>(11.2/11.2) | 24 |
| 440/600<br>(86.6/118.1) | 390/600<br>(76.8/118.1) | 340/600<br>(66.9/118.1) | 320/600<br>(63.0/118.1) | 25 |
| 500/460<br>(98.4/90.6) | 500/460<br>(98.4/90.6) | 500/460<br>(98.4/90.6) | 500/460<br>(98.4/90.6) | 26 |
| 1620/1220<br>(3571.5/2689.6) | 1590/1190<br>(3505.3/2623.5) | 1450/1100<br>(3196.7/2425.1) | 1440/1100<br>(3174.7/2425.1) | 28 |
| 28.0/32.0<br>(15.6/17.7) | 24.0/28.0<br>(13.5/15.6) | 19.0/23.0<br>(10.8/13.0) | 18.0/22.0<br>(10.2/12.4) | 30 |
| | | | | |
| 3990(8796.4) | 4400(9700.3) | 4770(10516.0) | 4930(10868.8) | 32 |
| 5191/799<br>(11444.2/1761.5) | 5979/921<br>(13181.4/2030.5) | 6855/915<br>(15112.7/2017.2) | 7135/995<br>(15730.0/2193.6) | 33 |
| 1891/2099<br>(4168.9/4627.5) | 1854/2546<br>(4087.4/5613.0) | 2092/2678<br>(4612.1/5904.0) | 2054/2876<br>(4528.3/6340.5) | 34 |
| | | | | |
| 2/2 | 2/2 | 2/2 | 2/2 | 35 |
| 23x10-12 | 23x10-12 | 23x10-12 | 23x10-12 | 36 |
| 18x7-8 | 18x7-8 | 18x7-8 | 18x7-8 | 37 |
| 1400(55.1) | 1400(55.1) | 1550(61.0) | 1550(61.0) | 38 |
| 950/998(37.4/39.3) | 950/998(37.4/39.3) | 950/998(37.4/39.3) | 950/998(37.4/39.3) | 39 |
| 110(4.3) | 110(4.3) | 110(4.3) | 110(4.3) | 40 |
| 125(4.9) | 125(4.9) | 125(4.9) | 125(4.9) | 41 |
| foot/hyd | foot/hyd | foot/hyd | foot/hyd | 42 |
| hand/mech | hand/mech | hand/mech | hand/mech | 43 |
| | | | | |
| 48/715 | 48/800 | 48/850 | 48/850 | 45 |
| 48/1050 | 48/1050 | 48/1200 | 48/1200 | |
| 1100 (2425.1) | 1220 (2689.6) | 1440 (3174.7) | 1440 (3174.7) | |
| 16.0 (21.5) | 16.0 (21.5) | 16.0 (21.5) | 16.0 (21.5) | 47 |
| 21.0 (28.2) | 21.0 (28.2) | 21.0 (28.2) | 21.0 (28.2) | |
| MOSFET Inverter | MOSFET Inverter | MOSFET Inverter | MOSFET Inverter | 54 |
| ODB | ODB | ODB | ODB | 55 |
| 16600<br>(2407.5) (169.3) | 19300<br>(2799.1) (196.9) | 20700<br>(3002.2) (211.1) | 23500<br>(3408.3) (239.7) | 57 |
| 15500<br>(2248.0) (158.1) | 15500<br>(2248.0) (158.1) | 15500<br>(2248.0) (158.1) | 15500<br>(2248.0) (158.1) | |



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# Noise and Vibration

## Noise at operator ear (measured by PREN 12053)

unit:dB(A)

| Model | Noise Level[unit:Db(A)] |
|---|---|
| | Sound Pressure Level at operator's |
| B(C)20S-5<br>B(C)25S-5<br>B(C)30S-5<br>B(C)32S-5 | Ear(Leq) |
| | PREN 12053 |
| | 70.0 |

* Test Model : B32S-5

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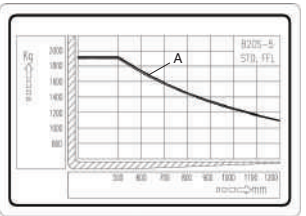
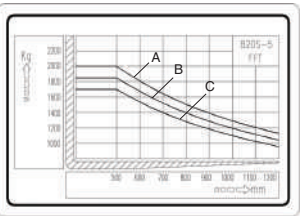
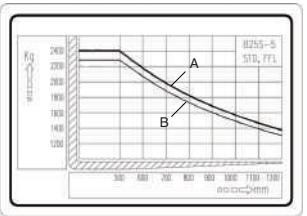
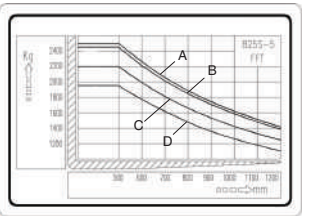
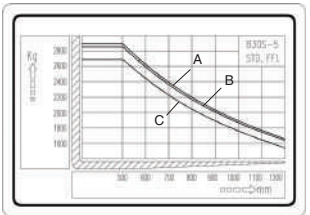
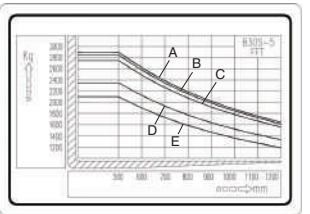
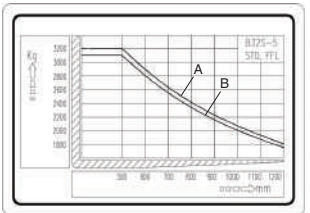
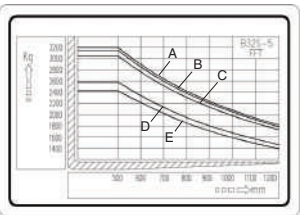
# Capacity Chart

| MODEL | STD, FFL | FFT |
|---|---|---|
| B20S-5 |  <br>A. 2030 – 4960 mm MAST |  <br>A. 3900 – 4730 mm MAST<br>B. 5560 mm MAST<br>C. 6010 mm MAST |
| B25S-5 |  <br>A. 2030 – 4350 mm MAST<br>B. 4960 mm MAST |  <br>A. 3900 - 4290 mm MAST<br>B. 4730 mm MAST<br>C. 5560 mm MAST<br>D. 6010 mm MAST |
| B30S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| B32S-5 |  <br>A. 2030 – 4350 mm MAST<br>B. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |

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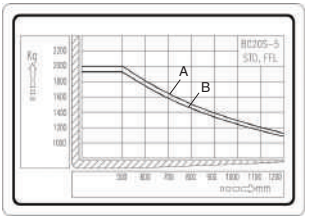
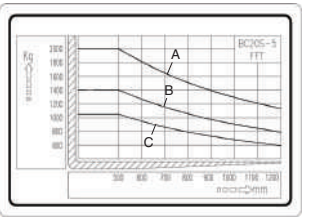
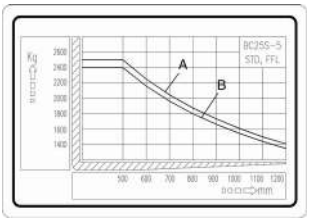
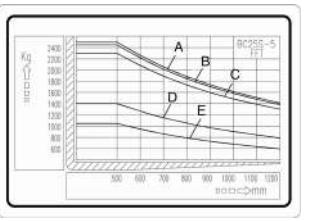
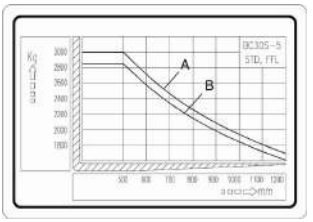
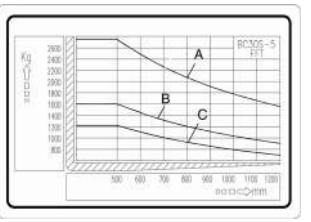
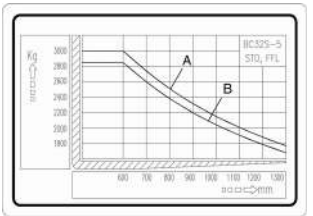
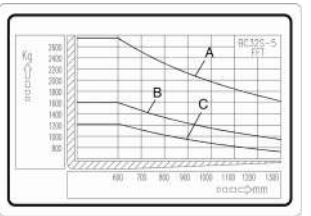
# Capacity Chart

| MODEL | STD, FFL | FFT |
|---|---|---|
| BC20S-5 |  <br><br>A. 2030 – 4350 mm MAST<br>B. 4960 mm MAST |  <br><br>A. 3900 – 4730 mm MAST<br>B. 5560 mm MAST<br>C. 6010 mm MAST |
| BC25S-5 |  <br><br>A. 2030 – 4350 mm MAST<br>B. 4960 mm MAST |  <br><br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| BC30S-5 |  <br><br>A. 2030 – 4350 mm MAST<br>B. 4960 mm MAST |  <br><br>A. 3900 - 4730 mm MAST<br>B. 5560 mm MAST<br>C. 6010 mm MAST |
| BC32S-5 |  <br><br>A. 2030 – 4350 mm MAST<br>B. 4960 mm MAST |  <br><br>A. 3900 – 4730 mm MAST<br>B. 5560 mm MAST<br>C. 6010 mm MAST |

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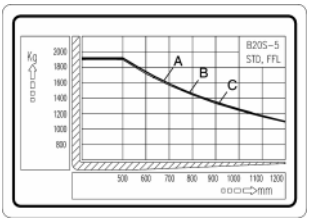
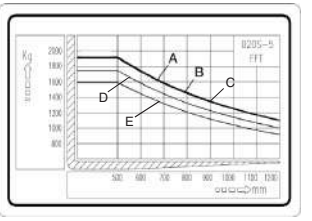
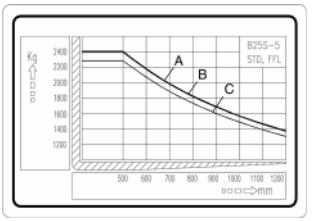
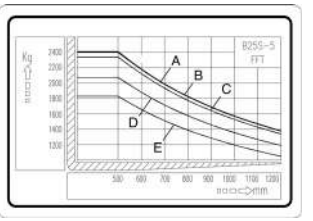
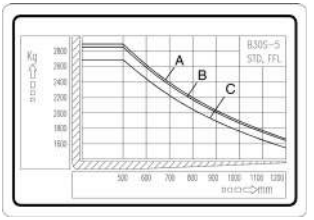
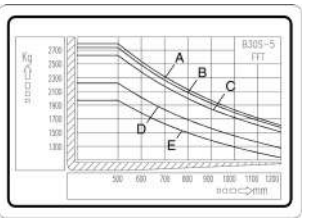
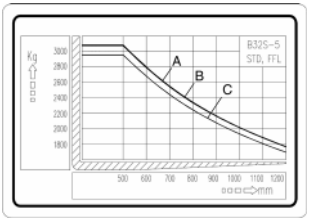
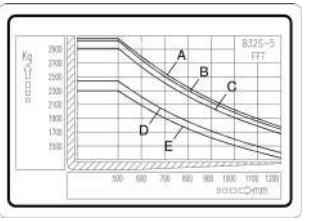
# Capacity Chart - With Side Shifter (Integrated)

| MODEL | STD, FFL | FFT |
|---|---|---|
| B20S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| B25S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| B30S-5 |  <br>A. 2030 - 3950mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290mm MAST<br>C. 4730mm MAST<br>D. 5560mm MAST<br>E. 6010mm MAST |
| B32S-5 |  <br>A. 2030 - 3950mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900mm MAST<br>B. 4290mm MAST<br>C. 4730mm MAST<br>D. 5560mm MAST<br>E. 6010mm MAST |

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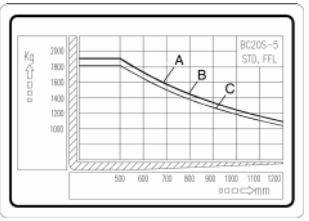
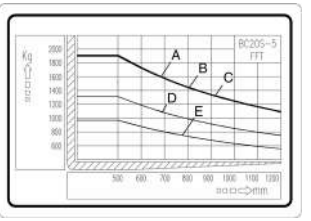
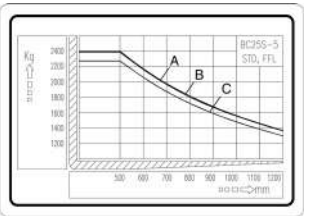
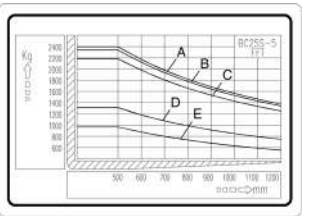
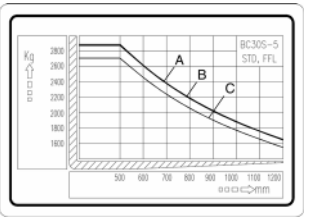
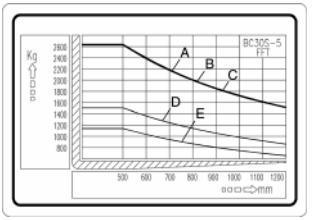
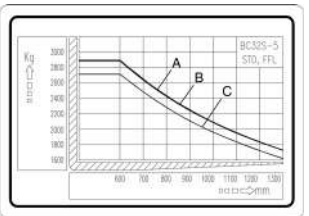
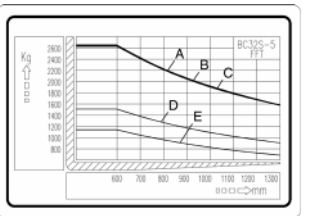
# Capacity Chart - With Side Shifter (Integrated)

| MODEL | STD, FFL | FFT |
|---|---|---|
| BC20S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| BC25S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| BC30S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| BC32S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |

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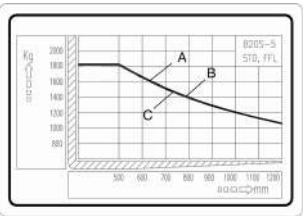
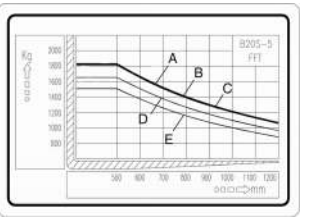
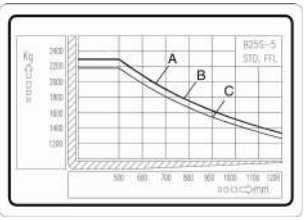
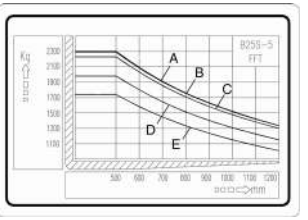
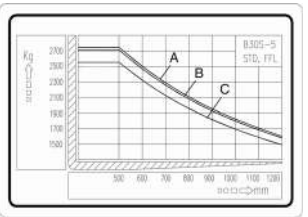
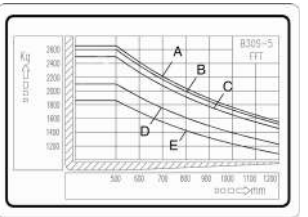
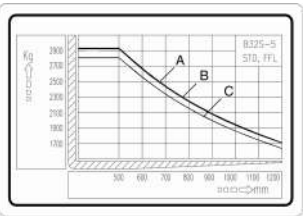
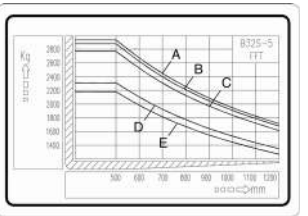
# Capacity Chart - With Side Shifter (Hook on)

| MODEL | STD, FFL | FFT |
|---|---|---|
| B20S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| B25S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290mm MAST<br>C. 4730mm MAST<br>D. 5560mm MAST<br>E. 6010mm MAST |
| B30S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290mm MAST<br>C. 4730mm MAST<br>D. 5560mm MAST<br>E. 6010mm MAST |
| B32S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900mm MAST<br>B. 4290mm MAST<br>C. 4730mm MAST<br>D. 5560mm MAST<br>E. 6010mm MAST |

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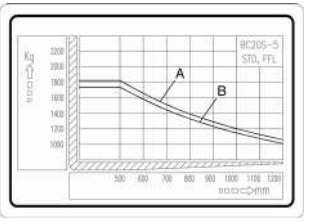
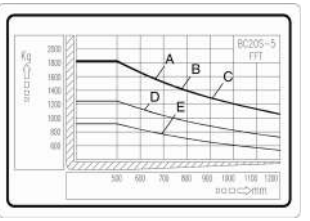
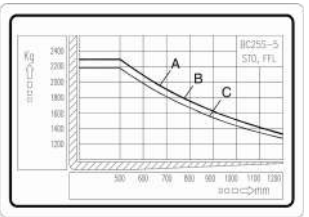
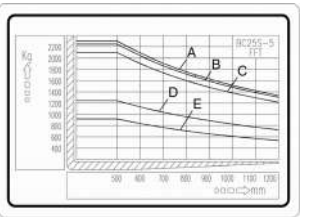
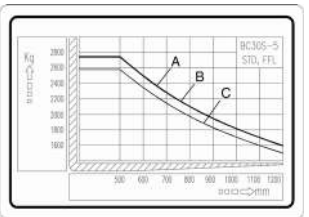
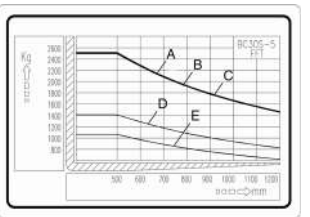
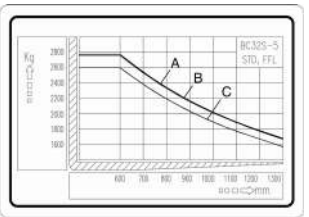
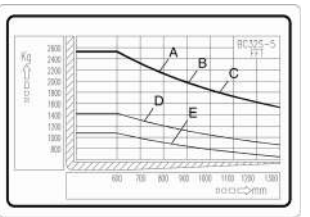
# Capacity Chart - With Side Shifter (Hook on)

| MODEL | STD, FFL | FFT |
|---|---|---|
| BC20S-5 |  <br>A. 2030 – 4350 mm MAST<br>B. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| BC25S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| BC30S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |
| BC32S-5 |  <br>A. 2030 – 3950 mm MAST<br>B. 4350 mm MAST<br>C. 4960 mm MAST |  <br>A. 3900 mm MAST<br>B. 4290 mm MAST<br>C. 4730 mm MAST<br>D. 5560 mm MAST<br>E. 6010 mm MAST |

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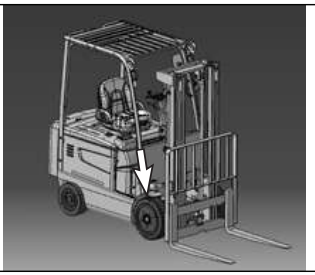
# Serial Number

## Serial Numbers Locations

For quick reference, record the serial numbers in the space provide below the illustration photographs.



Lift Truck Serial Number

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# Operator’s Warning and Indentification Plate

Familiarize yourself with the information on the Identification, Lift Capacity and Attachment Plates. Do not exceed allowable lift truck working capacity load ratings.

## Operator’s Warning Plate

Located on the right side of the operator’s seat on the battery cover.

## Identification, Lift Capacity and Attachment Plate

### Lift Truck Capacity Rating

DO NOT exceed allowable lift truck working capacity load ratings.

The capacity of the lift truck is given by weight and distance to the load center. For example: a capacity of 1200kg(2540 lb) at 600mm(24in) means that the lift truck can lift 1200kg(2640lb) if the load center is 600 mm (24in) from both the vertical and horizontal faces of the forks.

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

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

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

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

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## Mast Abbreviations

The identification plate indicates the type of mast installed on the lift truck when it left the factory. The type of mast is indicated by an abbreviation.

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

**FF** - Full Free Mast (single inner member, high free lift with primary cylinder).

**FFT** - Triple Lift Mast (two inner members, high free lift with primary cylinder).

**QUAD** - Quadruple(Quad) Mast(three inner members, high free lift with primary cylinder).

**SPEC** - Special Mast, such as non-telescopic or double mast, not within the other classifications.

**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).

**ISS** - Integral type Sideshift Carriage.

**ISFP** - Integral Shifting type Fork Positioner.

**CW** - Special Counterweight.

**SF** - Special Forks.

**NOTE:** Numbers following this abbreviation indicate number and/or length of forks.

**SS** - SWS-Sideshift-Swing Shift.

**RAM** - Ram or Boom

**ROTC** - Rotating Carriage.

**DBCBH** - Double Cube Block Handler

**HFP** - Hydraulic Fork Positioner, Non Sideshift.

**CR** - Crane Arm or Crane Boom.

**TH** - Tire Handler.

**CTH** - Container Top Handler.

**CSH** - Container Side Handler

**LP** - Load Push Device, Non Sideshift.

**LPP** - Load Push-Pull Device, Non Sideshift.

**C** -General Clamp (other than Bale, Carton or Roll).

**BC** - Bale Clamp.

**CC** - Carton Clamp.

**RC** - Roll Clamp.

**LS** - Load Stabilizer.

**LH** - Log Handler.

**PWH** - Pulp Wood Handler.

**SS-ST** - Sideshift-Side Tilt Carriage.

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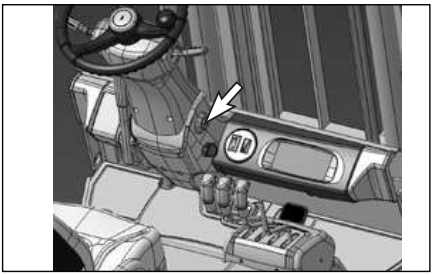
# Operator’s Station and Monitoring Systems

Read and understand the “Safety”, “Operation” and “Maintenance” sections before operating the lift truck.

