SM123

SERVICE MANUAL

AX20 SERIES FORKLIFT TRUCKS

Federal Environmental Protection Agency (EPA) Emission Control Compliant

AX20: FG15/18(S)(H)-17 S/N 670001A~

CHASSIS

AX20

WARNING

Read and observe all warnings on this unit before operating it.
DO NOT operate this equipment unless all factory installed guards and shields are properly secured in place.

KOMATSU

Komatsu Forklift USA, Inc.

ISSUED: NOVEMBER 2004

INTRODUCTION

This Service Manual has been developed as an information resource to help the reader learn about, understand, repair and maintain the AX20 Series forklift trucks, and the various equipment, systems, inspections, sensors, diagnostic procedures and diagnostic equipment utilized to maintain, adjust and troubleshoot these systems. Although reference is made to maintenance procedures necessary to perform servicing of this vehicle, you should refer to the applicable *Operation and Maintenance Manual* for these lift trucks for more complete maintenance information.

Komatsu Forklift is involved in a concentrated and highly technical program of designing and developing cleaner burning, more efficient and more powerful engines for use in the industrial truck market. As a result, new computerized sensors, systems and diagnostic monitors have been created to make the job of maintaining and repairing these systems simple and easy.

Read this manual carefully, refer to it often and learn the repair, testing and adjustment procedures to the best of your ability. Please note that some illustrations are generic and may not look exactly like your unit in every detail.

Ensure that, when you are working on or around industrial trucks, **Safety is priority Number One**. Read, understand and obey all **WARNINGS** and **CAUTIONS**.

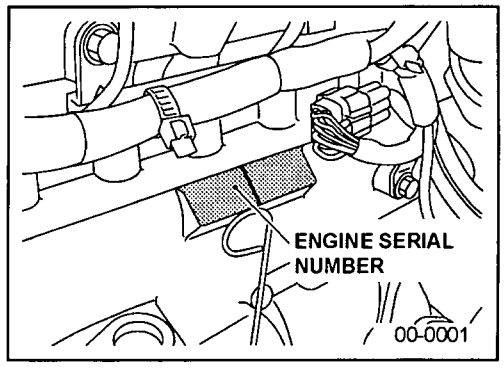
Follow the instructions and procedures presented in this manual when working on these lift trucks and their systems. Damage to the equipment, and possible injury to yourself or others, may result if these procedures are not adhered to carefully.

Keep this manual nearby and accessible for use when necessary. If this book becomes dirty, worn or illegible, contact Komatsu Forklift for a replacement. The procedures outlined in this manual will be updated periodically. Be sure that you have the latest revision in order to learn the newest information available. Revision dates will be clearly displayed on the lower left hand corner of the cover page.

This will aid in maintaining your equipment in excellent condition and in ensuring that these lift trucks will operate safely at maximum efficiency.

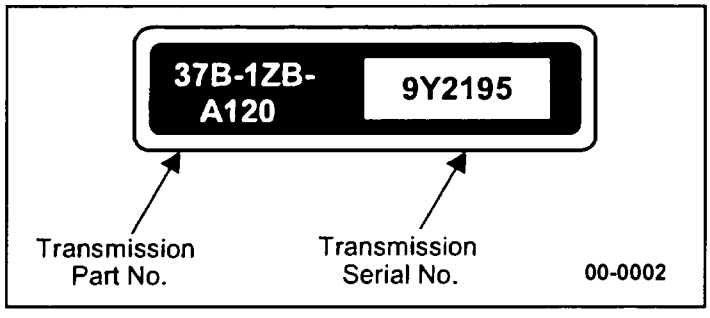
ENGINE SERIAL NUMBER LOCATION

The K21/K25 engine serial number is stamped on an angled and machined pad on the right side of the engine block in the center just beneath the valve cover.
The machined boss is split vertically by a groove. The Engine Model number is on the left pad and the Engine Serial number is on the right pad.



TRANSMISSION DATA PLATE

Example



Location on transmission — On top of the torque converter bell housing.

Transmission Serial No. — Example: 9Y2195

1st character = Year of manufacture
2nd character = Month of manufacture
(1, January; 2, February; 3, March; etc.; x, October; Y, November; Z, December)
3rd character = Monthly serial number
S/N 9Y2195 was manufactuered in November 1999, and was transmission no. 2,195 for that month.

NOTICE

For EPA engine-related troubleshooting, refer to the following manuals:

- **TM100 - "EPA Engine Training Manual" (separate from this book)**
- **SM300 - "K21/K25 Engine Service Manual" (follows the chassis / mast section of this book)**

CONTENTS

30D/35D/40D/50D/55D/60D-MT 3-Stage Masts

APPLICABLE AX20 "EPA" LIFT TRUCK MODELS	
Model	**Description**
FG15HC-17	3,000 lb. capacity, K21 Engine, Clutch Spec, Pneumatic Tire
FG15HT-17	3,000 lb. capacity, K21 Engine, Torqflow Spec, Pneumatic Tire
FG15HTLS-17	3,000 lb. capacity, K21 Engine, Torqflow Spec, LP Special, Pneumatic Tire
FG15ST-17	3,000 lb. capacity, K21 Engine, Torqflow Spec, Cushion Tire
FG15STLS-17	3,000 lb. capacity, K21 Engine, Torqflow Spec, LP Special, Cushion Tire
FG18HT-17	3,500 lb. capacity, K21 Engine, Torqflow Spec, Pneumatic Tire
FG18HTLS-17	3,500 lb. capacity, K21 Engine, Torqflow Spec, LP Special, Pneumatic Tire
FG18ST-17	3,500 lb. capacity, K21 Engine, Torqflow Spec, Cushion Tire
FG18STLS-17	3,500 lb. capacity, K21 Engine, Torqflow Spec, LP Special, Cushion Tire