## Key Switch



The key switch is located on the right side of the steering column.

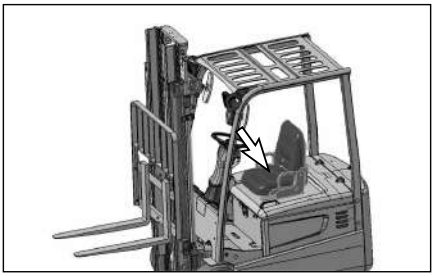
**OFF -** Turn the key switch to OFF (1) to disconnect the electrical circuits.

**ON -** Turn the key switch the ON (2) to connect the electrical circuits. If the key switch is left in the ON position when the operator leaves the lift truck, the LCD display will show a flashing “EE”.

The power steering pump motor is activated when the key switch is turned to ON and the seat switch is closed.

**NOTE:** The power steering pump motor will shut off if the directional lever is left in NEUTRAL and no control levers are actuated for approximately six seconds.
The motor will be turned on when any control lever is used.

## Seat Switch



the seat switch is located under the operator’s seat.

**OPEN -** When the operator’s seat is in the up position the electrical circuits are disconnected.

**CLOSE -** When the operator’s seat is in the down position(operator seated) the electrical circuits are connected.

The power steering pump motor is activated when the key switch is turned to ON and the seat switch is closed.

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## Monitoring Systems Indicator(Compact Display)

### Display Segments

The display gives the following information about the operating state of the system:

Lift truck speed (expressed in kmh or mph)

Handbrake active, indicated by the warning symbol

Safety contact open, indicated both by EE blinking message visualized in timemeter area and by relative symbol.

With any directional switch active and safety contact still open, lift truck can't be moved, even after seat switch is closed; in such a case, after safety contact is closed, the symbol disappears.

EE code disappears only after active directional switch is turned off.

Time meter or, otherwise, milometer

Steering angle

Maintenance time expiry, indicated by warning symbol

Slow speed operation, indicated by Lift truck speed level, range from 0 (NO speed) to 9 (MAXIMUM speed) segment, as in symbol

Battery level, indicated by a 9 segments symbol.

In following Table 1, you can read the generic relation between battery charge level and number of visualized bars. See Table 2 in case of a 48V system and table 4 in case of a 80V system. Display signals with alarm code EL the fact battery is completely discharged.

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**Relation between battery charge level and number of visualized bars**

Table 1 : Case of a generic system

| DISPLAY INDICATION | BATTERY CHARGE LEVEL |
|---|---|
| No segments | Discharged battery |
| 1 flashing segment | 10 % |
| 1 segment | 20 % |
| 2 segments | 30 % |
| 3 segments | 40 % |
| 4 segments | 50 % |
| 5 segments | 60 % |
| 6 segments | 70 % |
| 7 segments | 80 % |
| 8 segments | 90 % |
| 9 segments | Full charged battery |

Table 2 : Case of an 36V system (BC25S – 36V)

| BATTERY CHARGE LEVEL | BATTERY VOLTAGE [ V ] |
|---|---|
| Discharged battery | Voltage < 34.5 V |
| 10 % | 34.5 V ÷ 35.1 V |
| 20 % | 35.1 V ÷ 35.5 V |
| 30 % | 35.5 V ÷ 35.9 V |
| 40 % | 35.9 V ÷ 36.2 V |
| 50 % | 36.2 V ÷ 36.5 V |
| 60 % | 36.5 V ÷ 36.8 V |
| 70 % | 36.8 V ÷ 37.1 V |
| 80 % | 37.1 V ÷ 37.4 V |
| 90 % | 37.4 V ÷ 37.6 V |
| Full charged battery | Voltage > 37.6 V |

Table 3: Case of a 48V system (B(C)25S – 48V)

| BATTERY CHARGE LEVEL | BATTERY VOLTAGE [ V ] |
|---|---|
| Discharged battery | Voltage < 45.6 V |
| 10 % | 45.6 V ÷ 46.4 V |
| 20 % | 46.4 V ÷ 47 V |
| 30 % | 47 V ÷ 47.6 V |
| 40 % | 47.6 V ÷ 48.2 V |
| 50 % | 48.2 V ÷ 48.7 V |
| 60 % | 48.7 V ÷ 49.2 V |
| 70 % | 49.2 V ÷ 49.7 V |
| 80 % | 49.7 V ÷ 50.1 V |
| 90 % | 50.1 V ÷ 50.4 V |
| Full charged battery | Voltage > 50.4 V |

Table 4 : Case of a 80V system

| BATTERY CHARGE LEVEL | BATTERY VOLTAGE [ V ] |
|---|---|
| Discharged battery | Voltage < 75.7 V |
| 10 % | 75.7 V ÷ 76.5 V |
| 20 % | 76.5 V ÷ 77.3 V |
| 30 % | 77.4 V ÷ 78.2 V |
| 40 % | 78.3 V ÷ 79.1 V |
| 50 % | 79.2 V ÷ 80.0 V |
| 60 % | 80.1 V ÷ 80.9 V |
| 70 % | 81.0 V ÷ 81.8 V |
| 80 % | 81.9 V ÷ 82.7 V |
| 90 % | 82.8 V ÷ 83.6 V |
| Full charged battery | Voltage > 83.6 V |

Table 5 : Contraction for dot matrix display

Alarm Code

| Display Code | Description | Contraction |
|---|---|---|
| 17 | Main breaker fault | CONTACTOR FAULT |
| 60 | Battery/inverter mismatch | BATT MISMATCH |
| 61 | Blocking Overtemperature of right motor (over 165℃) | R-MOTOR SHUTDOWN |
| 62 | Blocking Overtemperature of left motor (over 165℃) | L-MOTOR SHUTDOWN |
| 65 | Blocking Overtemperature of pump motor (over 165℃) | P-MOTOR SHUTDOWN |
| 76 | Pump motor Encoder | P-MOTOR ENCODER. |
| 77 | Wrong right traction motor thermal switch | R-M TEMP SENSOR |
| 78 | Wrong left traction motor thermal switch | L-M TEMP SENSOR |
| 79 | Wrong pump motor thermal probe | P-M TEMP SENSOR |
| 80 | Wrong right traction module thermal probe | R-INV T SENSOR |
| 81 | Wrong left traction module thermal probe | L-INV T SENSOR |
| 82 | Wrong pump module thermal probe | P-INV T SENSOR |
| 83 | CRC fault | CRC FAULT |
| 84 | Bank CRC restored | CRC RESTORED |
| A | Capacitors not charged : fast charge | FAST CHARGE |
| A | Trans.precharge in Short / Cap. Too charged | TOO CHARGED |
| A | Capacitors not charged : slow charge | CAP SLOW CHARGE |
| A | Capacitors not charged : time out | TIME OUT CHARGE |

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| | | |
|---|---|---|
| A | Capacitors not charged | CAP NOT CHARGED |
| E1 | Drive right module Overtemperature | R-INV OVERTEMP |
| E2 | Drive left module Overtemperature | L-INV OVERTEMP |
| E3 | Pump module Overtemperature | P-INV OVERTEMP |
| E4 | Drive right motor Overtemperature | R-MOTOR OVERTEMP |
| E5 | Drive left motor Overtemperature | L-MOTOR OVERTEMP |
| E6 | Pump motor Overtemperature | P-MOTOR OVERTEMP |
| EE | Wrong start | WRONG START |
| EE (FLASI NG) | Seat switch | SEAT SW OPEN |
| EL | Low battery voltage | LOW BATT VOLT |
| F | Wrong Eeprom | EEPROM FAULT |
| F | WD Timer/Enable micro signals | WD TIMER FAULT |
| F | Serial communication | COMM FAULT |
| F0 | Maximum battery voltage | MAX BATT VOLT |
| F1 | Minimum battery voltage | MIN BATT VOLT |
| F2 | Pedal trimmer fault | ACCEL FAULT |
| F3 | Drive right module Desat/overcurrent | R-INVERTER FAULT |
| F4 | Drive left module Desat/overcurrent | L-INVERTER FAULT |
| F5 | Pump module Desat/overcurrent | P-INVERTER FAULT |
| F6 | Drive right motor current Offset | R-MOTOR I OFFSET |
| F7 | Drive left motor current Offset | L-MOTOR I OFFSET |
| F8 | Pump motor current Offset | P-MOTOR I OFFSET |
| F9 | Steer sensor fault | STEER SENSOR OUT |
| FA | 5V encoders not ok | 5V NOT OK |
| Fc | Drive right motor Encoder | R-MOTOR ENCODER |
| Fd | Drive left motor Encoder | L-MOTOR ENCODER |
| FE | 24V out | 24V NOT OK |
| FH | 12V out not ok | 12V NOT OK |
| FL | Pump input on at the start | PUMP SIGN ON |

**Lift truck operation mode**

Pressing E-S-H button, you can set energetic operating mode for your system.

This function is enabled using EYE menu named Calibration – ESH, to select desired operating mode. In particular you can choose between E-S-H or PROGRAMMABLE WORKING :

- Pressing E-S-H (economic, standard, high) button, you change energetic mode and update related parameters with a value, corresponding to selected operating mode, that operator can't modify.
- Pressing PROGRAMMABLE WORKING you can manage 3 further options (limit 1, limit 2, and limit 3). You can set parameters value, that are expressed in per cent of high energetic mode; changing active limitation (among L1, L2 or L3), related per cent data are used to calculate actual parameters value.

**NOTE:** Percent values can be modified only with EYE Calibration – E-S-H menu.

**NOTE:** Pressing PROGRAMMABLE WORKING you can manage economic, standard or high operating mode too.

COMPACT display shows different symbols in function of selected energetic mode:

- E-S-H management disabled: no symbol visualised.
- E-S-H management enabled: active mode is indicated by symbol.

- PROGRAMMABLE WORKING management enabled: in case you have chosen one of L1, L2 or L3 operating modes, and lift truck is stopped, one of the segments of speed indicator symbol (see Table 5 ) blinks to show selected energetic mode.

Table 6 : selected energetic mode

| DISPLAY VISUALISATION (from symbol left side) | OPERATING MODE |
|---|---|
| 1st segment | L1 (Limit 1) |
| 5st segment | L2 (Limit 1) |
| 9st segment | L3 (Limit 1) |

Otherwise symbol indicates, as usual, selected operating mode.

**NOTE:** as usual, if lift truck is moving, symbol indicates speed level

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**NOTE:** if active mode is one of L1, L2 or L3 limitations and you change operating mode (from PROGRAMMABLE WORKING to E-S- H), software automatically sets operating mode to economic one

Alarm message, indicated by an alpha-numerical code in the display area where usually lift truck speed appears.
See Table 6 for the meaning of alarm codes.

Over-temperature warning, indicated by the warning light In case the temperature of power transistors exceeds the warning limit and relative light blink.
If this light is on, there is possibility that cooling fan is breakdown. Inspect cooling fan.

Hour meter separation point, usually blinking, stops in following cases:
- Seat switch open.
- Serial communication between display and control unit not active
- Main breaker open

Turning your lift truck on, some alphanumeric codes, visible for 3 seconds, appear where usually is visualized speed indicator symbol; those codes help to identify system in use (see Table 7).
Where usually is visualized hour meter, on left side appears feed voltage in VDC, and on right side, maximum weight industrial truck can lift, expressed in quintals.

Table 7

| CODE | MEANING |
|---|---|
| C0 or C1 | 4 WHEEL/ 3 WHEEL |
| 36 or 48 or 80 | BATTERY VOLTAGE |
| 30 or 32 | MAX. CAPACITY |

## LED Indicators

On left side, COMPACT display has four LED indicators which, when switched on, give information as follows:

Alarm message; red color LED

Message of lamps; green color LED

Indicator lights activated; green color LED(OPTION)

Low oil level of the brakes; red colour LED.

Seat Belt warning (Option) : red color LED for 10 seconds.

**NOTE:** Alarm LED is managed as follows:

- Display normally working: LED lights up briefly switching on /off your system
- Display not communicating with control board: after 3 seconds from the moment in which the communication stops, alarm LED brightens
- Display board microprocessor not working: alarm LED brightens.

## No Alarm, No Movement

In case the truck does not move forward or reverse direction, check to see if the service brake switch is activated.

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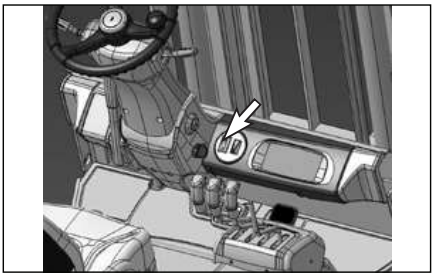
## Front and Rear Floodlights Switch



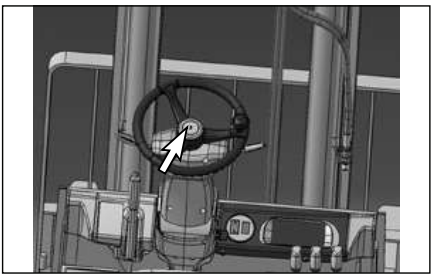
Located on the right side of the instrument panel, by the display panel.

**OFF -** Push down on the left side of the switch to turn both front and rear flood lights off.

**Front Floodlights -** Push down on the right side of the switch, to the first position, to turn the front floodlights on.

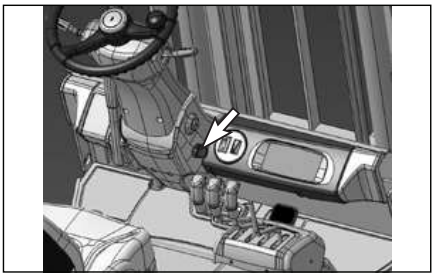
**Front and Rear Floodlights -** Push down on the right side of the switch, to the second position, to turn both the front and rear floodlights on. The rear floodlights are optional.

## Horn Button



Located in the center of the steering wheel. Push in on the horn button to sound the horn.

## Tilt Steering Column



Located on the lower front of the steering column.

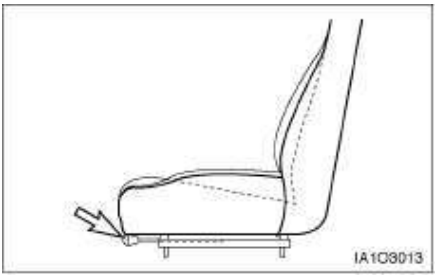
To adjust the steering column, raise the handle(1) and move the steering column to the desired position. Release the handle and the steering column will remain in the desired position.

## Seat Adjustment

Adjust the seat at the beginning of each shift or when changing operators.

Adjust the seat to allow full travel of all pedals with the operator seated against the seat back.

The seat must be adjusted with the operator seated.




Move the lever to adjust the seat forward or backward. Release the lever. Move the seat slightly to lock it.

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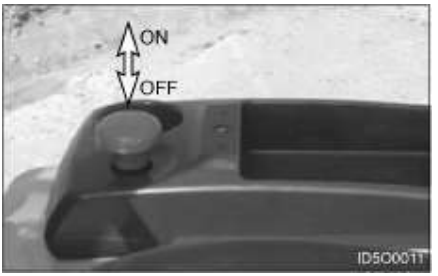
## Emergency Switch (If Equipped)



**OFF -** Push the emergency switch button to disconnect the electrical circuits. (It must be done after the key switch is turned off. If use often this button by the key switch, the electric system can make a problem. So, this button uses in emergency certainly).

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

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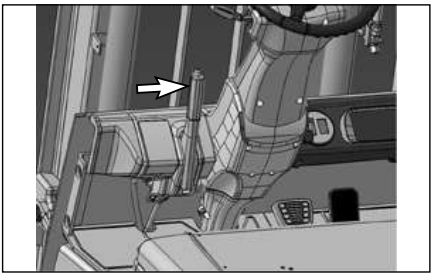
# Lift Truck Controls

## Parking Brake

**NOTICE**

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

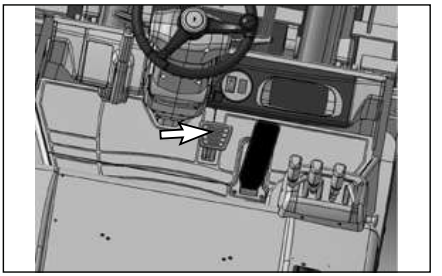


**Parking Brake -** The parking brake lever is located on the left side of the cowl.

**Parking Brake Engaged -** Pull the parking brake lever (1) up, which will engage the interlock switch that shuts off power to the drive motor.

**Parking Brake Disengaged -** Push the parking brake lever (2) down to release the parking brake.

## Service Brake Pedal



**Service Brake -** The service brake pedal is located on the floor of the operator's compartment.

Depress the service brake pedal to slow or stop the lift truck. Drive circuit will be interrupted while the pedal is depressed.

Release the service brake pedal to allow the lift truck to move.

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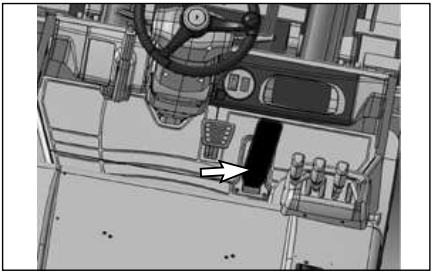
## Accelerator Pedal

**NOTICE**

The service brake and accelerator pedals should not be used at the same time, except for emergency situations. Use of both the brake and accelerator pedals at the same time may cause the drive motor to overheat.



**Accelerator Pedal -** The accelerator pedal is located on the floor of the operator's compartment.

Push down the pedal to increase travel speed.

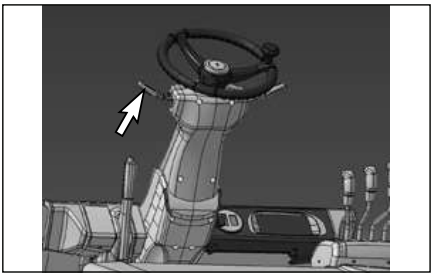
If the accelerator pedal is depressed before the key switch is turned to the ON position, the lift truck will not move until the pedal is released and depressed again.

Release the pedal to decrease travel speed.

### Film For function of pedals (if equipped)

This plate shows the function of the brake and accelerator pedals.

## Directional Control Lever



**Forward(1) -** Push the lever forward. The lift truck will move forward.

**Neutral(2) -** Move the lever to center position. The lift truck should not move when lever is in neutral.

If the operator leaves the seat, or turns the key switch off, the lever must be returned to NEUTRAL. The lift truck will not move until accelerator pedal is released and lever is returned to NEUTRAL.

**NOTE:** Wait Mode of Operation-This condition will go into effect when the following occurs. The seat switch is closed, key switch is on and the directional control lever is left in NEUTRAL for more than five seconds, with no operator input to any control.

The line contactor will open and the power steering motor will turn off to conserve energy. The lift truck will remain in this mode until the operator moves the directional control lever, pushes on the accelerator pedal and/or moves any control valve lever.

**Reverse(3) -** Pull the lever toward the operator. The lift truck will move in reverse.

**NOTE:** The directional control lever can be used for electrical braking(plugging). To slow or stop the lift truck when traveling in either direction, move the directional control lever to the opposite direction of travel while keeping the accelerator depressed. The lift truck will slow to a complete stop and then accelerate in the opposite direction.

When the operator raises off the seat (seat switch opens) while the lift truck is in motion, the drive motor will lose power. When this occurs, release the accelerator, close the seat switch (operator seated), move the directional control lever to NEUTRAL and then to desired direction of travel. Push down on the accelerator.

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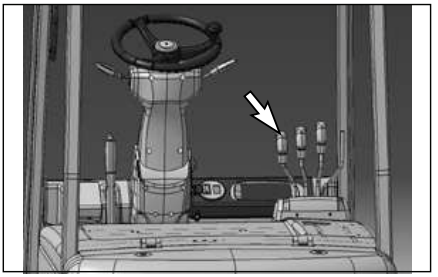
## Lift Control Lever



The forks' lift control is located at the operator's right side front. The lift control lever is the lever at the left.

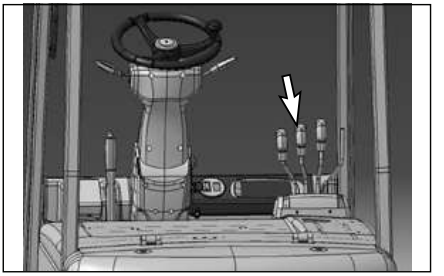
**Lower(1) -** Push the lever forward smoothly to lower the lift forks.

**Hold(2) -** Release the lift lever. The lever will return to the center(hold) position and the forks will remain in the position they are in.

**Raise(3) -** Pull the lever back smoothly to raise the lift forks.

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

## Tilt Control Lever



The forks' tilt control is located at the operator's right side front. The tilt control lever is the lever at the center.

**Tilt Forward(1) -** Push the lever forward smoothly to tilt the forks forward.

**Hold(2) -** Release the tilt lever. The lever will return to the center(hold) position and the forks will remain in the position they are in.

**Tilt Back(3) -** Pull the lever back smoothly to tilt the forks back.

**NOTE:** To prevent a sudden change of position of the load, operate all lift, tilt and attachment controls smoothly. Never tilt an elevated load forward past vertical.

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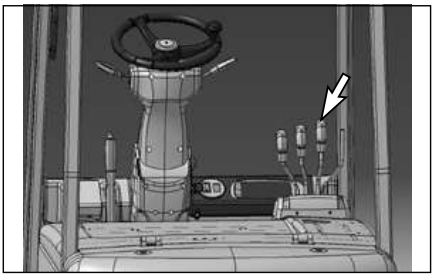
## Sideshift Attachment Control (If Equipped)



The sideshift attachment control is located at the operator's right side front. The sideshift attachment control lever is the lever at the right.

**Sideshift Left(1) -** Push the lever forward smoothly to shift the carriage to the left.

**Sideshift Hold(2)** - Release the sideshif attachment lever. The lever will return to the center(hold) position and sideshifting action will stop.

**Sideshift Right(3) -** Pull the lever 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 controls smoothly.

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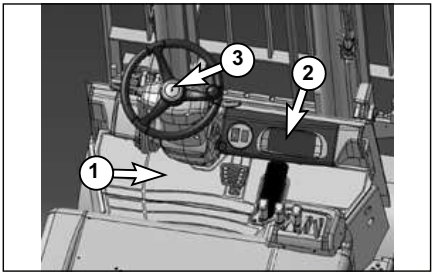
# Before Operating the Lift Truck

## Walk-Around Inspection

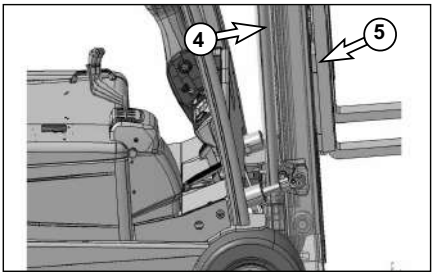
For your own safety and maximum service life of the lift truck, make a thorough walk-around inspection before mounting the lift truck or starting to move it.
Look for such items as loose bolts, trash build-up, oil leaks, condition of tires, mast, carriage, forks or attachments.




1. Inspect the operator's compartment for loose items and clean any mud or debris from the floor plates for safe footing.

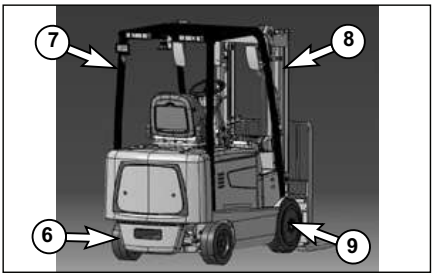
2. Inspect the instrument panel for damage to the indicator display.

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.



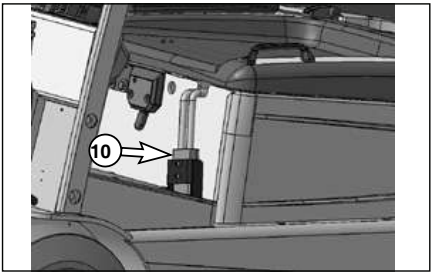

6. Inspect the tires and wheels for proper inflation, cuts, gouges, foreign objects and loose or missing nuts.

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

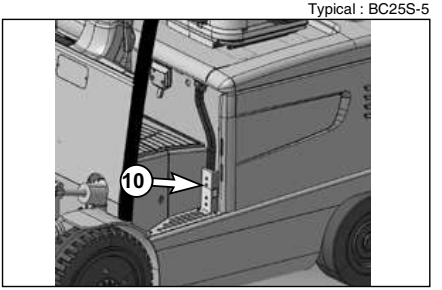
8. Inspect the hydraulic system for leaks, worn hoses or damaged lines.

9. Inspect the drive axle housing and the ground for oil leaks.

Typical : B25S-5




Typical : BC25S-5




10. Inspect the battery compartment for loose connections, frayed cables and properly secured battery restraint.

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**⚠ 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.**

**11.** Disconnect the battery. Tilt the steering column to the full upright position and move the seat fully rearward.

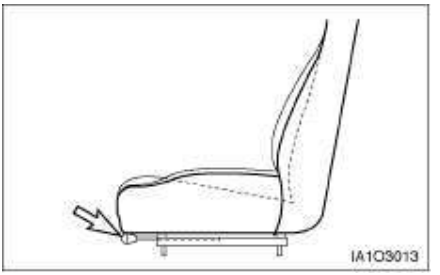
**12.** Raise the seat and cover assembly and latch the cover to the cowl.

**13.** Observe the battery electrolyte level for proper level. Lower the seat and cover assembly and connect the battery to the lift truck.

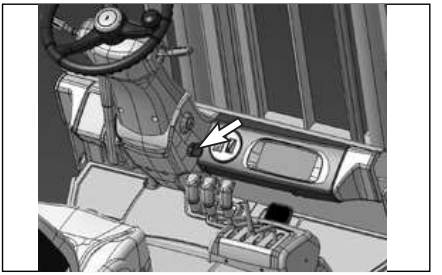
**⚠ WARNING**

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

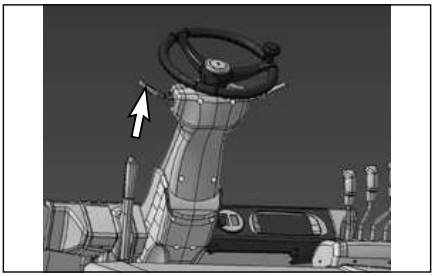
**Seat adjustment must be done at the beginning of each shift and when operators change.**




**14.** Position the seat by operating the lever and moving the seat forward or backward to a comfortable position.



**15.** Adjust the steering wheel to comfortable position. Grasp the steering wheel and raise the handle to release the steering column. PULL the steering column BACK or PUSH FORWARD to obtain the most comfortable position. RELEASE the knob and make sure the steering column is locked in this position.



**16.** With the seat switch closed and the directional lever in NEUTRAL, turn the key switch ON. Observe the battery discharge indicator.

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**17.** Make sure the battery is charged before operating the lift truck. A fully charged battery will cause “9 Segments” to be displayed on the BDI display.

## Better Battery Performance

**NOTICE**

The lift truck operator must not start a shift with a battery that has been taken off a charger too soon.

A battery should never be disconnected from a charge until the charge cycle has been completed.

The batteries that have been fully charged should have a tag attached for identification.

In Operation, a battery should be discharged then recharged in 8 to 12 hours, depending on the charger type. Then, they should be allowed to cool and stabilize 4 to 8 hours. Repeated undercharging must be prevented. It can damage the battery.

If there is an indication of low battery operation, the lift truck operator should return the lift truck to the battery charging area.

**NOTE:** Refer to the Maintenance Section of this guide for additional battery exchanging and charging information.

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# Lift Truck Operation

Be sure no one is working on or near the lift truck.

Keep the lift truck under control at all times.

Reduce speed when maneuvering in tight quarters or when braking over a rise.

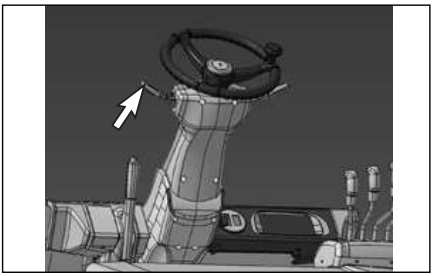
Do not allow the lift truck to overspeed downhill. Use the service brake pedal to reduce speed when traveling down hill.

**NOTICE**

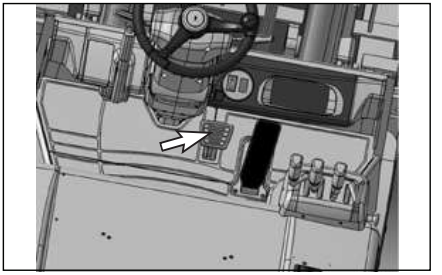
Do not move directional control lever from one direction to the other(plug) when the drive wheels are off the ground and rotating at full speed.

Damage can occur to the control panel.

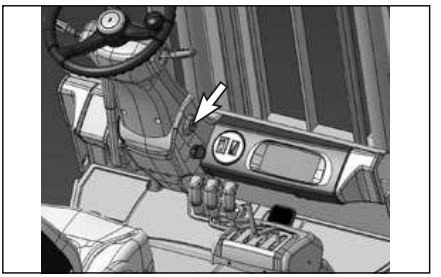
1. Adjust the operator's seat.



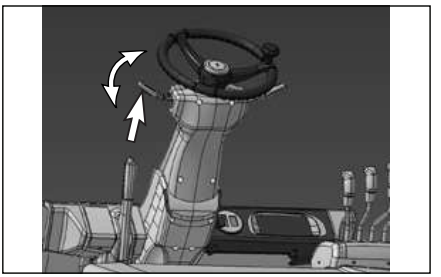
2. Move the directional control lever into the NEUTRAL position, if it is not already in this position..



3. Push down on the service brake pedal and Prelease the parking brake.



4. Turn the key switch to the ON position. Raise the attachments.



5. Move the directional control lever to the desired direction of travel.

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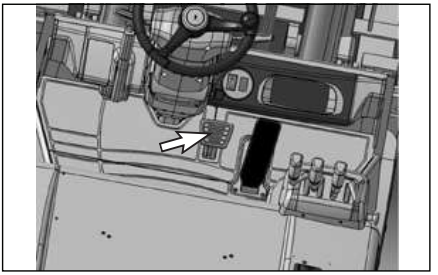
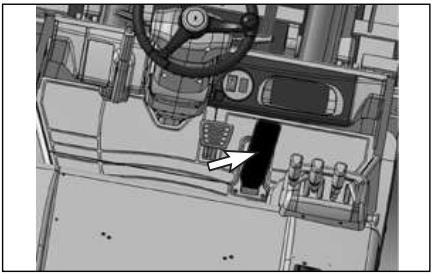


**6.** Release the service brake pedal.



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

**8.** To change the lift truck direction of travel, electrical braking(plugging) can be used to slow or stop the lift truck.

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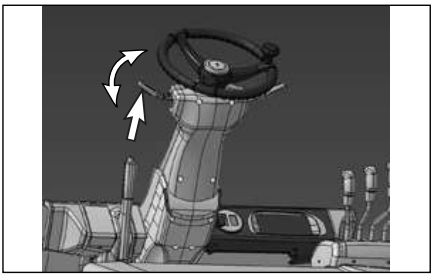
## Electrical Braking (Plugging)

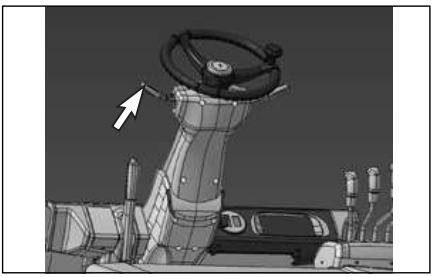


To slow, stop or change direction when traveling in either direction, move the directional control lever (1) to the opposite direction while keeping the accelerator pedal (2) depressed.

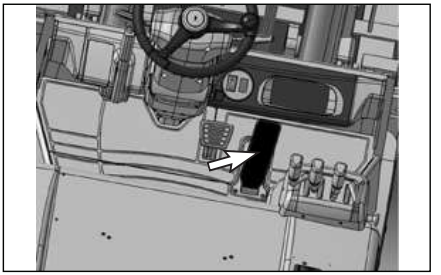
The Micro-controller senses that the motors are turning opposite to the lift truck and immediately goes into the plugging mode.

Rotation of the motors is retarded at a predetermined rate by electrical braking (plugging).

If the accelerator pedal is kept depressed, the Microcontroller will slow the lift truck to a complete stop and then accelerate in the opposite direction.



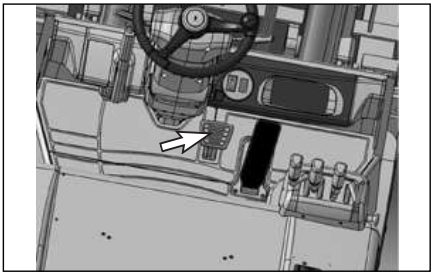
1. Move the directional control lever to the opposite direction of lift truck travel.



2. Hold the accelerator pedal down until the lift truck nearly comes to a complete stop. Release the accelerator pedal.

3. Push down on the service brake pedal to bring the lift truck to a complete stop and hold it.

4. If a change of direction is desired, continue to push down on the accelerator pedal until the desired travel speed in the opposite direction is obtained.



5. To stop the lift truck where conditions do not permit electrical braking(plugging). Release the accelerator peadal (1). Push down on the service brake pedal (2) and bring the lift truck to a smooth stop.

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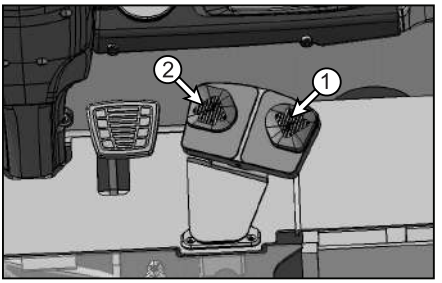
# Mono-Ped Control System (Option)




**Forward**-Push the left side (2) of the pedal for FORWARD direction travel.

**Neutral**-The lift truck should not move when the Mono-Ped pedal is released..

**Reverse**-Push the right side (1) of the pedal for REVERSE direction travel.

The MONO-PED pedal controls the speed and direction of the lift truck. Pushing on the right side of the pedal (1) causes the lift truck to move in REVERSE. The optional reverse lights and optional back-up alarm will be ON in the REVERSE position. Pushing on the left side of the pedal (2) causes the lift truck to move in FORWARD.
The speed of the truck increases as the pedal is depressed

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# Finger Tip (Option)

## Function of Knobs

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

### Lift Control knob

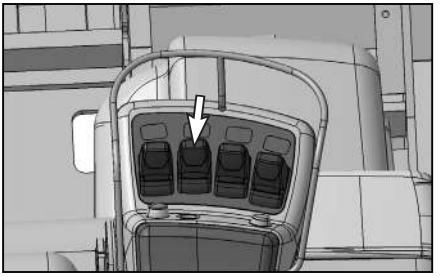
**Lower -** Push the knob forward smoothly to lower the lift forks.

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

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

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

### Tilt Control knob



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

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

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

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

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## Sideshift Attachment Control

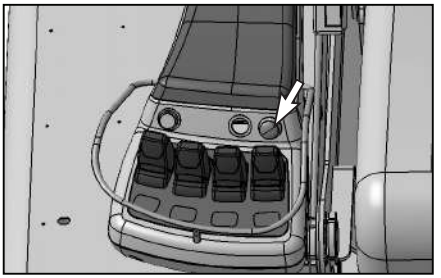
**Sideshift Left -** Push the knob forward smoothly to shift the carriage to the left.

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

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

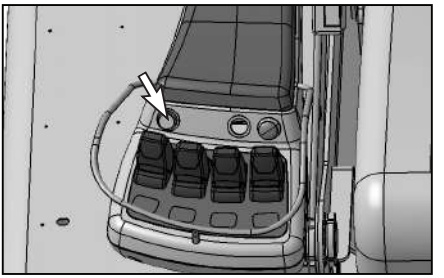
**NOTE:** To prevent a sudden change of position of the load, operate all lift, tilt and attachment knobs smoothly.

## 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 ECU can be checked by the external warning lamp blinking.

| Blinking Lamp | State |
|---|---|
| No Lighting | Normal |
| Lighting | System Failure |

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

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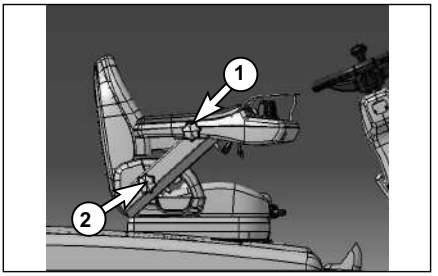
## Adjustment of Armrest




By using 4 knobs, adjust the position of the armrest to give the operator the best comfortable position of arm.

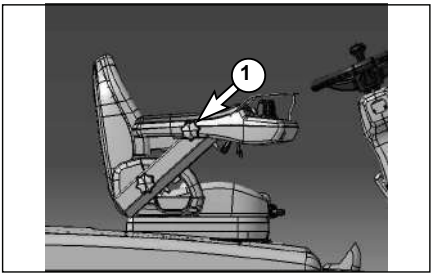
**knob #1 -** Forward and backward adjustment

**knob #2 -** Up and down adjustment

**knob #3 -** Clockwise and Counterclockwise rotation adjustment

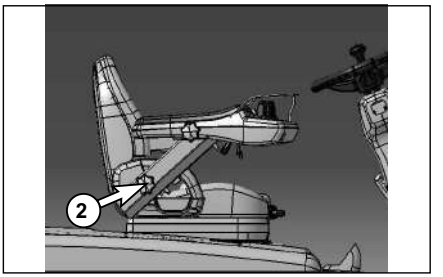
**knob #4 -** Tilt angle adjustment

### Forward and Backward Adjustment

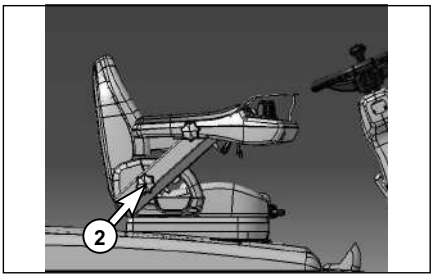



1. Loosen the knob bolt(1).
2. Adjust the position of armrest forward or backward.
3. Tighten the knob bolt(1) to be locked tightly

## Up and Down Adjustment




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




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

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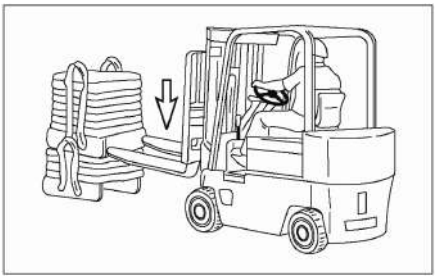
# Operating Techniques

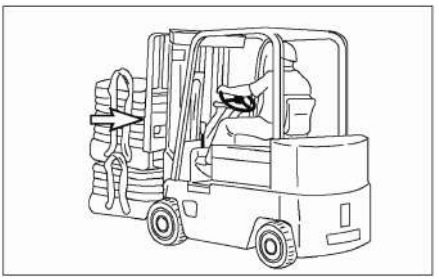
**NOTE:** The photographs and line art used in the following Operating Techniques, are typical examples and may not apply to your particular lift truck.

## Inching into Loads

1. Move the lift truck slowly forward into position and engage the load. Lift truck should be square with load, forks spaced evenly between pallet stringers and as far apart as load will permit.