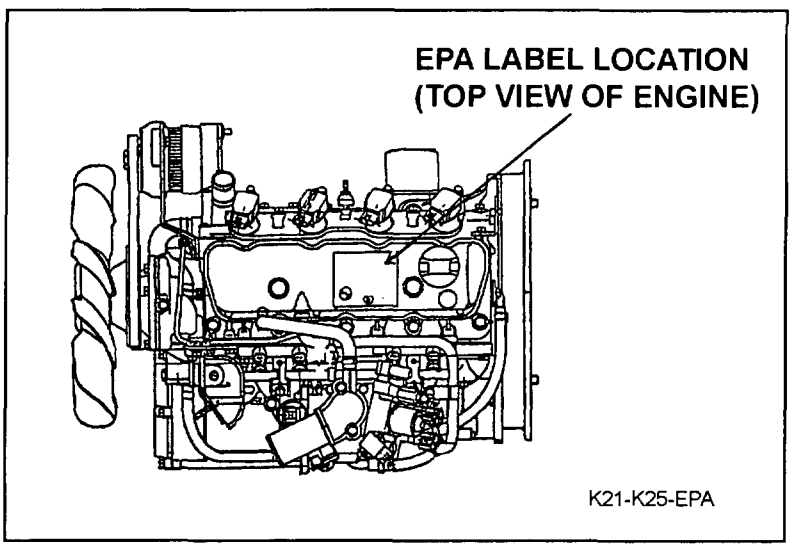
FEDERAL EPA EMISSION CONTROL STATEMENT FOR OFF-ROAD LSI (NON-DIESEL) ENGINES (K21 AND K25 ENGINES)

This section presents information concerning the correct labeling, warranty, parts and maintenance of K21 and K25 engines in order to comply with the EPA off-road, large-spark-ignition (LSI) engine regulations.

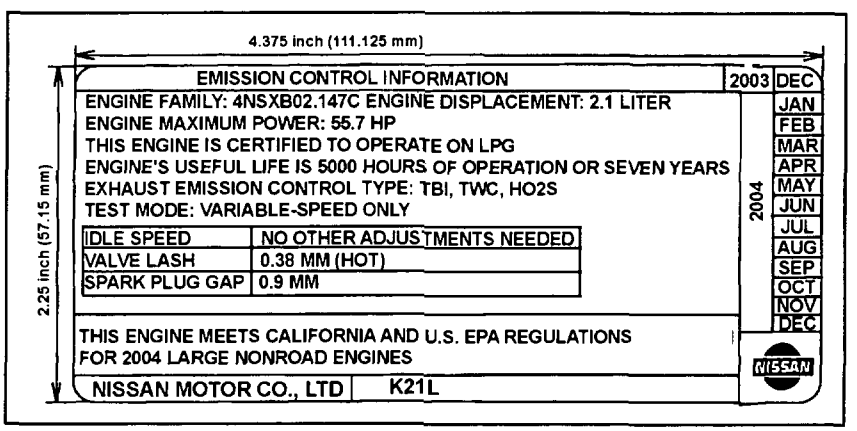
1. LABELS REQUIRED AND LABEL LOCATIONS

All "K" series engines will display the required identification label as follows.

Location on K21/K25 Series engines:



Emission compliance label (SAMPLE shown below)



2. WARRANTY

The following statement is hereby provided as required by regulations of the United States Environmental Protection Agency (EPA).

YOUR WARRANTY RIGHTS AND OBLIGATIONS

All off-road large spark-ignition (LSI) engines must be designed, built and equipped to meet the Federal EPA's stringent anti-smog standards.

Komatsu Forklift USA, Inc. ("KFI") must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, damage, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the carburetor, regulator or fuel-injection system, ignition system, engine computer unit (ECM), catalytic converter and air induction system.

Also included may be sensors, hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, an Authorized Komatsu Forklift Dealer will repair your LSI engine at no cost to you, including diagnosis, parts and labor.

MANUFACTURER'S WARRANTY COVERAGE

Beginning January 1, 2004 off-road large spark-ignition EPA engines are warranted for the time periods listed below. If any emission-related part on your engine is defective, the part will be repaired or replaced by an Authorized Komatsu Forklift Dealer.

OWNER'S WARRANTY RESPONSIBILITIES

As the off-road LSI engine owner, you are responsible for the performance of the required maintenance listed in your Operation and Maintenance Manual.

KFI recommends that you retain receipts covering maintenance on your off-road engine, but KFI cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

As the off-road large spark-ignition engine owner, you should be aware, however, that KFI may deny you warranty coverage if your off-road large spark-ignition engine, or a part thereof, has failed due to abuse, damage, neglect, improper maintenance or unapproved modifications.

Your engine is designed to operate on gasoline and/or LPG fuel. Use of any other fuel may result in your engine no longer operating in compliance with the Federal EPA's emissions requirements.

You are responsible for initiating the warranty process. It is suggested that you present your off-road large spark-ignition engine to an Authorized Komatsu Dealer as soon as you become aware that a problem exists. The warranty repairs should be completed by the dealer as expeditiously as possible.

If you have any questions regarding your warranty rights and responsibilities, you should contact Komatsu's Product Support Dept. at 1-770-385-4815.

In addition to the standard warranty periods, the components listed below are covered by the following specific warranty periods.

EMISSION CONTROL WARRANTY – 36 MONTHS OR 2,500 HOURS FOR GENERAL PARTS

For the first 2,500 operating hours, or for a period of thirty-six months from the date of the first use by the original purchaser from an Authorized Komatsu Forklift Dealer, whichever occurs first, KFI warrants the following emission-related parts:

- Oxygen sensor
- Water temperature sensor
- LPG injector
- LPG solenoid
- Mass air flow sensor
- Ignition coil
- Camshaft position sensor
- Spark plugs
- PCV valve
- Gasoline injector
- LPG pressure sensor
- LPG switching module
- Throttle chamber
- Crankshaft position sensor
- Distributor

EMISSION CONTROL WARRANTY – 36 MONTHS OR 4,000 HOURS FOR POWER TRAIN PARTS

- Intake manifold
- Exhaust manifold

EMISSION CONTROL WARRANTY – 60 MONTHS OR 3,500 HOURS FOR GENERAL PARTS

- ECM
- Catalytic converter
- Vaporizer

NOTICE

Follow the instructions in the Operations Manual concerning any other maintenance programs not required for EPA compliance.

For questions and additional information concerning EPA Diesel Engine Exhaust Regulations, contact:

Komatsu Forklift USA, Inc.
14481 Lochridge Blvd., Bldg. #2
Covington, GA 30014-4908

Voice phone: (770) 385-4815
Fax phone: (770) 385-4838

FEDERAL EPA EMISSION CONTROL STATEMENT FOR OFF-ROAD DIESEL ENGINES (4D94E ENGINES)

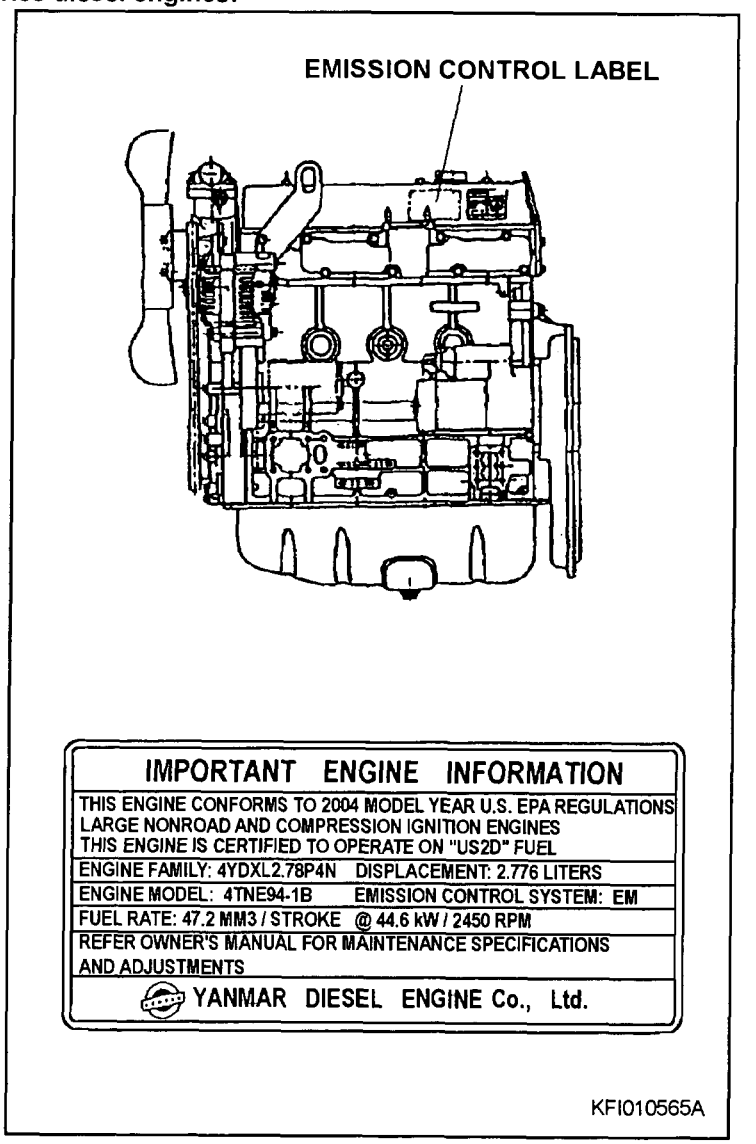
Exhaust emissions produced by diesel engines are regulated by the United States Environmental Protection Agency (EPA). This section presents information concerning the correct labeling, warranty, parts and maintenance of 4D94E diesel engines in order to comply with current EPA regulations.

1. LABELS REQUIRED AND LABEL LOCATIONS

All certified 4D94E diesel engines will display the required identification label as follows:

- 4D94E diesel engines: Labels will be affixed to all appropriate engines on KFI production trucks.

Location on 4D94E Series diesel engines:



2. WARRANTY

The following statement is hereby provided as required by regulations of the United States Environmental Protection Agency (EPA).

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The Federal EPA and Komatsu Forklift USA, Inc. (hereinafter referred to as "KFI") are pleased to explain the emission control system warranty on your 2004 or later Diesel heavy duty off-road engine. All new, heavy-duty off-road engines must be designed, built and equipped to meet the EPA's stringent anti-smog standards. KFI must warrant the emission control system on your engine for the period of time listed below, provided there has been no abuse, damage, neglect or improper maintenance of your engine.

Your emission control system may include parts such as fuel injection pump. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, an authorized Komatsu dealer will repair the heavy-duty off-road engine at no cost to the owner, including diagnosis, parts and labor.

Now, KFI hereby certifies that diesel engines for lift trucks produced in 2004 model year and after shall be regulated by Federal EPA exhaust gaseous regulations. The difference between current and EPA-certified engines is only the label attached on the engine. See available drawing and/or illustration of emission label and its location.

MANUFACTURER'S WARRANTY COVERAGE

Beginning January 1, 2004 heavy-duty off-road EPA engines are warranted for a period of five (5) years, or three-thousand (3,000) hours of operation, whichever occurs first. If any emission-related part on your engine is defective, the part will be repaired or replaced by at an authorized Komatsu Forklift dealer.

EMISSION-RELATED PARTS

- Fuel injection pump
- Fuel injection nozzles
- Turbocharger

OWNER'S WARRANTY RESPONSIBILITIES

As the heavy-duty off-road engine owner, you are responsible for the performance of the required maintenance listed in owner's manual (Instruction Manual). KFI recommends that you retain all receipts and records covering the maintenance on your engine, but KFI cannot deny warranty solely for the lack of receipts and records or for your failure to ensure the performance of all scheduled maintenance. For your reference, the following is an emission control maintenance schedule for certified Diesel engines.

- Check oil level and coolant level – Everyday
- Change of lubricating – Every 200 hours
- Change lubricating oil filter – Every 200 hours
- Initial adjustment of valve clearance – Every 200 hours
- Change fuel filter – Every 500 hours
- Check turbocharger, rebuild or replace if necessary – Every 2,000 hours
- Adjust valve clearance – Every 2,000 hours
- Check fuel injection nozzles, replace if necessary – Every 2,000 hours

Keep records to show proof of compliance with the required maintenance practices and intervals.