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



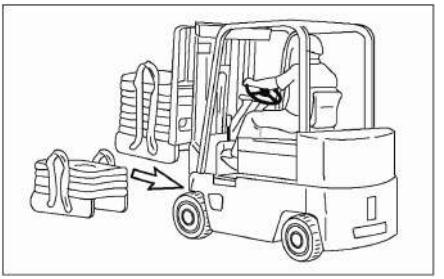
**⚠ WARNING**

**The forklift truck must not be used to push loads or other vehicles.**
**Only the moving equipment supplied or the rear hook for towing must be used.**

## Lifting the Load

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

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



3. Operate the lift truck in reverse until the load is clear of the other loads.

4. Lower the load to the travel position before turning or traveling.

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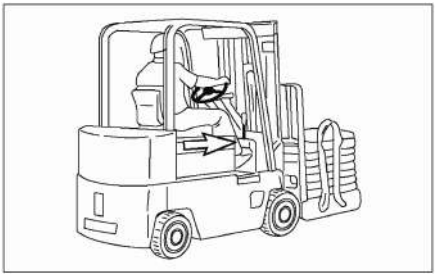
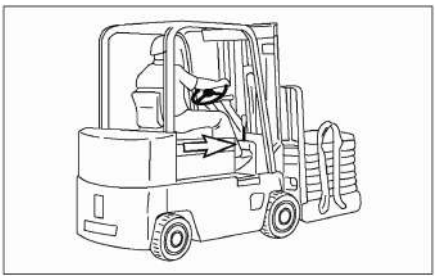
## Traveling With or Without a load

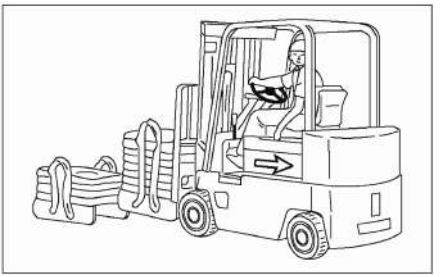
When traveling with and without a load, travel with the fork as low as possible, while still maintaining good floor clearance height.



1. Carry the load as low as possible, while still maintaining ground clearance.

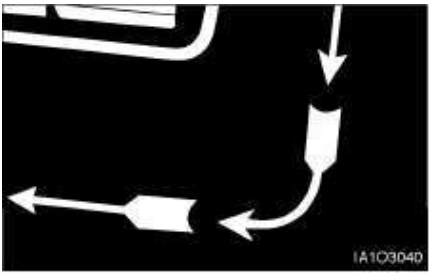


2. Travel with the load uphill on upgrades and downgrades.

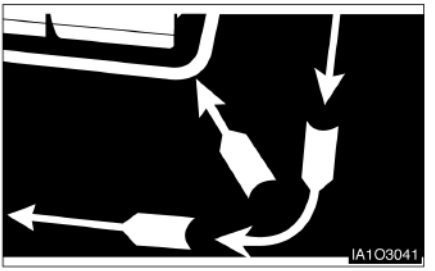


3. For better vision, travel in reverse with bulky loads.

## Lift Truck Turning




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




2. When turning in narrow aisles, keep as far from the stockpile as possible when making a turn into the aisle. Allow for counterweight swing.

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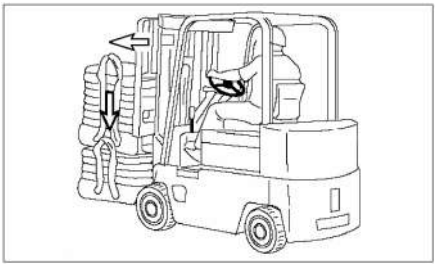
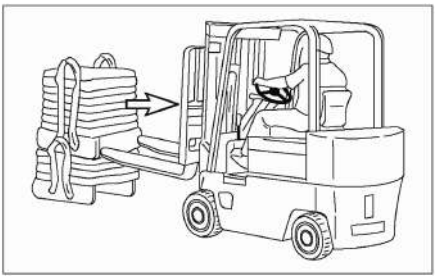
## Unloading Lift Truck



1. Move the lift truck into the unloading position.
2. Tilt the mast forward only when directly over the unloading area.

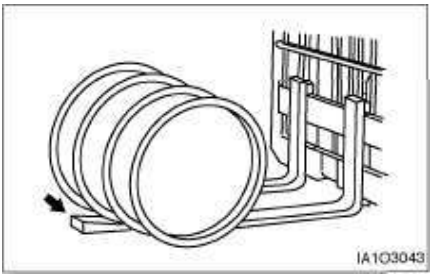
**⚠ WARNING**

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

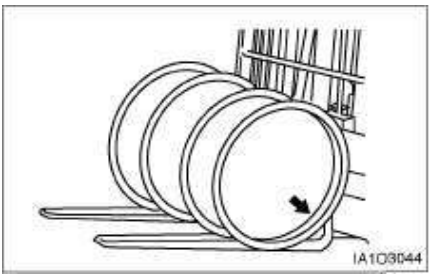


3. Deposit the load and back away carefully to disengage the forks.
4. Lower the carriage and forks to either travel position or park position.

## Lifting Drums or Round Objects




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




2. Tilt the mast back slightly until the load is cradled on the forks before lifting.
3. Lift the load to the travel position.

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# Parking the Lift Truck

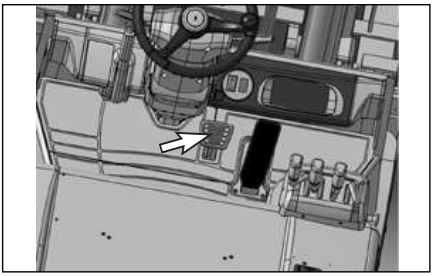
**NOTICE**

Parking or storage of electric lift trucks outdoor can cause lift truck system damage or failure.

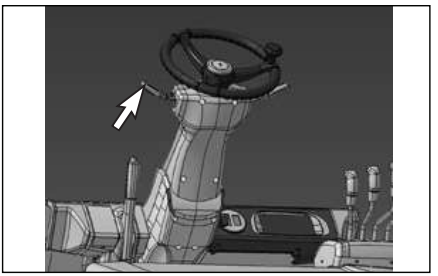
Park or store all electric lift trucks inside a building to protect electrical system from moisture damage.

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

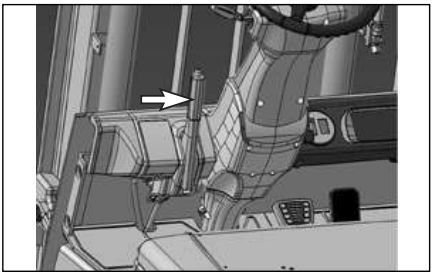
Park the lift truck level, with the forks lowered and the mast tilted forward until the fork tips touch the floor. Block the drive wheels when parking on an incline.



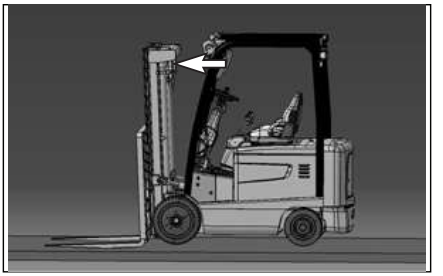
1. Apply the service brake to stop the lift truck.



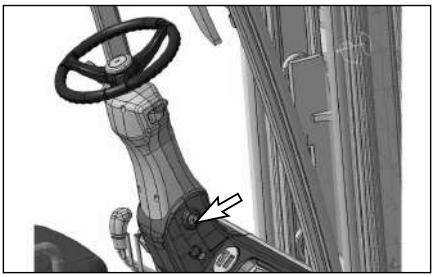
2. Move the directional control lever into NEUTRAL.



3. Engage the parking brake.



4. Tilt the mast forward and lower forks to the floor.



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

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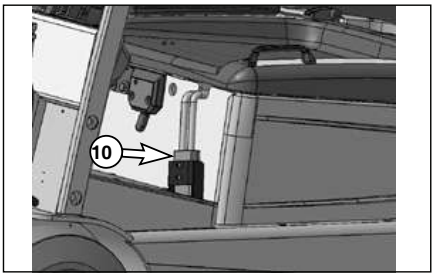
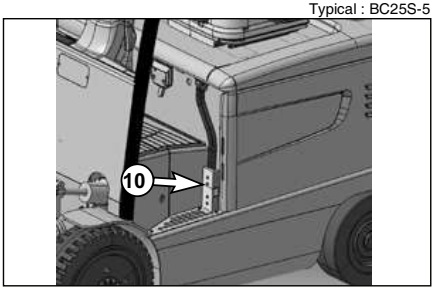
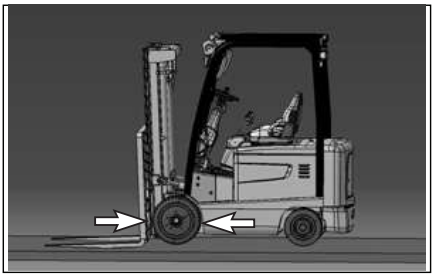
Typical : B25S-5




Typical : BC25S-5




**6.** Disconnect the battery.



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

## Packing Alarm Warning (If Equipped)

When leaving the operator's station without engaging the parking brake, a warning buzzer will sound.

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

**⚠ WARNING**

**Make sure the forks are locked before carrying a load.**

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# Storage Information

## Before Storage

To place the machine in storage for an extended period of time, the following measures must be taken to ensure that it can be returned to operation with minimal service.

1. After every part is washed and dried, the machine should be housed in a dry building. Never leave it outdoors. In case it has to be left outdoors, lay wooden boards on the ground, park the machine on the boards and cover it with canvas, etc.

2. Lubricate, grease and replace oil before storage.

3. Apply a thin coat of grease to metal surface(hydraulic piston rods.)

4. Cover batteries after removing terminals, or remove them from the machine and store separately.

## During Storage

Drive the truck for a short period at least once a month. This coats moving part surfaces with a new film of oil. Charge the battery at this same time.

## After Storage

After storage (when it is kept without cover or rust preventive and once is month operation has not been made), you should apply the following treatment before operation.

1. Remove the drain plug on hydraulic tank and drain mixed water.

2. Wipe off grease from hydraulic cylinder piston rod.

3. Measure specific gravity and check that battery is charged.

4. Drive at low speed to make sure inside of transfer is well oiled.

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# Transportation Hints

## 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.

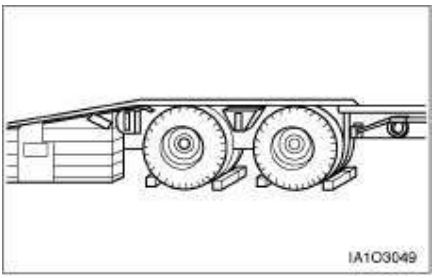
To prevent the lift truck from slipping while loading, or shifting in transit, remove ice, snow or other slippery material from the loading dock and the truck bed before loading.

**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.




1. Always block the trailer or the rail car wheels before loading the lift truck.
2. Position the lift truck on the trailer or the rail car.
3. Apply the parking brake and place the transmission control in NEUTRAL.
4. Tilt the mast forward and lower forks to the floor.
5. Turn key switch OFF and remove the key.
6. Disconnect the battery.
7. Block the tires and secure the lift truck with tiedowns.

## Machine Lifting and Tiedown Information

**NOTICE**

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

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

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

Contact your *DOOSAN* Lift Truck dealer for shipping instructions for your lift truck.

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# 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°Δ angle from the straight ahead position.
Connect the tow line as low as possible on the lift truck that is being towed.

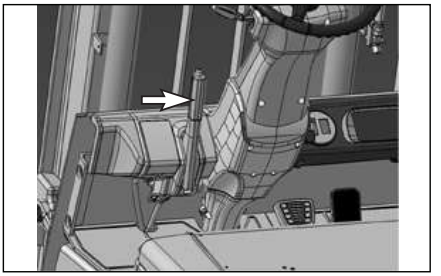
Quick lift truck movement could overload the tow line or bar and cause it to break. Gradual and smooth lift truck movement will work better.

Normally, the towing lift truck should be as large as the disabled lift truck. Satisfy yourself that the towing lift truck has enough brake capacity, weight and power, to control both lift trucks for the grade and the distance involved.

To provide sufficient control and braking when moving a disabled lift truck downhill, a larger towing lift truck or additional lift trucks connected to the rear could be required. This will prevent uncontrolled rolling.

The different situation requirements cannot be given, as minimal towing lift truck capacity is required on smooth level surfaces to maximum on inclines or poor surface conditions.

**Consult your *DOOSAN* Lift Truck dealer for towing a disabled lift truck.**



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. Disconnect the battery.
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.**

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# Inspection, Maintenance and Repair of Lift Truck Forks

The following provides 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 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 on the job failures.

Repairs and modifications should be done only by the fork manufacturer or a qualified technician knowledgeable of 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. Generally on the top or side of the fork shank.

- A fork rated at 1500 pounds at 24 inch load center will be stamped 1500B24.
- A fork rated at 2000 kg at 600 mm load center 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 Powerd Industrial Truck, and ANSI/ASME Safety Standard(s) B56.1, B56,5 or B56.6 as applicable to the type of machine(s) in use.

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# 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.

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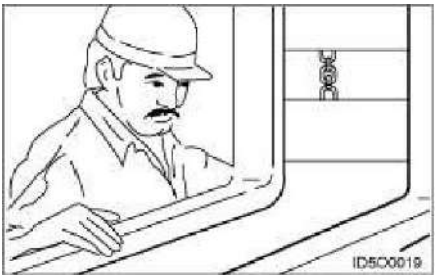
## Fork Inspection




Establish a daily and 12 month inspection routine by keeping a record for the forks on each lift truck.

Initial information should include the machine serial number on each the forks are used, the fork manufacturer, type, original section size, original length and capacity. Also list any special characteristics specified in the fork design.

Record the date and results of each inspection, making sure the following information is included.

- Actual wear conditions, such as percent of original blade thickness remaining.
- Any damage, failure or deformation which might impair the use of the truck.
- Note any repairs or maintenance.

An ongoing record of this information will help in identifying proper inspection intervals for each operation, in identifying and solving problem areas and in anticipating time for replacement of the forks.

## First Installation

1. Inspect forks to ensure they are the correct size for the truck on which they will be used. Make sure they are the correct length and type for the loads to be handled.

   If the forks have been previously used, perform the“12 Month Inspection”.

   If the forks are rusted, see “Maintenance and Repair”.

2. Make sure fork blades are level to each other within acceptable tolerances. See “Forks, Step 4,” in the “2000 Service Hours or 1 Year” 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 1 Year” in “Maintenance Intervals”.

## Daily Inspection-Before First Use and at Each Preventive Maintenance 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 1 Year” in “Maintenance Intervals”.

3. Remove all defective forks from service.

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## 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 Maintenance Section of this manual.

## Maintenance and Repair

1. Repair forks only in accordance with the manufacturer’s recomendations.

   Most repairs or modifications should be done only by the original manufacturer of the forks or an expert knowledgeable of the materials, design, welding and heat treatment process.

2. The following repairs or modifications SHOULD NOT be attempted.

   - Flame cutting holes or cutouts in fork blades.
   - Welding on brackets or new mounting hangers.
   - Repairing cracks or other damage by welding.
   - Bending or resetting.

3. The following repairs MAY be performed.

   - Forks may be sanded or lightly ground, to remove rust, corrosion or minor defects from the surfaces.
   - Heel sections may be ground with a carbon stone to remove minor surface cracks or defects. Polish the inside radius of the heel section to increase the fatigue life of the fork. Always grind or polish in the direction of the blade and shank length.
   - Repair or replace the positioning locks on hook type forks.
   - Repair or replace most fork retention devices used with other fork types.

4. A fork should be load tested before being returned to service on completion of repairs authorized and done in accordance with the manufacturer’s recommendations.

   Most manufacturers and standards require the repaired fork to be tested with a load 2.5 times the specified capacity and at the load center marked on the fork arm.

   With the fork restrained in the same manner as its mounting on the lift truck, apply the test load twice, gradually and without shock. Maintain the test for 30 seconds each time.

   Check the fork arm before and after the second application of the test load. It shall not show any permanent deformation.

   Consult the fork manufacturer for further information as may be applicable to the specific fork involved.

   Testing is not required for repairs to the positioning lock or the markings.

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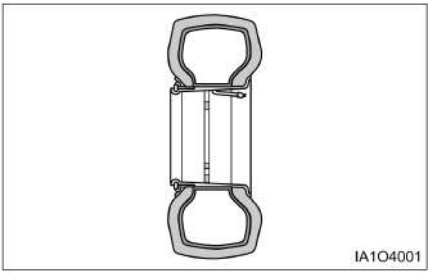
# Tire Inflation Information

## Tire Inflation




**⚠ WARNING**

**Personal injury or death could result when tires are inflated incorrectly.**

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

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

**NOTICE**

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

## Tire Shipping Pressure

The inflation pressures shown in the following chart are cold inflation shipping pressures for tires on *DOOSAN* lift trucks.

| Size | Ply Rating or Strength Index | Shipping preeeure | |
|---|---|---|---|
| | | kPa | psi |
| B20/25/30/32S-5 | | | |
| 18 x 7 – 8 Steer | 16 | 1000 | 145 |
| 23 x 10 - 12 Drive | 16 | 930 | 135 |

The operating inflation pressure is based on the weight of a ready-to-work lift truck without attachments, at rated payload, and in average operating conditions. Pressures for each application may vary and should always be obtained you're your tire supplier.

## Adjusted Inflation Pressures

A tire inflation in a warm shop area, 18°C to 21°C (65°F to 70°F), will be underinflated if the lift truck works in freezing temperatures. Low pressure shortens the life of a tire.

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# Torque Specifications

**Metric Hardware -** This lift truck is almost totally metric design. Specifications are given in metric and U.S. Customary measurement. Metric hardware must be replaced with metric hardware. Check parts books for proper replacement.

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

## Torque for Standard Hose Clamps-Worm Drive Band Type

**NOTICE**

The following chart gives the torques for initial installation of hose clamps on new hoses 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 inch) | 7.5±0.5 | 65±5 |
| 13.5 mm (.531 inch) | 4.5±0.5 | 40±5 |
| 8 mm (.312 inch) | 0.9±0.2 | 8±2 |
| **Clamp Width** | **Reassembly or Retightening Torque** | |
| | **N•m[1]** | **lb•in** |
| 16 mm (.625 inch) | 4.5±0.5 | 40±5 |
| 13.5 mm (.531 inch) | 3.0±0.5 | 25±5 |
| 8 mm (.312 inch) | 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 following charts 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 Bolt & Nut Torque | |
|---|---|---|
| | N•m[1] | lb•in |
| 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.

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## Torques for Taperlock studs

| Thread Size Inch | Standard Taperlock Stud Torque | |
|---|---|---|
| | N•m[1] | lb•in |
| 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 as0.1 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 saved for reassembly whenever possible. If new fasteners are needed, they must be of the same size and grade as the ones that are being replaced.

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

**NOTE:** Metric hardware must be replaced with metric hardware. Check parts book for proper replacement.

| METRIC ISO2 THREAD | | |
|---|---|---|
| Thread Size Metric | Standard Torque | |
| | N•m[1] | lb•in |
| 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.
[2]ISO-International Standard Organization.

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# Lubricant Specifications

## Lubricant Information

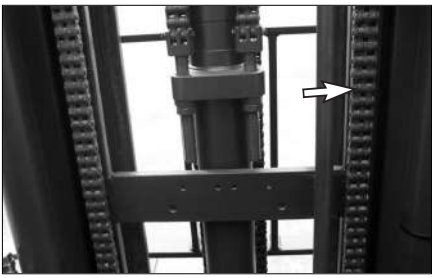
Some classifications and abbreviations we use in this section follow S.A.E. (Society of automotive Engineers) J754 nomenclature and others follow S.A.E. J183.

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

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

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

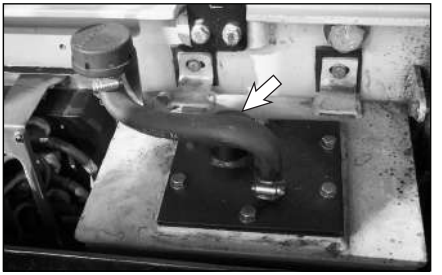
## Chain and Linkage Oils (DEO or EO)



Use following engine oils are recommended for use on chains and linkages.

- European oil specification CCMC D3.
- API Specification CD, CD/SF, CE
- Military specifications MIL-L-2104D or E

## Hydraulic Oils (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 VG 32

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**

Correct Hydraulic Oil should be used to achieve maximum life and performance from hydraulic system components. The following hydraulic Oil is recommended in most hydraulic and hydrostatic systems.

Make-up oil added to the hydraulic tanks must mix with the oil already in the systems. Use only petroleum products unless the systems are equipped for use with special products.

If the hydraulic oil becomes cloudy, water or air is entering the system. Water or air in the system will cause pump failure. Drain the fluid, retighten all hydraulic suction line clamps, purge and refill the system.Consult your *DOOSAN* Lift Truck dealer for purging instructions.

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## Drive Axle Oil

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

The API GL 4 specification or SAE 80W oils could be used.

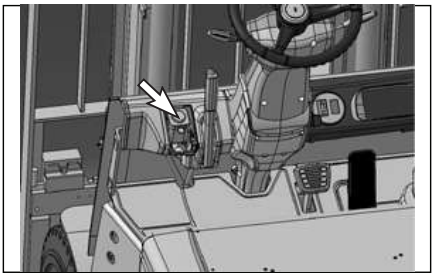
**NOTE:** Multi-grade oils are not blended by *DOOSAN* for use in transmissions. Multi-grade oils which use high molecular weight polymers as viscosity index improvers lose their viscosity effectiveness by permanent and temporary shear of the viscosity index improver and therefore, are not recommended for transmission and drive train compartments.