- As the heavy-duty off-road engine owner you should, however, be aware that KFI may deny your warranty coverage if your heavy-duty off-road engine or part has failed due to abuse, damage, neglect, improper maintenance or disapproved modifications.
- Your engine is designed to operate on commercial diesel fuel only. Use of any other fuel in our engine will result in the engine operating in non-compliance with the Federal EPA regulations.
  You are responsible for initiating the warranty process. It is suggested that you present your heavy duty off-road engine to an authorized Komatsu dealer as soon as you become aware that problem exists. The warranty repair should be completed by the dealer as expeditiously as possible.
- If you have any questions regarding your warranty rights and responsibilities, you should contact the authorized KFI dealer.

LIMITATIONS

KFI is not responsible for resultant damages to an emission-related part or component resulting from:

- Any application or installation KFI deems improper as explained in the Instruction Manual.
- Attachments, accessory items or parts not authorized for use by KFI.
- Improper off-road engine maintenance, repair or abuse.
- Owner's unreasonable delay in making the product available after being notified of a potential product problem.

This warranty is in addition to the KFI standard warranty applicable to the off-road engine product involved.

Remedies under this warranty are limited to the provision of material and services as specified herein. KFI is not responsible for incidental or consequential damages, such as downtime or lost use of the forklift truck.

CUSTOMER ASSISTANCE – EMISSION CONTROL SYSTEMS WARRANTY

Komatsu Forklift aims to ensure that the Emission Control Systems Warranty is properly administered. In the event that you do not receive the warranty service to which you believe you are entitled under the Emission Control Systems Warranty, call or write to your Komatsu Forklift Dealer.

Authorized dealers are recommended for major maintenance and repair work, as they are staffed with trained personnel, proper tools and are aware of the latest maintenance methods and procedures. Owners and others who desire to perform their own work should purchase a service manual and obtain current service information from their KFI engine dealer.

NOTICE

Follow the instructions in the Operations Manual concerning any other maintenance programs not required for EPA compliance.

For questions and additional information concerning EPA Diesel Engine Exhaust Regulations, contact:

Komatsu Forklift USA, Inc.
14481 Lochridge Blvd., Bldg. #2
Covington, GA 30014-4908

Voice phone: (770) 385-4815
Fax phone: (770) 385-4838

1. SAFETY MANAGEMENT

⚠ WARNING OPERATION MANUAL AND SAFETY LABELS

- Read the instructions in this Manual and the Safety Labels attached to the various parts of the lift truck, and make sure that you understand and follow them. If you do not understand or do not follow the instructions, this will lead to improper operation which may lead to damage, personal injury or death.
- Be sure that you understand the proper method of using the lift truck and the procedure for carrying out an inspection, and ensure that they are carried out safely.
- Read this Manual and the Safety Labels again from time to time. If the Operation and Maintenance Manual or Safety Labels have been lost or become dirty and cannot be read, obtain replacements from your Komatsu Forklift distributor/dealer and attach the Safety Labels in the specified positions.

⚠ WARNING OPERATING QUALIFICATIONS

- This lift truck should be operated only by qualified personnel. Be sure you have proper qualifications before operating the lift truck.
- When operating this lift truck, even if you have experience in operating other lift trucks, obtain instructions from an authorized person who has experience in operating this lift truck or the same type of lift truck.

⚠ WARNING CLOTHING AND PERSONAL PROTECTIVE ITEMS

- Avoid loose clothing, jewelry, and loose long hair. They can catch on controls or in moving parts and cause serious injury or death.
- Always wear a hard hat and safety boots.
- Depending on the working conditions, wear other safety equipment in addition to the hard hat and safety boots.

A0055010

⚠ WARNING OVERHEAD GUARD, LOAD BACKREST

- Do not use this lift truck unless it is equipped with the overhead guard and load backrest shipped with the lift truck from the factory by Komatsu Forklift.

⚠ WARNING UNAUTHORIZED MODIFICATION

- Any modification made without authorization from Komatsu Forklift can create hazards.
- Before making any modification whatsoever, consult your Komatsu Forklift distributor/dealer. Komatsu Forklift will not be responsible for any damage, injury or death caused by any unauthorized modification.
- Do not install any equipment or parts which obstruct or limit the operator's view.

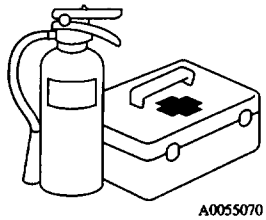
⚠ WARNING EXHAUST GAS

- Do not leave the engine running where there is poor ventiliation. The engine exhaust gas contains carbon monoxide. There is a danger that this will cause gas poisoning which may result in serious injury or death.

A0055060

⚠ WARNING FIRE EXTINGUISHER AND FIRST AID KIT

- If any abnormality in the lift truck occurs, stop operation immediately, park the lift truck in a safe place and safe condition, then contact the person in charge.
- Be sure that fire extinguishers have been provided and that you read the labels to ensure that you know how to use them.
- Know what to do in the event of a fire.
- Be sure that you know the phone numbers of persons you should contact in case of an emergency.
- Provide a first aid kit at the storage point.
- Do not use the lift truck if it is leaking fuel. Inform the person on charge of the nature of the abnormality, and repair the leakage before using the lift truck.
- Do not leave the lift truck with the engine running. Always apply the parking brake securely, lower the forks to the ground, stop the engine, and remove the key before leaving the lift truck.



A0055070

⚠ WARNING SAFETY RULES

- Do not operate the lift truck if you are fatigued, or when you have been drinking, or you have taken any medication which can make you drowsy or sleepy.
- When carrying out operation, inspection, or maintenance of the lift truck, always follow all work shop rules, safety regulations and precautions.
- During operation, always pay attention to safety and be careful of pedestrians, traffic and other surrounding conditions.

⚠ WARNING CHECK WHEN TRAVELING IN REVERSE

- When reversing, depending on the situation, an optional alarm, reversing lamp or rotary lamp should be used. In all cases, be sure to face the rear and check around before traveling in reverse.

⚠ WARNING TRAVELING REGULATIONS ON PUBLIC ROADS

- Always observe all traffic regulations when operating the lift truck.
- Do not drive on public roads with the lift truck loaded.
- Do not tow other machines on public roads. (Do not tow other machines even when not on public roads).
- Always carry your driver's license when traveling on public roads.

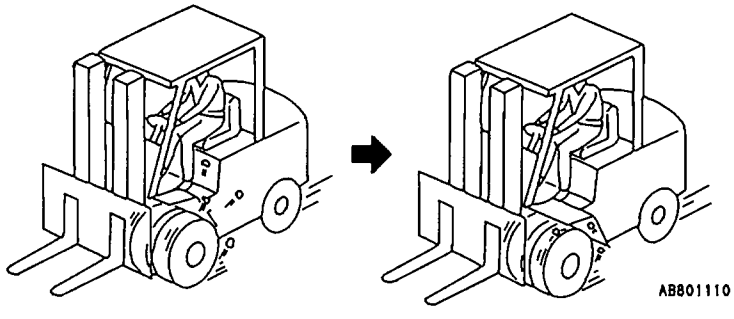
⚠ WARNING SAFETY EQUIPMENT

- The overhead guard is installed to protect the operator from falling objects. It is designed to withstand the force of light boxes or small packages. It is not designed to withstand every possible impact. Always be careful to prevent damage or injury from falling objects.

⚠ WARNING TIRE FENDERS

- The tire fenders prevent objects from being thrown up by the tires. When changing from a single tire to a double tire arrangement on your forklift truck, always extend the tire fenders to cover the additional tires. If the fenders are not extended, small stones and other objects will be thrown up and may injure the operator or other people in the surrounding area.

INCORRECT FENDERS



CORRECT FENDERS

⚠ WARNING SAFE WORKING AREA

- Always work on level surfaces and wipe up all oil or grease from the ground.
- When working on quays, platforms, docks or other places where there is a danger of falling, set up blocks to prevent the lift truck from going over the edge.
- Put warning signs up in dangerous places to warn the operator not to approach.
- Mark the travel areas clearly and maintain the road surfaces in good condition.
- Put up signs to prevent unauthorized machines from entering areas where trucks are being operated.
- Ensure that there is adequate lighting to enable operations to be carried out safely.

⚠ WARNING CLEAN OPERATOR'S COMPARTMENT

- Keep the operator's compartment clean and tidy. Be sure to clean up all oil or mud. If the operator's hand or foot slips, this may lead to a serious accident.
- Do not leave tools or spare parts lying around in the operator's compartment. They may damage or obstruct the control levers or pedals. Always keep them in the tool box when not being used.

⚠ WARNING SAFE OPERATING PLAN

- Before operation, establish an operating plan and hold a meeting to discuss operating safety.
- In confined areas, position a signal person and carry out operations in accordance with his/her instructions.
- When carrying out operations on roads, put up fences around the working area and carry out operations in accordance with instructions from the signal person.

⚠ WARNING REDUCE LOAD FOR LIFT TRUCKS WITH ATTACHMENT

- The permissible load for any lift trucks equipped with an attachment is lower than the permissible load for the standard lift truck.
  Reason:
  1) The permissible load must be reduced by an amount equivalent to the weight of the attachment itself.
  2) Because of the thickness of the attachment, the load center moves forward.
- Always observe the permissible load table strictly (this table is stuck to the lift truck or the attachment). Never exceed the permissible load.

⚠ WARNING "NO JUMP START" SAFETY PLATE (DECAL)

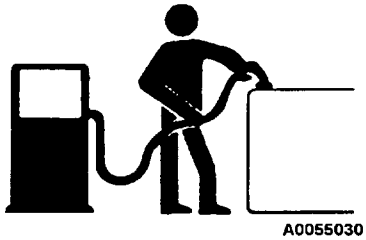
- DO NOT JUMP START the engine by short circuiting the starting motor terminals.
- This SAFETY PLATE (DECAL) is located on the top center of the starter's magnet switch.
- If your machine is not equipped with this SAFETY PLATE, install a new plate (decal) in the specified location after cleaning the surface.

⚠ WARNING FIRE PREVENTION FOR FUEL

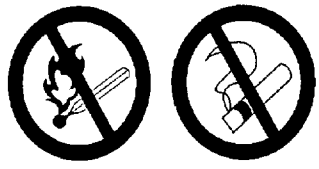
FUEL IS EXTREMELY FLAMMABLE AND CAN CAUSE FIRES AND EXPLOSIONS.

- Carry out refueling away from flames or sparks.
- Stop the engine when refueling.
- After refueling, tighten the gas cap securely and wipe up any spilled fuel.
- The specific gravity of LPG is heavier than air, so it is easy for the vapors to accumulate in low places (holes, road surface depressions, etc.). This can create a fire or explosion hazard. Be extremely careful!

A0055020



A0055030



A0055040

⚠ WARNING NO STARTING AIDS

Engine starting aids are highly flammable and may cause an explosion.

- Do not use starting aids to start the engine.

⚠ WARNING LPG SAFETY / FUEL SYSTEM SAFETY

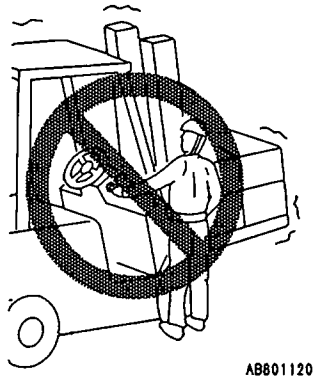
Accidents involving fuel systems are always dangerous and can cause fire and explosion, serious injury, death and property damage. Keep the following points in mind when working with fuel systems.

- Read, understand and remember relevant information in the ***NATIONAL FIRE PROTECTION AGENCY (NFPA)*** standard for fuel in use. Do this BEFORE working on any fuel system.
- Ensure you are wearing proper personal protective equipment.
- Check for fuel leaks before you begin work on any fuel system.
- On LPG systems, DO NOT work on the system if the fuel storage container is filled with fuel past the 80% liquid level.
- Ensure there are NO SOURCES OF IGNITION nearby before beginning work.
- Be sure your work area is adequately ventilated.
- Disconnect the battery before working on the fuel system.
- **LPG is heavier than air** and will sink to the lowest area possible. Avoid areas near floor drains or lubrication pits where escaped fuel may collect.
- LPG is stored under high pressure. Ensure the LPG fuel storage container valve is turned OFF (closed), and pressure is released from the lines, before working on system.
- Store all LPG cylinders OUTDOORS is a secured area and safe from any vehicle traffic.
- **NEVER WELD ON AN LPG PRESSURE VESSEL, STORAGE TANK OR CYLINDER.**
- LPG fuel tanks mounted horizontally MUST BE positioned properly. See MAINTENANCE Section.
- Always utilize a UL listed LPG tank.