## Lubricating Grease(MPGA)

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.

## Brake Fluid



Located on the left site of the cowl.

Use heavy duty hydraulic brake fluid certified by the oil supplier to meet ISO 6743/4 HM VG 10 latest revision.

| | |
|---|---|
| **TOTAL** | Azolla ZS 10 |
| **AGIP** | Acer 10 |
| **BP** | Energol HP 10 HLP 10 |
| **CALTEX** | Spindurn 10 |
| **ELF** | Spinelf 10 |
| **ESSO** | Nuto H 10 Spinesso 10 |
| **FINA** | Hydran 10 |
| **MOBIL** | Velocite oil No. 6 Velocite oil E |
| **SHELL** | Tllvs oil C10<br>Morlina 10 |

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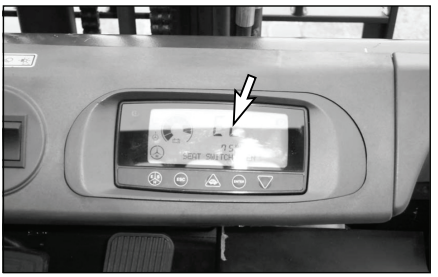
# Battery Discharge Indicator

The battery discharge indicator should be observed frequently before and during operation.

A fully charged battery will cause a “9 segments” to be displayed on the LCD display. As the battery is discharged, the LCD display will count down, 9, 8, 7, and etc., until “EL” is displayed. When the battery reaches 80% discharge level, the Micro-Controller will cause the LCD display to continuously index through the entire range (1 through 9 segments ) to signal that the battery is discharged and lift interrupt is imminent.



If the warning is ignored, lift interrupt will prevent the hydraulic pump motor from operating and an “EL” will be displayed on the LCD display.

To prevent over-discharge, the lift interrupt should not be reset by disconnecting and reconnecting the battery.

If the batteries are weak, have them charged or replaced.

The batteries should not be discharged below 80% of the full charge as indicated by their specific gravity.

This specification varies with different battery manufacturers. See the manufacturer’s specifications for specific gravity at 80% discharge. If information is not available from the battery supplier, use 1.140 specific gravity level.

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# Battery

**⚠ WARNING**

**When using pressure air for cleaning purposes, wear a protective face shield and protective clothing. Maximum air pressure must be below 207 kPa (30 psi).**

**Do not smoke near batteries that are being stored or when checking the electrolyte level.**

**Electrolyte is an acid solution and can cause personal injury. Avoid contact with skin and eyes.**

Maximum life and performance of lift truck batteries is dependent on the operator, battery charging, maintenance and service.

Most dirt and dust picked up by the battery can usually be blown off with low pressure compressed air.

However, if cells are overfilled and electrolyte collects on the covers, the top of the battery will stay wet.

If necessary, clean the top of the battery with a solution of baking soda and hot water.

**NOTICE**

Vent caps must be tight to prevent soda solution from entering battery cells.

To make the solution, add 0.5 kg (1 lb) of baking soda to 4 liters (1 gallon) of water. Use a brush having flexible bristles. Apply the soda solution to the top of the battery until the cleaning action of the soda stops.

After cleaning action has stopped, rinse batteries thoroughly with water. Dry the batteries with low air pressure.

The lift truck operator must not start his shift with a battery that has been taken off a charger too soon. Batteries are designed to be charged and allowed to cool and stabilize. A battery should never be disconnected from a charger until the charge cycle has been completed.

Low battery operation must be prevented. Operation with a low battery may cause damage to the battery.
Low battery operation will cause higher than normal current in the electrical system. This can damage contactor tips or shorten motor brush life.

Batteries that have been fully charged should have a tag attached for identification.

A battery should be recharged in 8 to 12 hours after being discharged, depending on the charger type, then allowed to cool and stabilize 4 to 8 hours.
Repeated undercharging must be prevented because it can damage the battery.

A battery requires an equalizing charge at least once every 20 normal charge/discharge cycles. This helps correct and prevent unequal cell specific gravity (SG) readings. An “equalizing charge” is a cycle charge with modification, given usually at an interval to bring all cells up to a state of equal charge. An equalizing charge usually adds three to four more hours to the cycle charge, at a low finish rate. It is usually given when the specific gravity (SG) of electrolyte has a variation of more than 20 points (.020) from cell to cell, after a regular cycle charge.

A “cycle charge” will completely recharge the battery. The typical cycle charge for a fully discharged battery usually is an eight-hour charge. The battery must be recharged before it has been discharged over 80% of the rated capacity of the battery. The work shift of the lift truck can be planned so the battery will not be discharged more than 80%.

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A battery should never be left in a discharged state because of sulfate formation. This reduces battery life drastically. To extend life always recharge the battery without delay after it has been discharged.

Repeated over discharging of the battery will damage the cells, which will shorten battery life and increase operating cost. Battery life(number of cycles) decreases as the depth of discharge increases. The estimated life of the battery discharged to 80% will be approximately twice as long as if it were discharged 100%.

The battery's maximum temperature is critical. The electrolyte temperature should never exceed 43°C (110°F) either while operating or charging. If higher temperatures are maintained through use or abuse, reduced battery service life can be expected.

Battery condition is important for a long life. The elecrolyte level should be maintained at the recommended levels and the battery should be kept clean and dry. "Washing down" batteries at different time periods will reduce the chance of "grounds" caused by electrolyte spills and corrosion. If done often enough, just washing with water alone will eliminate the need for using baking soda. If not, a solution of baking soda and water must be used to wash battery at different time periods.

Add water at regular intervals. Enough water should be added to bring the electrolyte approximately 13.0 mm (.50 inch) above the plates. This is a simple matter with the use of an automatic cell filler, which shows a light when the correct level has been reached. Water should always be added before charging to be sure thorough mixing with acid when gassing occurs near the end of charging period. Use distilled water or have the water supply analyzed.

Charge batteries correctly. It is important that all batteries should be charged according to the manufacturer's instructions. Most of the charging equipment is fully automatic and should be checked periodically. Never operate the lift truck with a fully discharged battery because this will damage the battery.

When a battery charger operates correctly and brings a good battery up to full charge, the current readings will level to the "finish rate." The charging voltage will stabilize, the specific gravity will stop rising and normal gassing can be seen.

**NOTICE**

- DISPOSAL OF OLD BATTERY

Careless disposal of a battery can harm the environment and can be dangerous to persons.
Always dispose of a battery to an authorized personnel only.

Do not attempt to open or dismantle a battery or a cell.

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# Cold Storage Applications

When an electric lift truck is operated in cold storage applications, at temperatures as low as -20°C (-4°F), the battery capacity is decreased. Operation at cold temperatures can also cause mechanical failures, short circuits and too much wear due to the formation of ice crystals.

The direct cause of these problems is the extreme changes in temperature in combination with humidity in the air which can result in condensation.

To protect the electric lift truck's components and decrease the effects of the cold temperature, perform the following items before you put the lift truck to work in cold storage applications.

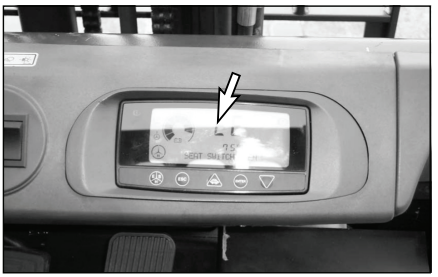
## Battery

There is a reduction in battery capacity in cold storage applications. For this reason, it is important to:

**a.** Be sure the battery is completely charged at the start of each work cycle.

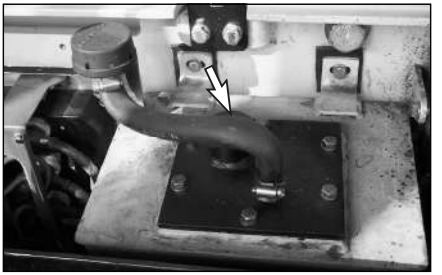
**b.** If possible, keep the lift truck in a warm storage area when it is not in use.

**c.** Do not store a discharged battery at below freezing temperature.



Observe the battery discharge indicator frequently

## Hydraulic System



Drain the hydraulic system and fill it with SAE 5. MIL-H-5606A hydraulic oil

## Lift Chains

1. Remove the chains Clean them in a nonflammable cleaning solvent.

2. Put the chains in molybdenum disulfide (MPGM) grease for one hour. Then, before installation, hang the chains, where they will not move, for three hours.

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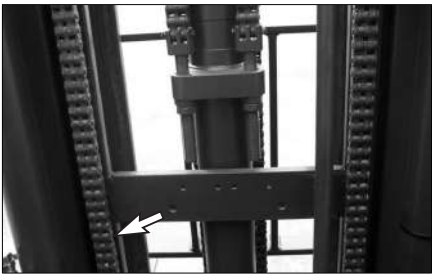

3. Put MPGM grease on the chains at one-week intervals.

4. Check chains very carefully for wear on the link plate edges, caused when they run over the sheaves. Check the chains regularly for cracked links, loss of shape in the holes, and corrosion.

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# Lubricant Viscosities and Refill Capacities

## Lubricant Viscosities

| LUBRICANT VISCOSITIES FOR AMBIENT (OUTSIDE) TEMPERATURES | | | | | | |
|---|---|---|---|---|---|---|
| Compartment or System | Oil Viscosities | | °C | | °F | |
| | | | Min | Max | Min | Max |
| Hydraulic and Power Steering System ISO 6743/4 HM | ISO VG 22 | | -30 | +20 | -22 | +68 |
| | ISO VG 32 | | -20 | +30 | -4 | +86 |
| | ISO VG 46 | | -10 | +40 | +14 | +104 |
| | ISO VG 68 | | 0 | +50 | +32 | +122 |
| *Drive Axle Housing | API GL 4 | SAE 80W | -20 | +80 | -4 | +176 |
| *Brake Reservoir | ISO VG 10 | | -30 | +50 | -22 | +122 |

* For the detailed information about the lubricant specifications, see "Lubricant Specifications" section.

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 | Imperial Gal |
| Hydraulic & Power Steering System | 32 | 8.3 | 7.0 |
| Drive Axle Housing | 9.2 | 2.64 | 2.15 |
| Brake Reservoir | 0.6 | 0.16 | 0.13 |

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# Maintenance Intervals

**NOTICE**

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

**NOTICE**

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

## When Required

Self Diagnostics - Test ..... 92
Compact Display Keys ..... 92
Run Time Diagnostic ..... 93
Carriage Roller Extrusion – Adjust ..... 96
Fuses - Replace ..... 98
Seat - Lubricate ..... 98
Wheel Bolts - Check for Tightness ..... 99
Drive Axle Gear Boxes ..... 99

## Every 10 Service Hours or Daily

Walk - Around Inspection - Inspect ..... 100
Mast Channels - Lubricate ..... 102
Battery - Check, Exchange, Change Indicator - Check ..... 104
Tires and Wheels - Inspect ..... 105
Back - up Alarm (If Equipped) -Test ..... 105

## First 50 - 100 Service Hours or 3 Months

Drive Axle - Change Oil ..... 106

## Every 250 Service Hours or Monthly

Hydraulic Return Filter - Change ..... 107
Brake System - Check Oil Level ..... 108
Parking Brake - Test ..... 108
Mast Hinge Pins - Lubricate ..... 109
Tilt Cylinders - Check, Adjust, Lubricate ..... 109
Hydraulic and Power Steering ..... 110
System - Check ..... 110
Steer Angle Switches - Check, ..... 111
Clean ..... 111
Mast Carriage, Chains and Attachments - Inspect, Adjust, Lubricate ..... 111

## Every 500 Service Hours or 3 Months

Drive Axle Oil - Change ..... 113
Cylinder Rod Extension - Adjust ..... 114
Crosshead Rollers - Check ..... 114
Mast Hinge Pin – Lubricate ..... 115
Steering - Lubricate ..... 115
Overhead Guard - Inspect ..... 115
Control Panel - Clean, Inspect ..... 116
Directional Lever - Check ..... 117

## Every 1000 Service Hours or 6 Months

Drive & Pump Motor - Clean, Inspect ..... 118
Tires and Wheels - Inspect, Check ..... 120
Lift Chains - Test, Check, Adjust ..... 121

## Every 2000 Service Hours or Yearly

Hydraulic , Power Steering System ..... 123
Steer Wheel Bearings - Reassemble ..... 124
Fork - Inspect ..... 126
Environment Protection ..... 129

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| Quick Reference to Maintenance Schedule | | | | FIRST | | EVERY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ITEMS | | PAGE | When Required | 50-100 Service Hours or a Week | 250 Service Hours or a Month | 10 Service Hours or a Day | 250 Service Hours or a Month | 500 Service Hours or 3 Months | 1000 Service Hours or 6 Months | 1500 Service Hours or 9 Months | 2000 Service Hours or a Year |
| Back - up Alarm (If Equipped) | Test | 105 | | | | O | | | | | |
| Battery | Check, Exchange, Change | 102 | | | | O | | | | | |
| Brake System | Check Oil Level | 108 | | | | | O | | | | |
| Carriage Roller Extrusion | Adjust | 96 | O | | | | | | | | |
| Compact Display Keys | | 92 | O | | | | | | | | |
| Control Panel | Clean, Inspect | 116 | | | | | | O | | | |
| Crosshead Rollers | Check | 114 | | | | | | O | | | |
| Cylinder Rod Extension | Adjust | 114 | | | | | | O | | | |
| Directional Lever | Check, | 117 | | | | | | O | | | |
| Drive & Pump Motor | Clean, Inspect | 118 | | | | | | | O | | |
| Drive Axle | Change Oil | 106 | | O | | | | | | | |
| Drive Axle Gear Boxes | | 99 | O | | | | | | | | |
| Drive Axle Oil | Change | 113 | | | | | | O | | | |
| Fork | Inspect | 126 | | | | | | | | | O |
| Fuses | Replace | 98 | O | | | | | | | | |
| Hydraulic , Power Steering System | | 123 | | | | | | | | | O |
| Hydraulic and Power Steering | | 110 | | | | | O | | | | |
| Hydraulic Return Filter | Change | 107 | | | | | O | | | | |
| Indicator | Check | 104 | | | | O | | | | | |
| Lift Chains | Test, Check, Adjust | 121 | | | | | | | O | | |
| Mast Channels | Lubricate | 102 | | | | O | | | | | |
| Mast Hinge Pin | Lubricate | 115 | | | | | | O | | | |
| Mast Hinge Pins | Lubricate | 109 | | | | | O | | | | |
| Overhead Guard | Inspect | 115 | | | | | | O | | | |
| Parking Brake | Test | 108 | | | | | O | | | | |
| Run Time Diagnostic | | 93 | O | | | | | | | | |
| Seat - Lubricate | | 98 | O | | | | | | | | |
| Self Diagnostics | Test | 92 | O | | | | | | | | |
| Steer Angle Switches | Check, Clean | 111 | | | | | O | | | | |
| Steer Wheel Bearings | Reassemble | 124 | | | | | | | | | O |
| Steering | Lubricate | 115 | | | | | | O | | | |
| System | Check | 110 | | | | | O | | | | |
| Tilt Cylinders | Check, Adjust, Lubricate | 109 | | | | | O | | | | |
| Tires and Wheels | Inspect | 105 | | | | O | | | | | |
| Tires and Wheels | Inspect, Check | 120 | | | | | | | O | | |
| Walk - Around Inspection | Inspect | 100 | | | | O | | | | | |
| Wheel Bolts | Check for Tightness | 99 | O | | | | | | | | |

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# When Required

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

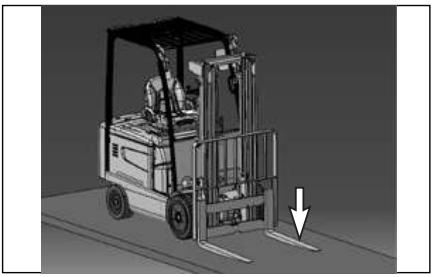
## Self Diagnostics - Test

### Test Circuits and Components

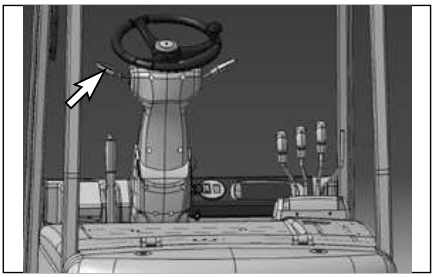
The Micro-Controller has a built-in diagnostic system to provide aid in rapid troubleshooting of lift truck problems.

**NOTE:** Make sure the battery is fully charged before any of the following tests are made.

After the self-diagnostics tests have been started, the procedure does not have to be completed. At any point the procedure can be interrupted, and the lift truck made ready for operation.

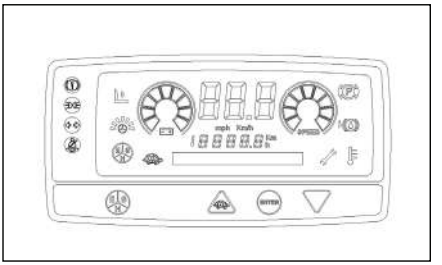


1. Park the lift truck level, with the forks lowered and the mast tilted forward until the fork tips touch the floor.
2. Block the drive wheels.
3. Release the parking brake.



4. Move the directional control lever to NEUTRAL.
5. Move the key switch to OFF.

## Compact Display Keys



As you can see in Fig. on right side of display for type1 or type2 there are four keys: E-S-H, UP (TURTLE), DOWN and ENTER.

The function of each of them is described as follows:

### ENTER key

1. When you switch your device on, this key, pressed for 3 consecutive seconds, allows entering both to parameter calibration and to diagnostic mode.
2. During usual operations, this key, pressed for 3 consecutive s, allows you to access merely to diagnostic mode.

Remember that if the display is operating in diagnostic mode during typical operations, you can exit this procedure pressing once ENTER key.

Moreover, ENTER key is used to confirm the new value of the parameter in calibration procedure.

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### UP key

1. Pressing of this key, in calibration and diagnostic mode, you increase the number of the parameter displayed.

2. In calibration phase, you increase the numeric value of the parameter displayed.

### TURTLE key

Remember that pressing this key you can toggle between slow running and normal working condition (if the lift truck is already in speed limitation mode).

### DOWN key

1. Pressing of this key, in calibration and diagnostic mode, you decrease the number of the parameter displayed.

2. In calibration phase, you decrease the numeric value of the parameter displayed.

3. "3. way of shifting from the visualization of "time meter" and "odometer": you can do it by pressing the "DOWN ARROW" button of Compact display for 1 second in succession during normal working of the display."

### E-S-H key

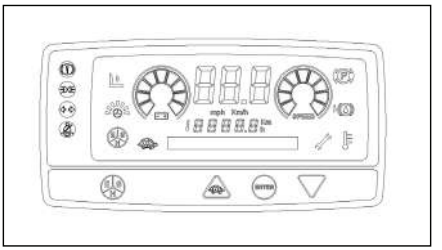
With this key, you can modify the device operating condition, in a circular sequence, as described in Table 7 :

| CURRENT WORKING CONDITION | WORKING CONDITION AFTER THE KEY PRESSURE |
|---|---|
| Economic (E) | Standard (S) |
| Standard (S) | High (H) |
| High (H) | Limitation 1 (L1)) |
| Limitation 1 (L1) | Limitation 2 (L2) |
| Limitation 2 (L2) | Limitation 3 (L3) |
| Limitation 3 (L3) | Economic (E) |

Table 7

**NOTE:** You can modify system operating modes only after enabling their management with EYE applicative software

## Run Time Diagnostic




This operating mode enables you to test main analog and digital signals managed by your system.

Enter diagnostic mode if you are switching on your lift truck:

1. Press ENTER key (for 3 consecutive s) until the symbol “0” lights up.

2. Press DOWN key to enter diagnostic mode; the symbol “d” is visualized and it persists until the first parameter has been selected.

Enter diagnostic mode if you are working as usual with your lift truck:

1. Press ENTER key (for 3 consecutive s) until symbol “d” appears; it will persist as long as the first parameter has been selected.

   After diagnostic operation mode has been enabled, you can choose the parameter you want to analyse using UP and DOWN keys (parameter number increases using UP key and decreases with DOWN key)

   Here, in Table 11, you have a list of the parameters you can analyze with their respective displaying order :DOWN key).