2. SAFE TRAVEL

⚠ WARNING PRECAUTIONS WHEN STARTING ENGINE

- Before starting the engine, always check that the parking brake is applied and that the directional and speed levers are in neutral. Depress the clutch pedal (for clutch type trucks), or the brake pedal (for TORQFLOW transmission trucks), firmly, and then start the engine.
- Adjust the operator's seat and the steering wheel before starting the engine. Always lock them in position after adjusting. Adjusting the seat or steering wheel during operation is dangerous and it may cause you to lose your balance or to operate the lift truck improperly.
- Before starting the engine, check that the surrounding area is safe. ALWAYS SIT IN THE OPERATOR'S SEAT when starting the engine.
- Before starting the engine, sound the horn to warn people in the area.
- With large-sized lift trucks, get off the lift truck and walk around it to check that no one is near the engine compartment, tires or counterweight, then get on the lift truck, sit in the operator's seat, and start the engine.



AB801120

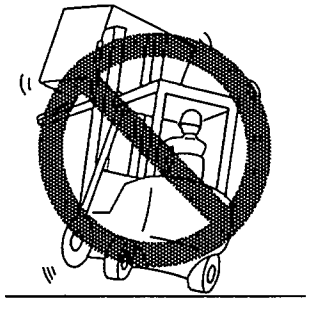
Do not attempt to start the engine by short-circuiting the engine starting circuit. Such an act may cause a serious bodily injury or fire.

⚠ WARNING PRECAUTIONS WHEN OPERATING DIRECTIONAL OR SPEED LEVERS

- When switching between FORWARD and REVERSE, always stop the lift truck. It is dangerous to change the direction of travel suddenly.
- When operating the directional lever or speed lever, always depress the clutch pedal before moving the lever (for clutch type lift trucks).
  If the lever is moved without disengaging the clutch, the lift truck will move suddenly and may cause injury.

⚠ WARNING TIPPING

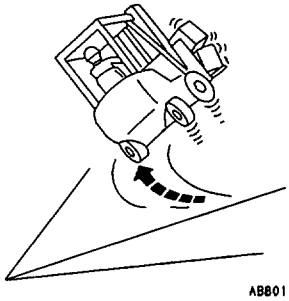
- If the load-engaging means or load is raised, the center of gravity of the lift truck will also rise and increase the danger of the lift truck tipping. Do not turn the lift truck when the forks are raised high.
- Do not suddenly raise the forks or tilt the mast to the front or rear when the forks are loaded. There is danger that the lift truck will tip.
- Reduce speed before turning the lift truck. In particular, when traveling unloaded, the rear of the lift truck is heavy.
- If the lift truck is turned at high speed, there is a greater chance of tipping than with the forks loaded.
- Always ensure that the hood is properly latched.



AB801130

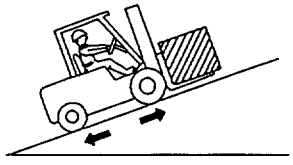
⚠ WARNING TRAVEL ON SLOPES

- Do not turn, or travel across or at an angle on slopes. There is danger that the lift truck will tip.
- Before starting to drive up a slope, stop the lift truck and adjust the clearance between the ground surface and the bottom of the forks so that the bottom of the forks or pallet do not contact the ground surface or the tip of the fork does not stick into the ground when traveling.

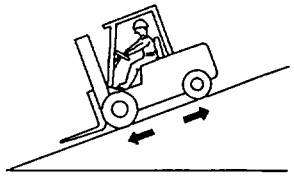


AB801140

- For safe travel on slopes:
  When loaded: Travel FORWARD up the slope and in REVERSE down the slope with the load upgrade.
  When unloaded: Travel in REVERSE up the slope and FORWARD down the slope with the load-engaging means downgrade.



- When traveling down slopes, use the braking force of the engine together with the foot brake, and travel slowly down the slope.

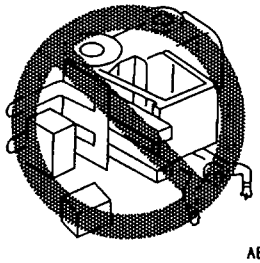


AB801150

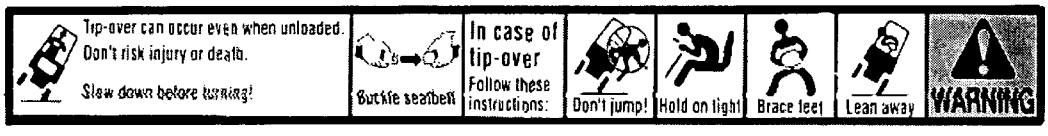
⚠ WARNING DO NOT JUMP OFF LIFT TRUCK EVEN IF IT TIPS

NEVER JUMP OFF the lift truck even if it seems that it will tip. Always do as follows:

- Hold the steering wheel securely.
- Stay in the operator's seat.
- Brace your legs.
- **If you jump off the lift truck when it turns over, there is danger that you will be fatally crushed under the lift truck.**
  Always stay in the operator's compartment if the lift truck turns over, then escape from the lift truck after it has stopped.
- Always wear the seat belt correctly.



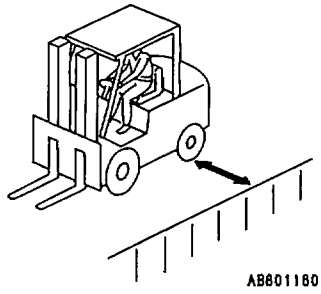
AB801880



KAC010449

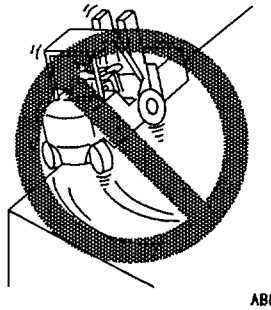
⚠ WARNING ROAD SHOULDER

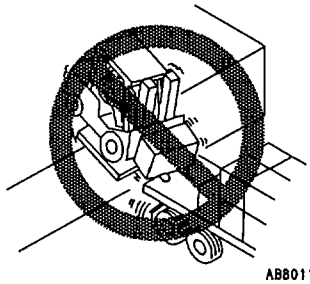
- There is danger that soft road shoulders may collapse, so do not go near them with the lift truck.
- Always maintain a safe distance from the edge of road shoulders and platforms.