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| PARAMETER NUMBER | PARAMETER DESCRIPTION |
|---|---|
| 1 | Right traction motor speed [rpm] |
| 2 | Right traction motor speed reference [rpm] |
| 3 | Left traction motor speed [rpm] |
| 4 | Left traction motor speed reference [rpm] |
| 5 | Lift voltage [mV] |
| 6 | Battery voltage [V·10] |
| 7 | Right traction motor power module temperature [℃ / °F] |
| 8 | Pump motor power module temperature [℃ / °F] |
| 9 | Pump motor speed [rpm] |
| 10 | Pump motor speed reference [rpm] |
| 11 | Accelerator potentiometer voltage [mV] |
| 12 | Accelerator second potentiometer voltage [mV] |
| 13 | Steering sensor voltage [mV] |
| 14 | Left traction motor power module temperature [℃ / °F] |
| 15 | Right traction motor phase current U [A rms] |
| 16 | Right traction motor phase current V [A rms] |
| 17 | Right traction motor phase current W [A rms] |
| 18 | Left traction motor phase current U [A rms] |
| 19 | Left traction motor phase current V [A rms] |
| 20 | Left traction motor phase current W [A rms] |
| 21 | Pump motor phase current U [A rms] |
| 22 | Pump motor phase current V [A rms] |
| 23 | Pump motor phase current W [A rms] |
| 24 | Right traction motor temperature [℃ / °F] |
| 25 | Left traction motor temperature [℃ / °F] |
| 26 | Pump motor temperature [℃ / °F] |
| 27 | Seat switch hour meter [h] |
| 28 | Drive motor hour meter [h] |
| 29 | Pump motor hour meter [h] |
| 30 | Seat switch[digit] |
| 31 | Park brake switch [digit] |
| 32 | Start switch [digit] |
| 33 | Reverse traction direction switch [digit] |
| 34 | Forward traction direction switch [digit] |
| 35 | Pedal brake switch [digit] |

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| | |
|---|---|
| 36 | 3 / 4 wheels selection switch [digit] |
| 37 | Auxiliary 1 function (Side shift) switch [digit] |
| 38 | Auxiliary 2 function switch [digit] |
| 39 | Auxiliary 3 function switch [digit] |
| 40 | High lift switch 1 [digit] |
| 41 | Tilt switch [digit] |
| 42 | High lift switch 2 [digit] |
| 43 | Main breaker command [digit] |
| 44 | 5V out [digit] |
| 45 | 12V out [mV] |
| 46 | 24V out [digit] |
| 47 | Buzzer command [digit] |
| 48 | Fans command [digit] |
| 49 | Drive right motor encoder channels |
| 50 | Drive left motor encoder channels |
| 51 | Drive pump motor encoder channels |
| 52 | Lift pressure [bar · 10] |
| 53 | Pressure sensor voltage [mV] |
| 54 | Weight of the load on the forks [kg] |

Table 11 : List of accessible parameters in diagnostic mode (from 1th to 54th).

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In diagnostic mode selected parameter is visualized as follows:

- In the area dedicated to speed and alarm signals, appears parameter number( flashing)

- Its actual value is displayed in the area reserved to the time meter.

In particular, if the selected parameter is:

**Analogue input:** COMPACT display shows the parameter value, expressed in the unit of Table 11

**Digital input:** if the command activated by the operator corresponds to the parameter selected, the value of the quantity is visualized.
Other way the symbol e (error) appears, except in following case:

- Seat switch active, for any selected digital input..

To exit diagnostic mode, type ENTER key again.

**NOTE:** If an alarm occurs when diagnostic mode is enabled, and the system is working as usual, display returns automatically to its typical visualization mode. However you can enter diagnostic mode again, pressing ENTER key (for 3 consecutives), until the last parameter displayed before exiting is visualized.

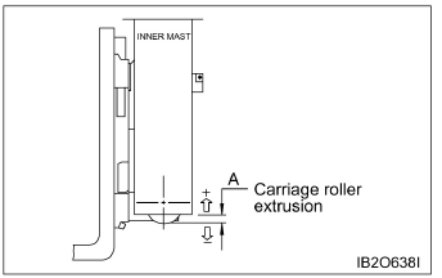
If the selected parameter is a temperature, also thermal alarm symbol is visualized.

## 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** |
| -6 | 8 | 8 |

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## Power Modules – Discharge

**⚠ WARNING**

**Personal injury could result if power modules have not been discharged properly.**

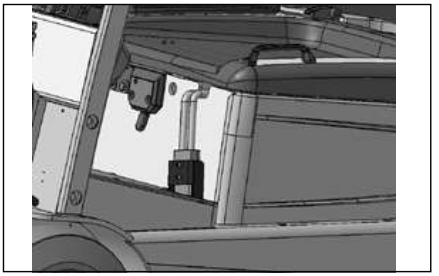
**Battery voltage and high amperage are present.**

**The power modules must be discharged before any contact with the electrical control system is made.**

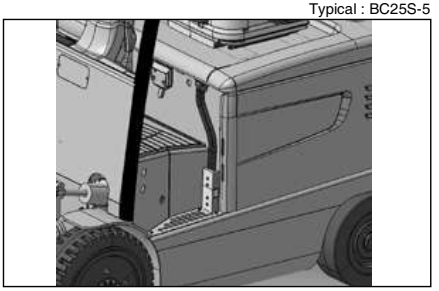
**Before touching any electrical components, remove rings, watches and other metallic objects from the hands and arms, then discharge the power modules.**

The power modules is located in the control panel at the rear of the lift truck.

Typical : B25S-5

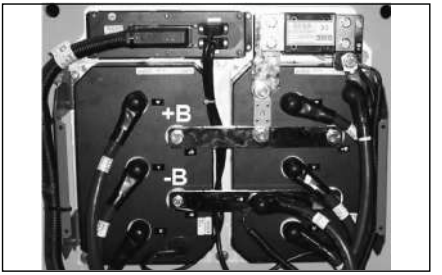


Typical : BC25S-5

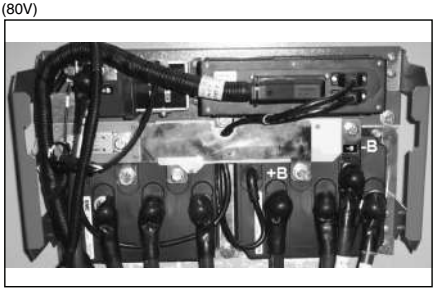


1. Disconnect the battery.
2. Open the rear door.

(36V / 48V)




(80V)




3. Before touching any electrical components, the power modules must be discharged. Put a 90 ohm, 30 watt resistor in position between the terminals of the power modules as shown. Hold the resistor in this position for approximately ten seconds. This will discharge the power modules.
4. Perform any necessary maintenance and repair at this time.
5. Close the rear door.
6. Connect the battery.

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## Fuses - Replace

The fuses are located in the control panel and fuse box at the rear of the lift truck.

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

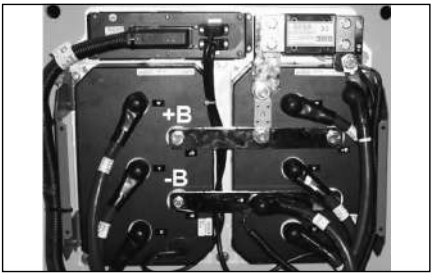
**NOTICE**

Replace fuses with the same type and size only. Otherwise, electrical damage can result.

If it is necessary to replace fuses frequently, an electrical problem may exist. Contact your *DOOSAN* Lift Truck dealer.

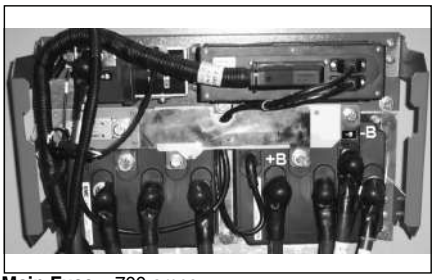
**Horn -** 10 amps
**DC/DC converter-** 10 amps
**Lights(1) -** 10 amps
**Lights(2) -** 10 amps
**FAN -** 10amps
**Key Switch -** 10amps

(36V / 48V)



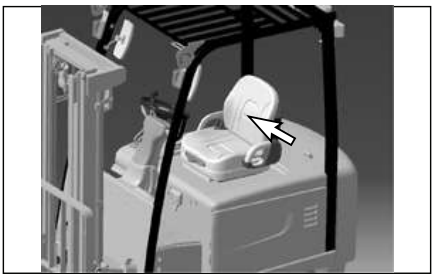

**Main Fuse -** 800 amps

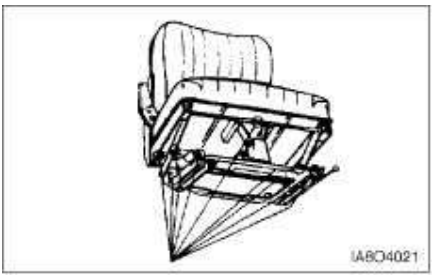
(80V)




**Main Fuse –** 700 amps

## Seat - Lubricate






Check the operation of the seat adjusters. Make sure that the seat slides freely on its track. Lightly oil the seat slider tracks.

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## Wheel Bolts - Check for Tightness

### Steer Wheels

Typical example

1. Inspect tightness of wheel nuts in a sequence opposite each other 100 N•m (75 lb•ft).

### Drive Wheels

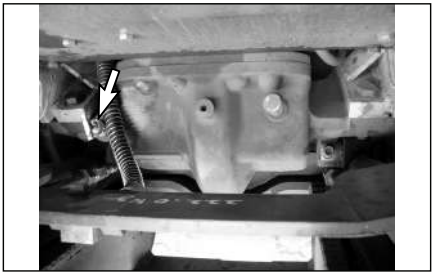
Typical example

2. Inspect tightness of wheel nuts in a sequence opposite each other to 644 N•m (475 lb•ft).

## Drive Axle Gear Boxes

**NOTE:** If there is a leak from drive axle, the oil level should be measured as follows.

### Measure Lubricant Level



1. Park the lift truck on a level surface. Raise the carriage high enough to gain access to the housing level/fill plugs.
2. Use blocking to secure the carriage in this position.
3. Remove the housing level checking plugs. Maintain lubricant level to the bottom of the plug opening. Install the level checking plugs.
4. Remove blocking. Lower the carriage.

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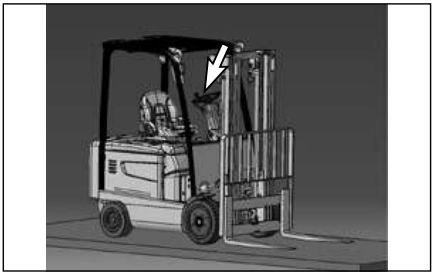
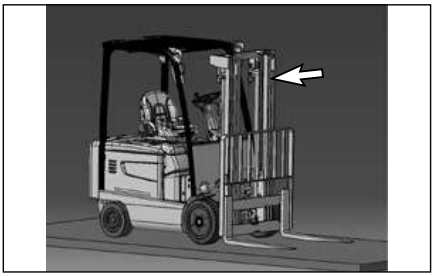
# Every 10 Service Hours or Daily

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

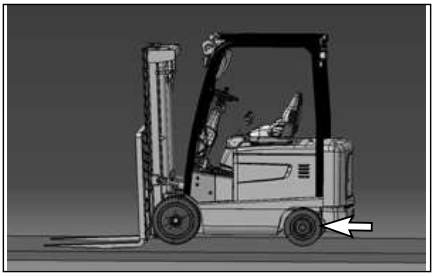
## Walk - Around Inspection - Inspect



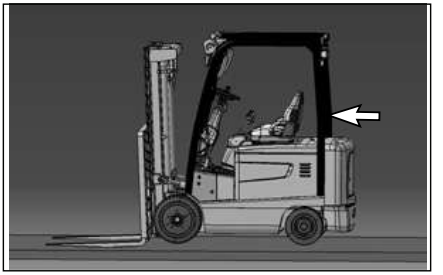
1. Inspect the operator's compartment for loose items and clean any mud or debris from the floor plates.
2. Inspect the instrument panel for damage to the display.
3. Test the horn and other warning devices for proper operation.



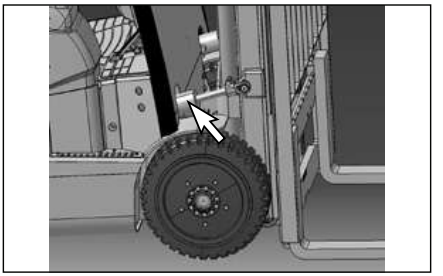
4. Inspect the mast and lift chains for wear, broken links, pins and loose rollers.
5. Inspect the carriage, forks or attachments for wear, damage and loose or missing bolts.



6. Inspect the tires, valve stems and wheels for cuts, gouges, foreign objects and loose or missing nuts. Refer to "Tires and Wheels" in "Every 10 Service Hours or Daily" section, if repairs or replacement is necessary.



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



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

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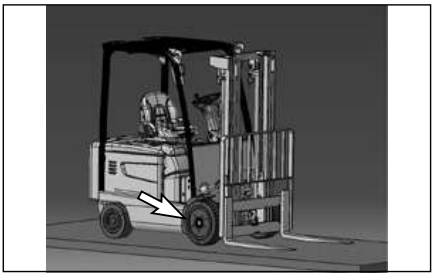
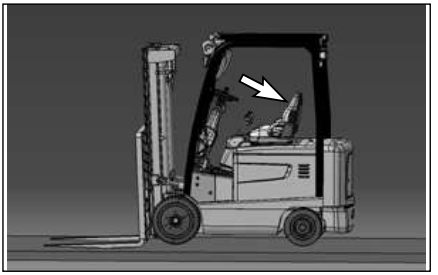
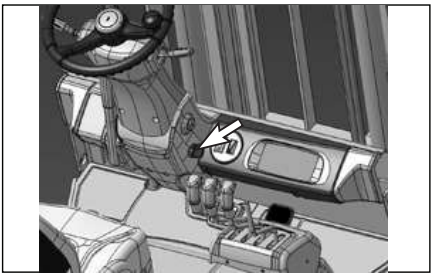


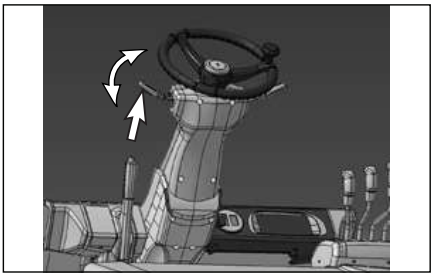
**9.** Inspect the drive axle housing and the ground for oil leaks. Refer to “Drive Axle” in “Every 1000 Service Hours or 6 Months” section, if an oil leak is found.



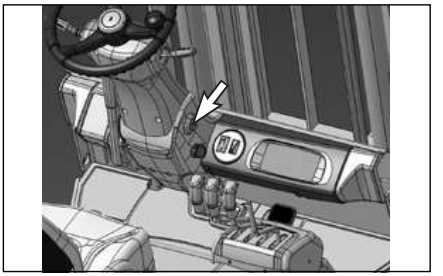
**10.** Adjust the operator’s seat.



**11.** Adjust the steering wheel to a comfortable position.



**12.** Move the directional lever to NEUTRAL.



**13.** Turn the key switch to ON.

**14.** Check the LCD display for battery discharge status. A fully charged battery will be displayed on the LCD display.

**15.** Check the operation of parking brake, service brake, controls and other devices that may be equipped on your lift truck.

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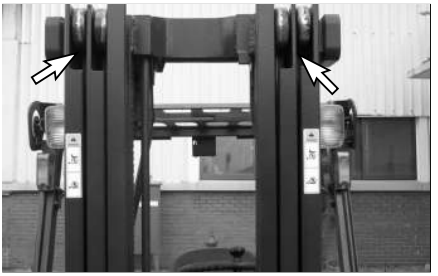
## Mast Channels - Lubricate



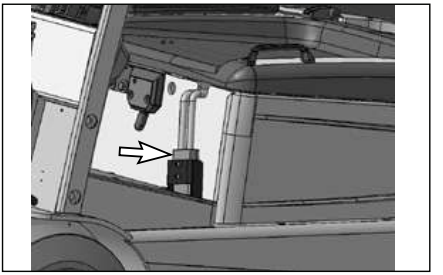
The channels on the roller-type mast require a break-in period. Apply a light film of lubricant on the channels where the rollers ride. This will prevent metal peel until the rollers set a pattern.

## Battery - Check, Exchange, Change

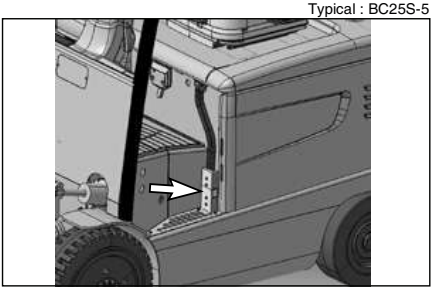
### Battery Access

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

Typical : B25S-5



Typical : BC25S-5



1. Disconnect the battery.
2. Tilt the steering column to the full upright position and move the seat fully rearward.
3. Release the hood latch lever which retain the seat and battery cover.

4. Raise the seat and battery cover.

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## Check Electrolyte

1. Inspect the battery compartment for loose connections, frayed cables and properly secured battery restraint.

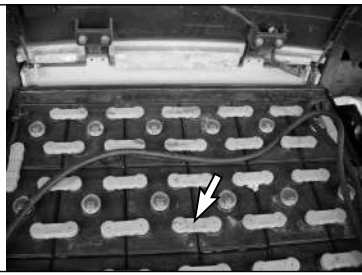
2. Clean the top of the battery. If necessary, clean the top of the battery with a solution of baking soda and hot water.

**NOTICE**

Vent caps must be tight to prevent soda solution from entering battery cells.

A clean battery top is essential to avoid conductive paths on higher voltage batteries.

To make the solution, add 0.5 kg (1 lb) of baking soda to 4 liters (1 gallon) of water. Use a brush having flexible bristles. Apply the soda solution to the top of the battery until the cleaning action of the soda stops.
After cleaning action has stopped, rinse batteries thoroughly with water. Dry the batteries with low air pressure.



3. Check the specific gravity of the battery. If the specific gravity reading is below 1.150, the battery must be charged.

**NOTICE**

The battery should not be used if a difference in specific gravity between two cells is greater than .020. If this condition exists, the battery should be put on an equalization charge. If this does not correct the condition, consult your battery supplier.

4. Check the electrolyte level of all cells. Maintain the electrolyte level about 13 mm (.50 inch) above the plates. Add water as needed. Use only distilled water. Water is always added after a battery is charged.

5. Lower the seat and battery cover. To closed position and secure with the latch on the front of the cover.

6. Connect the battery.

## Battery Exchanging

**NOTE:** Batteries should be changed, water added and charged only in areas where proper protective and ventilation facilities are provided.

1. Refer to “Battery Access” topic for battery access.

2. Cover the battery with hinged battery cover or with plywood.

3. Install insulated battery tree and hoist, of sufficient capacity, to the battery.

4. Remove the battery. Recharge the battery.

5. Install a fully charged battery.

6. Remove the battery tree. Remove hinged battery cover or plywood from the top of the battery.

7. Connect the battery.

8. Lower the seat and battery cover to closed position and secure with the latch on the front of the cover.

9. Adjust the seat position.

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## Battery Charging

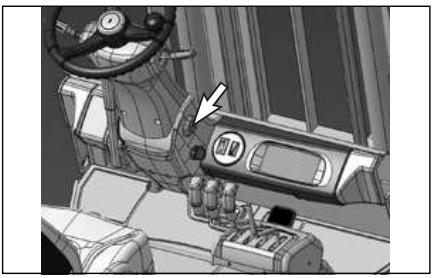
**⚠ WARNING**

**When charging, proper provision must be made for venting of the charging gases. Battery container lids and the covers of battery compartments must be opened or removed. The vent plugs should stay on the cells and remain closed.**

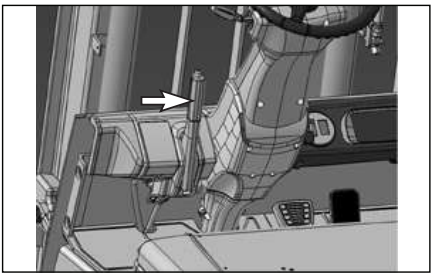
### With Battery Installed in Lift Truck

1. Refer to “Battery Access” topic for battery access.
2. Connect the battery to the charger and charge the battery. Observe safety warnings for charging batteries.
3. When the battery is fully charged, disconnect the battery from the battery charger.
4. Connect the battery to the lift truck.
5. Lower the seat and battery cover to closed position and secure with the latch on the front of the cover.
6. Adjust the seat position.

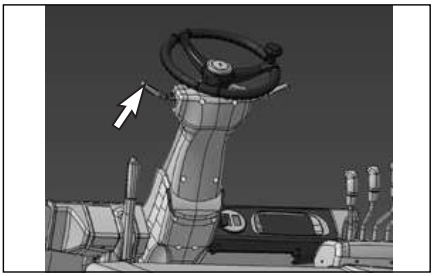
## Indicator - Check



1. Turn the key switch to ON.



2. Engage the parking brake.



3. Move the directional control lever to the NEUTRAL position.

4. Close the seat switch.

5. Check the indicator LCD display for the discharge state of the battery.

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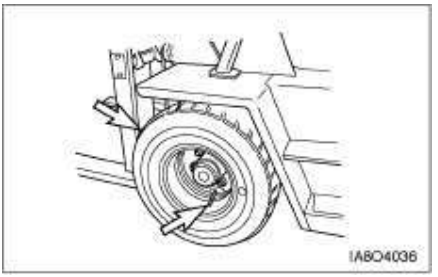
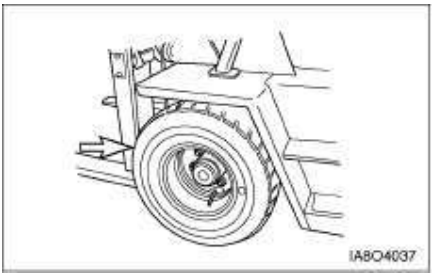
## Tires and Wheels - Inspect



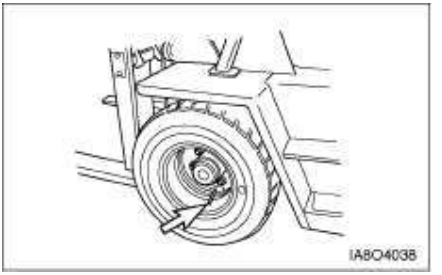

Inspect tires and valve stems for wear, cuts, gouges and foreign objects.




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.

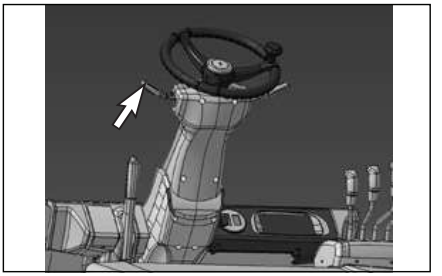
**Check Inflation Pressure (If equipped with pneumatic tires)**

Measure the tire air pressure on each tire.




Inflate the tires, if necessary. See “Tire Inflation Information” section of this manual.

## Back - up Alarm (If Equipped) - Test



With the key switch on, apply the service brake and move the directional control lever into REVERSE.

The alarm should start to sound immediately. It will continue to sound until the directional control lever is moved to NEUTRAL or FORWARD.

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# First 50 - 100 Service Hours or 3 Months

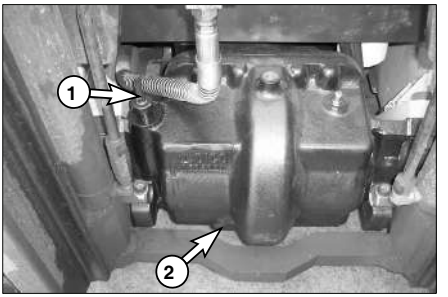
You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any aperation or maintenance procedures.

## Drive Axle - Change Oil

After the first 50~100 hour of operation, subseguently after every 500 hours or 3 months.

Park the lift truck level, with the parking brake engaged and directional control lever in NEUTRAL.

1. Raise the mast and block in place.
2. Turn the key switch to OFF.
3. Open loosely dipstick / filler plug ① and remove the drain plug ②, Allow the oil to drain.
4. Clean and install the drain plugs.




5. Fill the drive axle housing with oil through air - breather plug hole, the accurate amount of oil is defined by the opening of level checking plug.
6. Maintain the oil level.
7. Screw the level checking plug and air – breather in with the seal ring.
8. Raise the mast and remove the blocking.

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# 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 aperation or maintenance procedures.

## Hydraulic Return Filter - Change

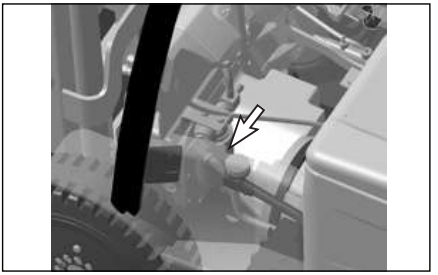
**⚠ WARNING**

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

Park the lift truck level with the forks lowered, parking brake engaged, directional lever in NEUTRAL and the key switch to OFF.

**1.** Remove the floor plate.

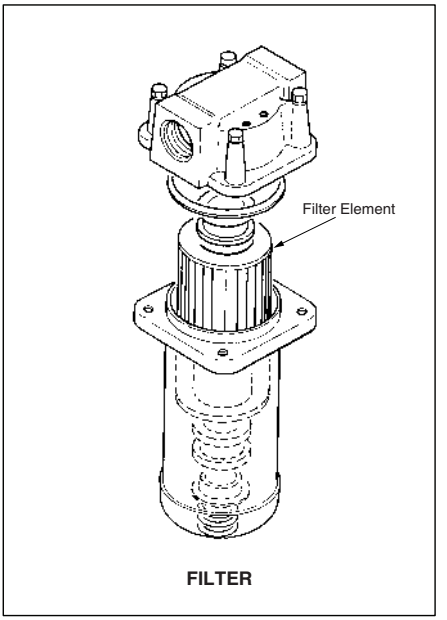
**2.** Remove mounting bolts and filter housing.



**3.** Remove and discard filter element from filter housing.

**4.** Clean the filter housing with a clean, nonflammable solvent.

**5.** Clean the housing base.




**FILTER**

**6.** Insert a new filter element into the filter housing.

**7.** Inspect the filter housing seal. Replace if necessary.

**8.** Apply a small amount of clean oil to the filter element seal and housing seal.

**9.** Install the filter housing with filter to the housing base. Install bolts and tighten 20 to 30 N•m (15 to 20 lb•ft).

**10.** Turn the key switch ON with the seat switch closed, and operate the hydraulic controls, and the steering system, through a few cycles to fill the lines. Look for oil leaks.

**11.** Retract all cylinders. Turn the key switch to OFF and check the oil level. Maintain the oil level to the FULL mark on the dip stick/filler cap assembly.

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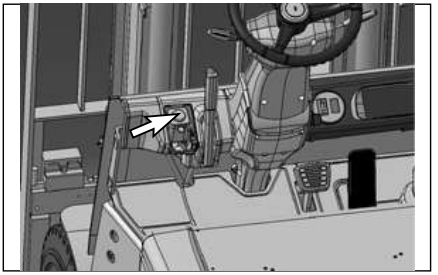
## Brake System - Check Oil Level



The brake system reservoir is located at the right side of the steering column.

1. Remove the filler cap.
2. Maintain the brake fluid level in the brake system reservoir.
3. Clean and install the filler ca.

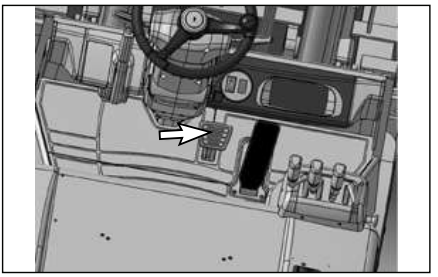
## Parking Brake - Test

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

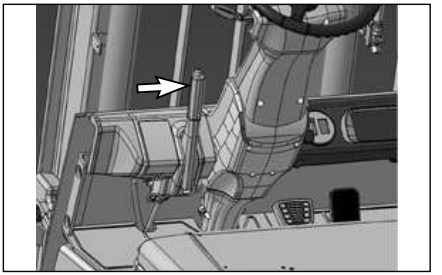
1. Drive the lift truck with a rated load up a 15% incline.

**⚠ 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.**



2. Halfway up the incline, stop the lift truck by applying the service brakes.



3. Engage the parking brake.
4. Release the service brake.

If the parking brake has the correct adjustment, the lift truck will be held in place.

**NOTE:** The lift truck may move slightly while the parking brake is engaging.

5. If the parking brake does not hold, adjust the parking brake lever screw.

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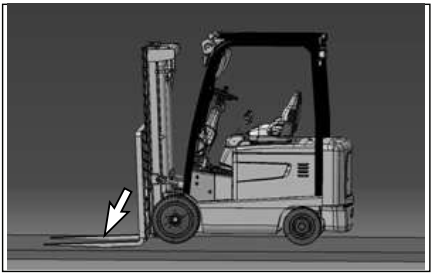
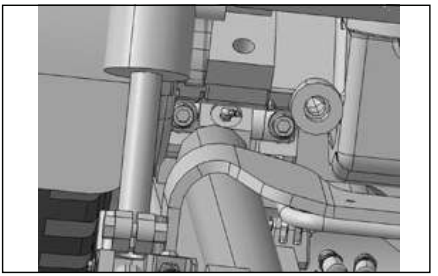
## Mast Hinge Pins - Lubricate

### Lubricate two fittings



**1.** Lower the forks and tilt the mast forward.



**2.** Lubricate the mast hinge pins. One fitting on each side of the mast. Total of two fittings.

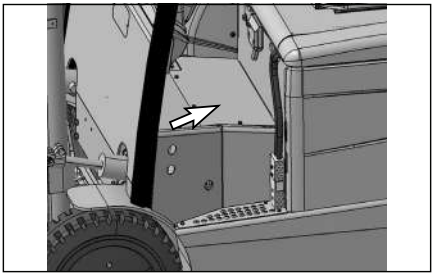
Lubricate more frequently than normal where the ground minute particles prevent smooth working.

## Drive Axle Oil(OCDB) – Change

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

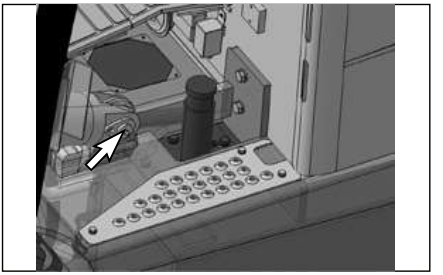
## Tilt Cylinders - Check, Adjust, Lubricate

### Chassis Pivot Eyebolts – Lubricate



Typical Example

**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.

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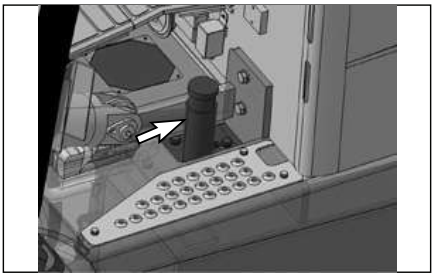
## Mast Pivot Eyes – Lubricate

Typical Example

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

## Hydraulic and Power Steering System - Check



1. Operate the lift truck for a few minutes to warm the oil.
2. Park the lift truck level, with the forks lowered, mast tilted back (all cylinders retracted), parking brake engaged, directional control lever in NEUTRAL, and the key switch to OFF.
3. Open the hood.
4. Remove the dipstick.
5. Maintain the oil level to the full mark on the dipstick.
6. Install the dipstick.
7. Install the access cover.

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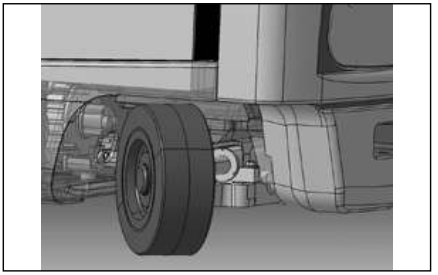
## Steer Angle Switches - Check, Clean

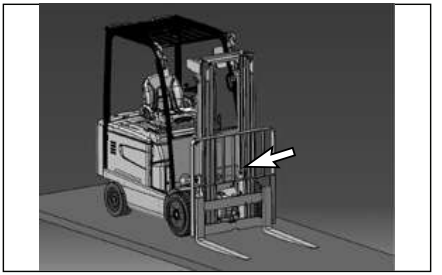


1. Clean steer angle switches with 205 kpa (30 psi) maximum air pressure until dust is removed.

2. Check the operation of steer angle switches and the tightness of bracket Adjustment if needed.

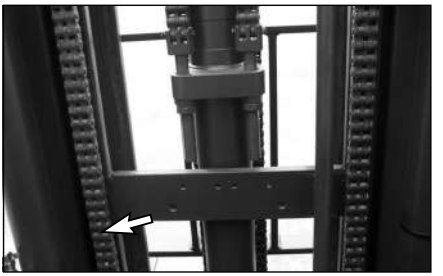
## Mast Carriage, Chains and Attachments - Inspect, Adjust, Lubricate

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 and load backrest. Remove any debris from the carriage and mast.

3. Inspect the forks and attachments for free operation and damage. Have repairs made if needed.



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

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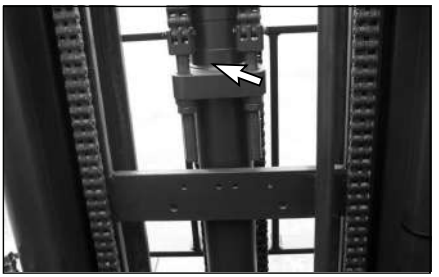
5. Raise and lower the carriage a few times to work lubricant into the chain links.

**NOTICE**

Lubricate chains more frequently than normal where the atmosphere can cause corrosion to 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.

**NOTE:** Have all repairs and adjustments made as required.

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# Every 500 Service Hours or 3 Months

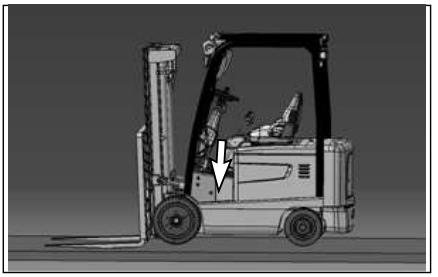
You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any aperation or maintenance procedures.

## Drive Axle Oil - Change

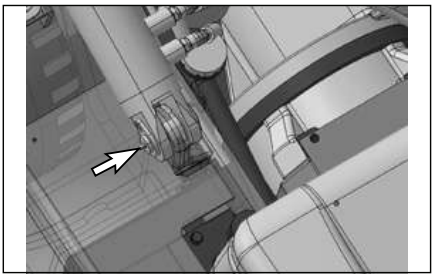
See topic, “ Drive Axle Oil - Change ” in “ First 50 - 100 Service Hours ”.

### Tilt Cylinders

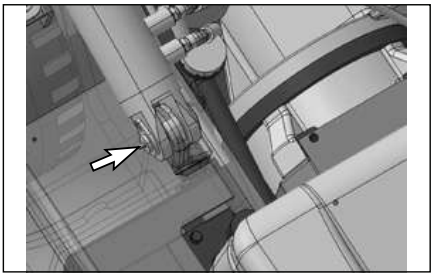
**Lubricate-Pivot Eyebolts**



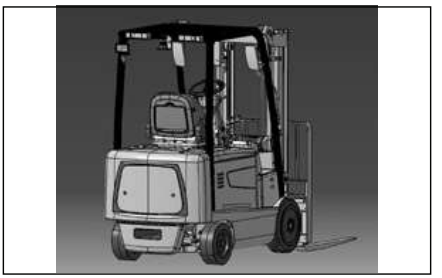
1. Remove floor plates.



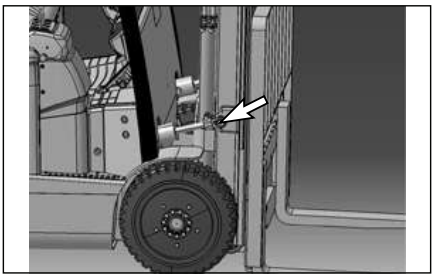
2. Lubricate pivot eyebolts, one fitting on each tilt cylinder.



3. Check the pivot eye pins for loose retainer bolts and wear.



4. Lubricate the mast pivot eyes, one fitting on each side of the mast.



5. Check the mast pivot eye pins for loose retainer bolts and wear.

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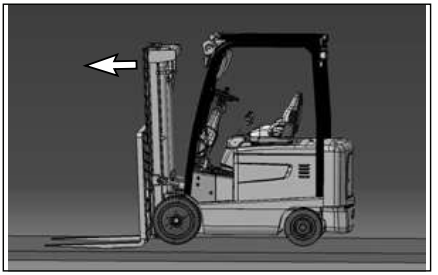
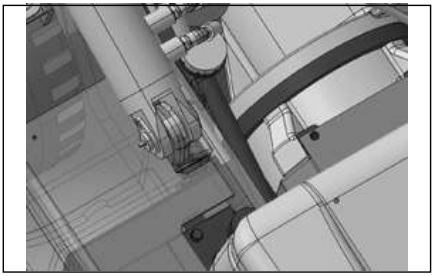
## Cylinder Rod Extension - Adjust



1. Tilt the mast to the full forward position.



2. Measure the extended length of the cylinder rods from the cylinder housing to the pivot eye. The cylinder rods must be within 3.18 mm (.125 inch) of each other..

3. To adjust the cylinder rod extension, loosen bolt.

4. Turn the cylinder rod in or out of pivot eye to obtain the proper adjustment. Turning the rod into pivot eye shortens the stroke. Turning the rod out of pivot eye lengthens the stroke.

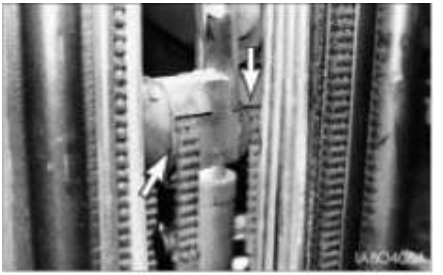
5. Tighten bolt to a torque of 95±15 N•m (70±10 lb•ft). Check the cylinder rods again for even travel.

6. With the mast at the tilt back position, install shims as required to permit no gap between pivot eye and spacer, so the mast does not twist at full tilt back position.

## Crosshead Rollers - Check

### Check Operation

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.

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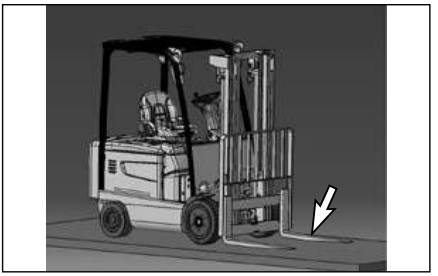
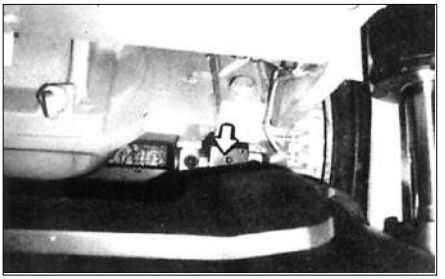
## Mast Hinge Pin – Lubricate



Typical Example

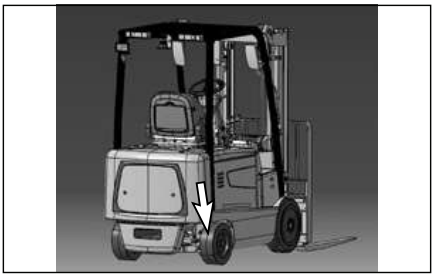
**1.** Lower the forks and the carriage.



**2.** Lubricate the two fittings for the mast hinge pins, one on each side of the mast.

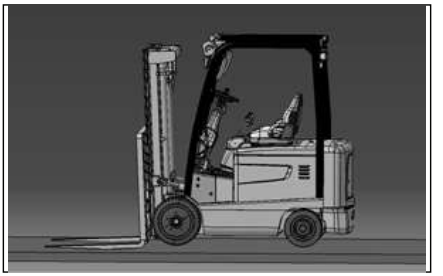
## Steering - Lubricate

### Lubricate one fitting



Lubricate fitting on steer axle.

## Overhead Guard - Inspect



Look for any loose or damaged bolts. Replace damaged bolts or missing bolts with original equipment part only. Retighten bolts to a torque of 60±10 N•m (45±7 lb•ft).

Check the overhead guard for bent or cracked sections. Repair if needed.

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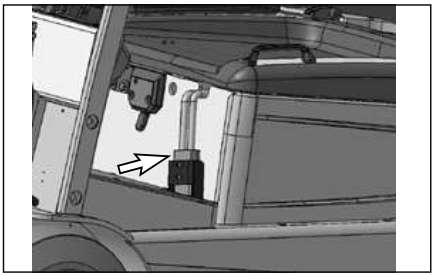
## Control Panel - Clean, Inspect

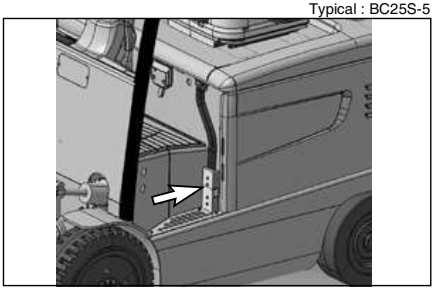
Park the lift truck level, with the forks lowered, parking brake engaged, directional control lever in NEUTRAL, and the key switch to OFF.

Disconnect the battery.