⚠ WARNING LOADING HIGHWAY TRUCKS OR RAILROAD CARS

- **Do not travel on the edge of docks. There is danger that the lift truck may fall, which may result in serious injury or death.**
- Before starting operations, check the load limit for the gang-planks (dock boards), and do not use them if they do not have ample strength to take the weight of the lift truck when loaded.
- Apply the brakes on the highway truck and block the wheels.
- With trailers, use jacks and take steps to prevent the trailer from sinking when the forklift truck travels on it.
- When driving the forklift inside trucks, reduce speed when backing out and be sure to check that the gangplanks are safe.
- Be careful of pedestrians.
- Tell the truck driver not to move the truck until the operation is completed.
- If there is some system to secure the truck to the dock, always use this system. Secure the gangplanks so that they do not slip and fall.





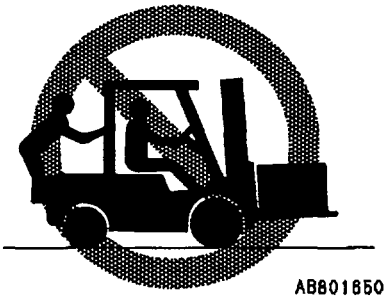
⚠ WARNING ESCAPING FROM A RAILROAD CROSSING

- If engine trouble occurs on a railroad crossing and the lift truck cannot move, you cannot use the starting motor to move the truck as can be done in automobiles. The lift truck's neutral safety switch prevents this action.
- In such an emergency, light a flare or smoke candle, to warn approaching trains, vehicles and pesons n the area that there is a broken down truck on the tracks.
- It is critically important to remove the lift truck from the tracks as soon as possible.

⚠ WARNING NO RIDERS

FORKLIFT TRUCKS ARE ONE-PERSON MACHINES.
Do not allow any other person to ride on the truck under any circumstances.
Never allow anyone to act as an extra counterweight.

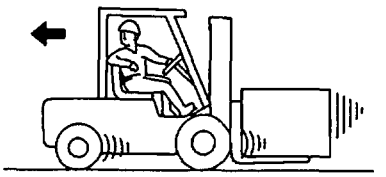
AD817960A



AB801850

⚠ WARNING DRIVING IN REVERSE

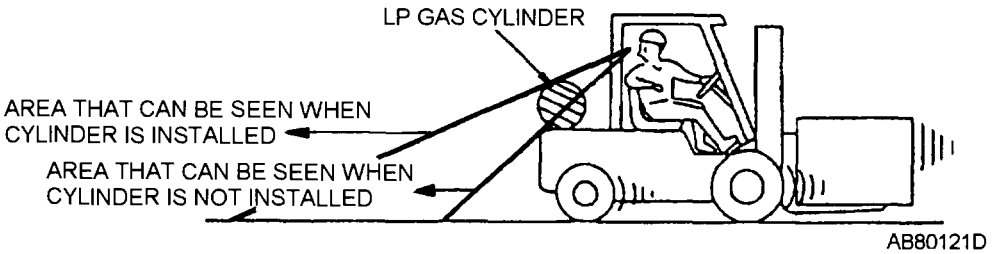
- When driving in REVERSE, turn to face the rear and check the area directly behind the lift truck.



AB801200

⚠ WARNING OBSTRUCTION OF REAR VIEW WHEN USING LP GAS FUEL

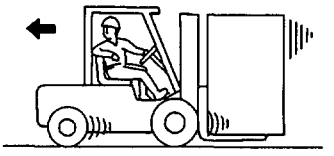
- The LP gas cylinder partially blocks the view to the rear, so there is danger of hitting personnel or products or buildings in the surrounding area.
  Install backup warning devices (backup buzzer, rotating backup lamp, etc.) or backup confirmation devices (rear view mirror, etc.) to warn personnel in the surrounding area and to confirm that the area to the rear is safe.
  Please contact your Komatsu Forklift distributor / dealer for details of installing such optional safety and warning equipment.



AB80121D

⚠ WARNING — WHEN FRONT VIEW IS POOR

- If the view to the front is obstructed by the load, turn to the rear and drive the forklift truck in reverse.
- When driving in reverse with a high load, use a signal person to ensure the safety of the load and the safety in the surrounding area.



AB801220

⚠ WARNING — CHECK BEFORE STARTING

- When checking the lift truck before starting, follow the procedure given in this Manual, and do not start the lift truck until all the checks have been completed.
- If anything abnormal is found, inform the person in charge and carry out the necessary repairs.

⚠ WARNING — LAMPS

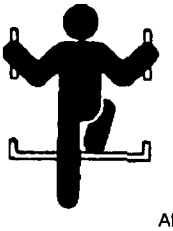
- Check that the lamps light up correctly. Replace any broken or inoperative bulbs.

⚠ WARNING — KEEP HANDS FREE FROM OIL AND WATER

- Do not drive the lift truck if your hands are wet or covered with oil. Your hands will slip on the work equipment control levers or directional lever, and this may cause a serious accident.

⚠ WARNING — MOUNTING AND DISMOUNTING

- **NEVER jump on or off the lift truck.**
- When getting on or off the lift truck, always stop the lift truck and use the handrails and steps to ensure that you support yourself.
- Never hold any control levers or the steering wheel when getting on or off the lift truck.
- If there is any oil, grease or mud on the handrails or steps, wipe it off immediately. Always keep these parts clean. Repair any damage.



AL187320

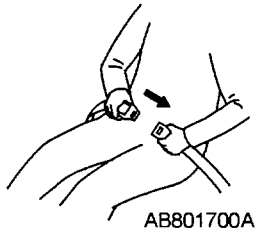
⚠ WARNING ALWAYS SIT IN OPERATOR'S SEAT

- Never operate the lift truck from outside the operator's compartment.
- Always keep your body under the overhead guard.
- Do not extend your arms and legs outside the operator's compartment.