Typical : B25S-5



Typical : BC25S-5



1. Open the hood.

**⚠ WARNING**

**Battery voltage and high amperage are present.**

**The power modules must be discharged before any contact with the control panel is made.**

**Personal injury could result if it has not been discharged properly.**

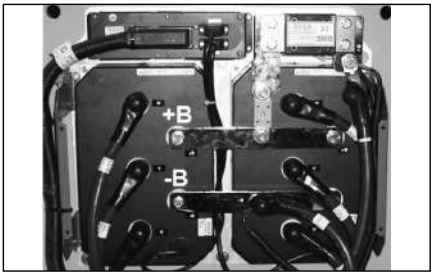
2. Discharge the head capacitor. See “power modules” in “When Required” section of this manual.

**⚠ WARNING**

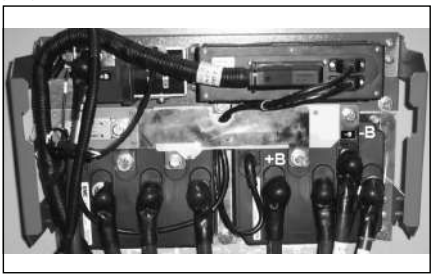
**Pressurized air can cause personal injury. When using pressurized air for cleaning, wear a protective face shield, protective clothing and protective shoes.**

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

(30V / 48V)




(80V)




3. Clean the control panel with 205 kPa (30 psi) maximum air pressure, until dust is removed from the control panel.

4. Inspect all wiring for loose connections, frayed cables and loose mounting bolts.

5. Inspect the fuses for looseness, corrosion and broken connections.

6. Close the hood cover and connect the battery.

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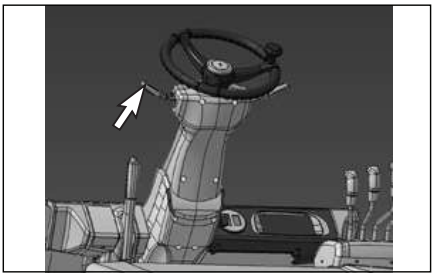
## Directional Lever - Check



Check the tightness of the directional lever mounting bracket. Adjust if needed.

Check for ease of movement of directional lever. Adjust if needed.

Check for loose wiring. Secure wiring if needed.

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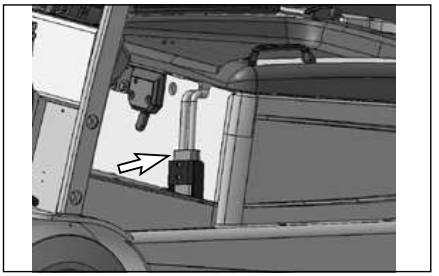
# Every 1000 Service Hours or 6 Months

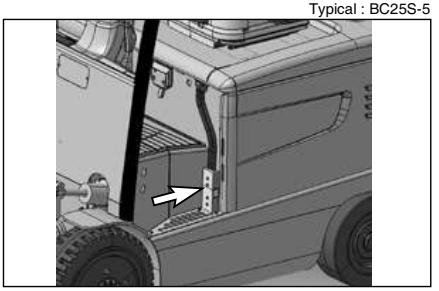
You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any aperation or maintenance procedures.

## Drive & Pump Motor - Clean, Inspect

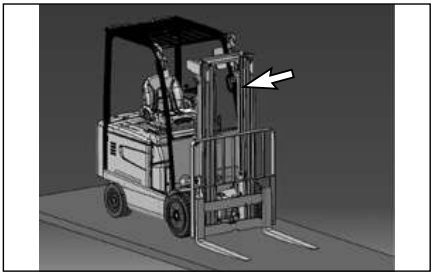
Typical : B25S-5



Typical : BC25S-5



1. Disconnect the battery.
2. Block the steer wheels.
3. Remove the battery. See topic, “Battery” in “Every 10 Service Hours or Daily” section of this manual.



4. Fasten lift chains, of equal length, in lift openings in the front of the lift truck.
5. Slowly lift the front of the lift truck, until the drive wheels are just off the ground.
6. Put stands under the frame. Remove the tension on the lift chains.
7. Remove the battery.
8. Remove the floor plate.

**NOTICE**

Do not move directional lever from one direction to the other when the drive wheels are off the ground and rotating.

Damage can be caused to the control panel.

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**⚠ WARNING**

**Battery voltage and high amperage are present.**

**The power modules must be discharged before any contact with the control panel is made.**

**Personal injury could result if it has not been discharged properly.**

**9.** Blow off the drive motor end shield with 205 kPa (30 psi) maximum air pressure, until dust is removed from the motor.

**10.** Install the floor plate.

**11.** Slowly lift the front of the lift truck and remove the stands. Lower the lift truck to the floor. Remove the chains.

**12.** Install and connect the battery. Lower the battery cover and adjust the seat.

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## Tires and Wheels - Inspect, Check

**⚠ WARNING**

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

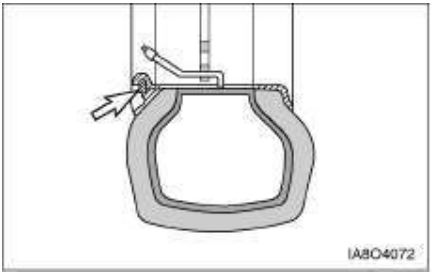
Inspect tires for wear, cuts, gouges and foreign objects. Look for bent rims and correct seating of locking ring.

If equipped with pneumatic tires, check tires for proper inflation. See topic, “Tire Inflation Pressure.”

To inflate tires always use a clip-on chuck with minimum 60 cm (24 inches) length of hose to an inline valve and gauge.

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

Lift truck capacity is dependent on tire type. Your lift truck dealer should be consulted for possible down ratings when pneumatic tires are used to replace solid (cushion) tires.




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

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

Check all components carefully and replace any cracked, badly worn, damaged and severely rusted or corroded parts with new parts of the same size and type. If there is any doubt, replace with new parts. Do not, under any circumstances, attempt to rework, weld, heat or braze any rim components.

1. Install drive wheel. Install two nuts opposite each other.

2. Install the remaining nuts. Tighten all nuts in a crisscross sequence opposite each other to 610 N•m (450 lb•ft).

3. Reverse the lifting procedure for the front of the lift truck and lower it to the ground.

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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 ension on lift chains.

Typical example

2. Measure precisely ten links of chain distance at the center of pins in millimeter.

3. Calculate chain wear rate*.

4. If the chain wear rate is 2% or more, replace the lift chain.

* Chain wear rate (%)

$$=\left(\frac{\text{Actual measurement - Pitch** X 10}}{\text{Pitch** X 10}}\right)\text{x}100$$

**1)** FOR STO,FF,FFT MAST(2~Light 3.5 ton) for 2~3 ton truck (4000~6500ℓb)
25.4㎜ (1 in) for 3.3~Light 3.5 ton truck(7000ℓb)

**2)** FOR QUAD MAST (for 2.5 ton)
19.05㎜ (0.75 in) for inner mast chain.
25.4㎜ (1 in) for carriage and qute mast chain.

**Chain Pitch = 15.88 mm(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.

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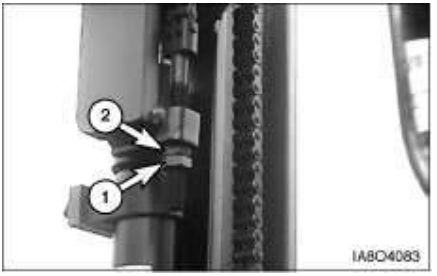
**Carriage Chain Adjustment**

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).

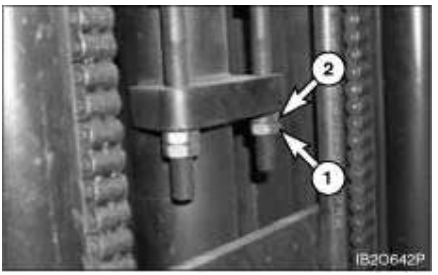
**NOTE:** See the previous section, “Carriage Roller Extrusion” in “When Required”. for proper height of carriage.

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



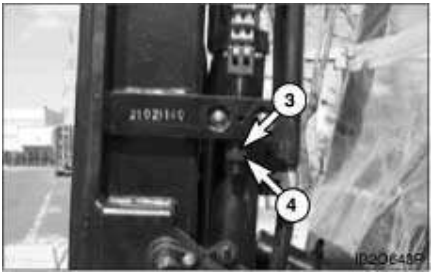

Typical example for carriage chain of FF,FFT QUAD mast

3. Make adjustment anchor nut(1),(2) for equal chain tension.

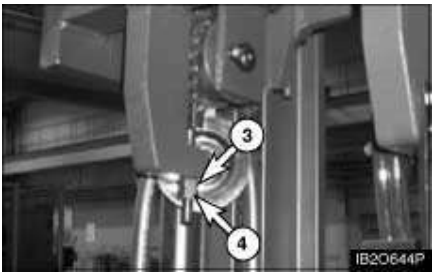
4. Set the mast vertical and raise the carriage and check equal chain tension. If not equal, repeat the same procedure as step 1 through step 3.

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 QUAD Mast**




Typical example for FF Mast




Typical example for FFT QUAD 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.

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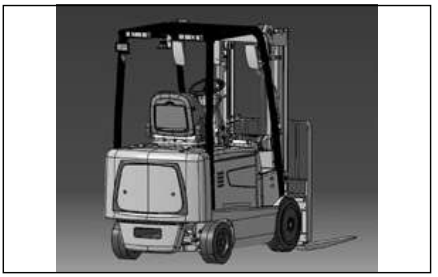
# Every 2000 Service Hours or Yearly

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

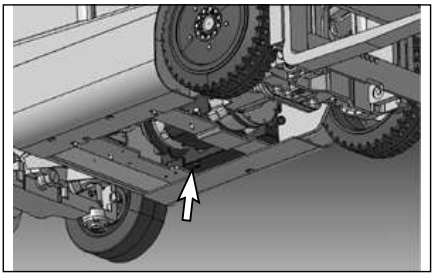
## Hydraulic , Power Steering System

### Change Oil and Filter Element

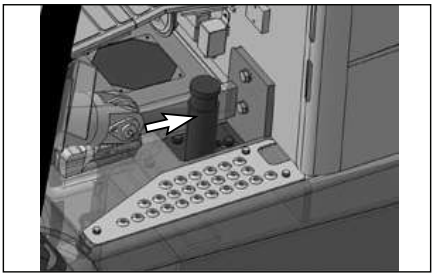


1. Operate the lift truck a few minutes to warm the oil.

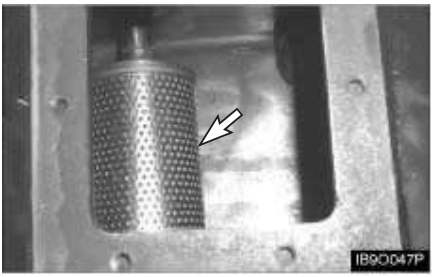
Park the lift truck level, with the forks lowered, parking brake engaged, directional lever in NEUTRAL and the key switch to OFF.



2. Remove the hydraulic tank drain plug. Allow the oil to drain. Clean and install the plug.



3. Remove an discard the hydraulic filter.




4. Remove the breather / dipstick and the strainer. Wash them in clean, nonflammable solvent and dry them.

5. Install the strainer. Fill the hydraulic tank. See “Refill Capacities.” Install the dipstick.

6. Turn the key switch to ON and close the seat switch. Operate the hydraulic controls and steering system through a few cycles, to fill the filter and lines.

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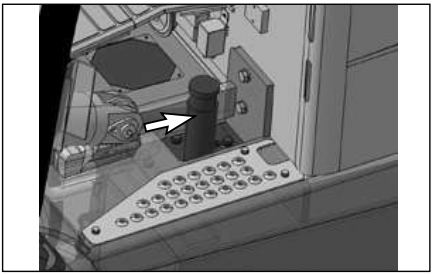


7. Check for oil leaks.

8. Retract all cylinders.

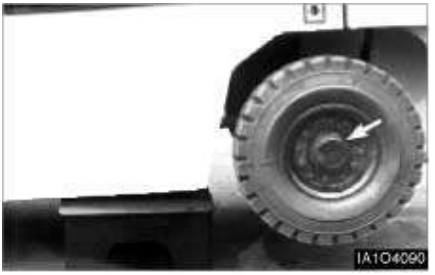
9. Turn the key switch to OFF.

10. Maintain the oil level to the FULL mark on the breather / dipstick. Add oil if necessary.F.

11. Remove the inner bearing. Clean and lubricate the steering knuckle. Repack both the inner and outer bearing cones.

12. Install the inner bearing. Lubricate the seal and install the wheel assembly on the knuckle.

13. Install the outer wheel bearing and the outer washer. Install the lockwasher and locknut.




14. Tighten the locknut to 135 N•m, while turning wheel hub to seat the bearing.

15. Loosen the locknut. Retorque it to 50±5 N•m. Bend the lockwasher tang to secure locknut.

16. Install the hub cap.

17. Raise the lift truck and remove the blocking Lower the lift truck to the ground.

## Steer Wheel Bearings - Reassemble

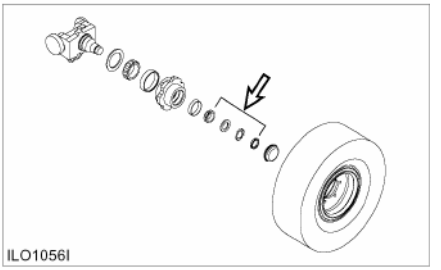
Park the lift truck level with the forks lowered, parking brake engaged, and directional control lever in NEUTRAL.

**NOTE:** The procedure is shown on a BC-Series lift truck. It is the same for B, BC-Series lift trucks.

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.



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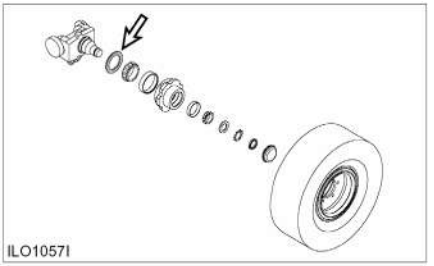
**4.** Remove the locknut, lock washer and flat washer. Remove the outer wheel bearing.

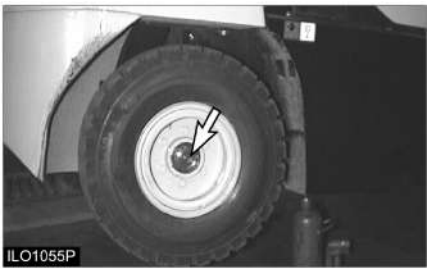


**5.** Remove the wheel assembly. Examine the seal for damage and wear. Replace the seal if necessary.

**6.** Remove the inner bearing. Clean and lubricate the steering knuckle. Reassemble both the inner and outer bearing cones.

**7.** Install the inner bearing. Lubricate the seal and install the wheel assembly on the knuckle.

**8.** Install the outer wheel bearing and the out washer. Install a new lock washer and fit the locknut.




Typical Example

**9.** Tighten the locknut to 135 N•m (100 lb•ft), while turning wheel hub to seat the bearing.

**10.** Loosen the locknut. Retorque it to 50 ± 5N•m (35 ± 4 lb•ft). Bend the lock washer tang to secure locknut.

**11.** Install the hub cap.

**12.** Raise the lift truck and remove the blocking. Lower the lift truck to the ground.

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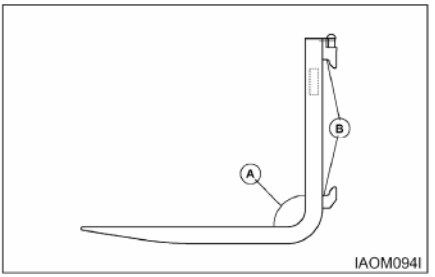
## Fork - Inspect



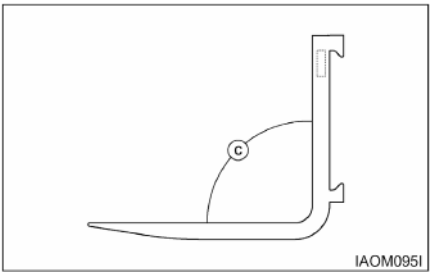

Forks should be inspected, at a minimum, every 12 months. If the truck is being used in a multi-shift or heavy duty operation, they should be checked every six months.

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.

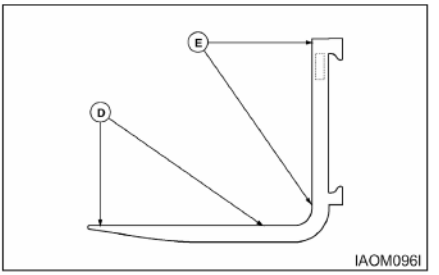
   Forks with cracks should be removed from service.

   "Wet Test" magnetic particle inspection is gener- ally 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 appli- cation 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").

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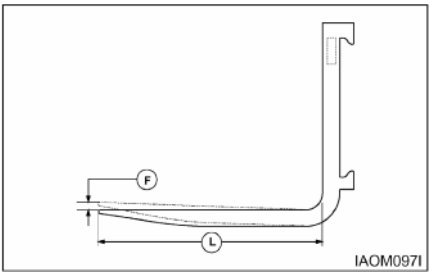
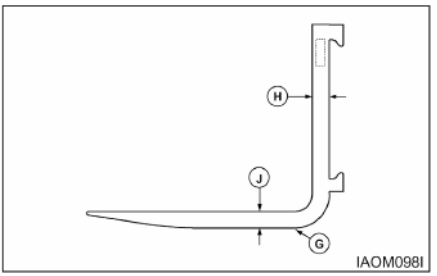



4. Check the difference in height of one fork tip to the other when mounted on the fork carrier. A difference in fork tip height can result in uneven support of the load and cause problems with entering loads.

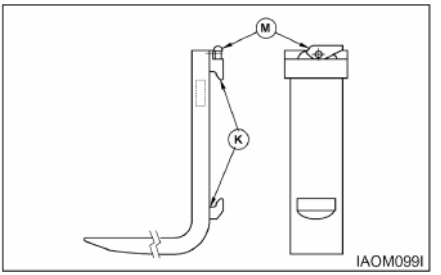
   The maximum recommended difference in fork tip elevation (F) is 6.5 mm (0.25") for pallet forks and 3 mm (0.125") for fully tapered forks. The maximum allowable difference in fork tip eleva- tion between the two or more forks is 3 percent of blade length (L).

   Replace one or both forks when the difference in fork tip height exceeds the maximum allowable difference. Contact your local *DOOSAN* Lift Truck Dealer for further information.




5. Check the fork blade (J) and shank (H) for wear with special attention to the heel (G). The fork should be withdrawn from service if the thickness is reduced to 90 percent or less of the original thickness.

   Fork blade length may also be reduced by wear, especially on tapered forks and platens. Remove the forks from service when the blade length is no longer adequate for the intended loads.




6. Check the fork mountings (K) for wear, crushing and other local deformation, which can cause excessive side to side wobble of the forks. Excessive clearance on hook type forks may allow them to fall from the carrier. Forks which show visible signs of such damage should be removed from service.

7. Check the positioning lock and other fork retention devices to make sure they are in place and working.

   Hook type forks use a spring loaded pin (M), located in the top hook, to engage notches in the top carriage bar to hold the fork in place.

   When adjusting the fork spacing, the forks are prevented from sliding off the end of the carriage by stop blocks. These stop blocks are at both ends of the carriage and in the path of the bottom fork hook. The load backrest extension may be used in place of the stop blocks in some cases.

   Shaft mounted forks may use set collars or spac- ers 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.

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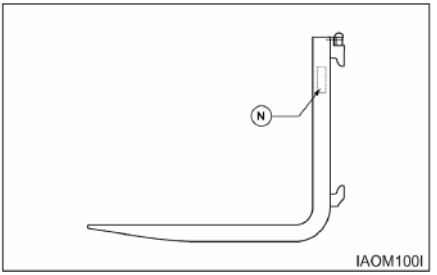
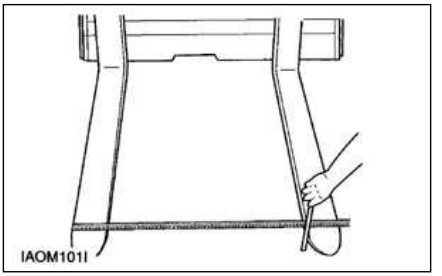



**8.** Check fork markings (N) for legibility. Renew markings as required to retain legibility.




**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, accross 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 completer 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.

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# Environment Protection

When servicing this lift truck, use an authorized servicing area and an approved container to collect coolant, oil, fuel, grease, electrolyte and any other potential environmental pollutant before any lines, fittings or related items are disconnected or removed.

After servicing, dispose of those materials in an authorized place and container. When cleaning the lift truck, be sure to use an authorized area.

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