AB801240

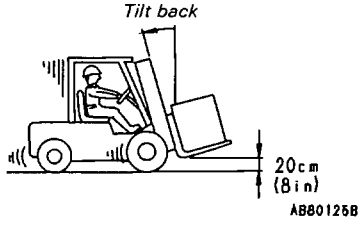
⚠ WARNING SEAT BELT

- Always wear your seat belt correctly when on the operator's seat. The seat belt will reduce the risk of injury.
- Always check the seat belt mounts and check for any damage to the seat belt itself. If any abnormality is found, repair or replace the seat belt immediately.


AB801700A

⚠ WARNING SAFETY WHEN STARTING

- Before starting and moving the lift truck, check that the surrounding area is safe.
- Before moving the lift truck, raise the forks (approx. 8 in. (20cm) from the ground surface), and tilt the mast back.
- Before moving the lift truck, release the parking brake.



AB801258

⚠ WARNING BRAKING WHEN TRAVELING

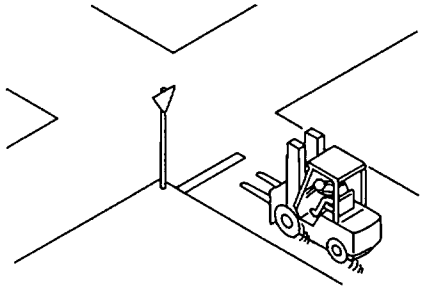
- Do not stop the engine when traveling. If the engine is stopped, the power steering (for lift trucks with power steering) and power brake (for trucks with power brakes) will not work.
- If the inching pedal is depressed, the braking effect of the engine will be lost.
- Do not use the brake excessively. Do not rest your foot on the brake pedal or inching pedal unless you are operating it.
  If you do, the brake will overheat and the braking effect will be lost.
  For TORQFLOW lift trucks, if you leave your foot on the inching pedal, the multiple disc clutch inside the transmission will overheat. In the worst case, the clutch discs will be deformed and the clutch will not function normally.

⚠ WARNING SAFETY DURING TRAVEL

- Keep a clear view of the path of travel and observe for other traffic, personnel and safe clearances.
- Yield the right of way to pedestrians,
- When passing oncoming vehicles, reduce speed and keep a safe distance from the other vehicle.
- In places where there are speed limits, observe the speed limit and maintain a safe distance from other vehicles.

⚠ WARNING CONFIRMING SAFETY

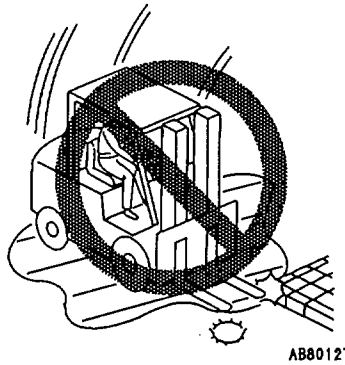
- When traveling, always pay careful attention to the area around your lift truck, particularly in the direction of travel or when turning.
- Do not pass other vehicles on narrow roads or at crossings or other places where the view is poor.
- When traveling through crossings or other places where the view is poor, or when entering or leaving narrow roads, stop and sound the horn to confirm safety before driving on.
- Even if you sound the horn, not everyone in the surrounding area will necessarily hear it. Always pay careful attention to the movements of people in the surrounding area.
- When crossing roads or turning corners, stop and confirm safety before continuing.
- Always pay careful attention to the movements of people in the surrounding area, and take steps to prevent people from entering the working area.



AB801280

⚠ WARNING SAFETY DURING TRAVEL

- Avoid traveling in places which are flooded or where there are holes.
- Do not try to drive the lift truck on soft ground.
- Avoid curbs, rails, ditches or other obstacles, and do not travel directly over them.
- Do not travel on slippery road surfaces.
- When entering buildings, check the weight limit of the floor and be careful not to exceed the limit.



AB801270

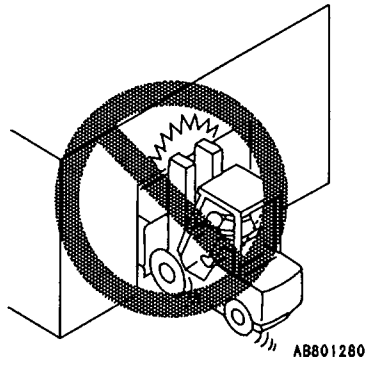
⚠ WARNING GIVE PRIORITY TO LOADED LIFT TRUCKS

- When traveling on slopes or in confined areas, unloaded lift trucks should always give the right of way to loaded trucks.

⚠ WARNING HEIGHT OR WIDTH LIMITS

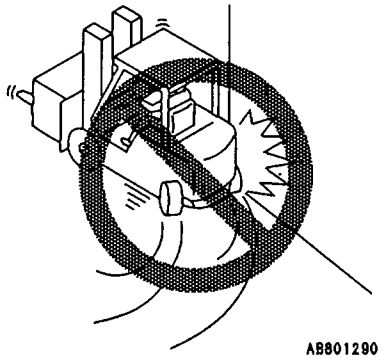
When going in or out of places with height or width limits:

- Ensure that there is ample height and width for the lift truck to pass.
- Do not extend your hands or legs outside the lift truck.
- Check that the surrounding area is safe.
- Be careful of electric wires and other obstacles inside and outside the building.



⚠ WARNING PRECAUTIONS WHEN TURNING

- When turning while traveling forward, the counterweight will swing far out. Keep an ample clearance from walls and other objects to ensure safety.
- When turning, travel slowly and be careful that the front or rear wheels do not come off the ground. When turning on soft road shoulders, there is danger that the rear wheels may come off the road shoulder and cause the lift truck to tip.



⚠ WARNING STOPPING DISTANCE

- When traveling downhill, it requires a longer distance for the lift truck to stop then when traveling on level ground.
- When traveling downhill, reduce the speed and make sure that you have ample room at the bottom of the slope to stop.
- When traveling on wet surfaces, it requires a longer distance to stop then when traveling on normal road surfaces. Always have ample room to stop.

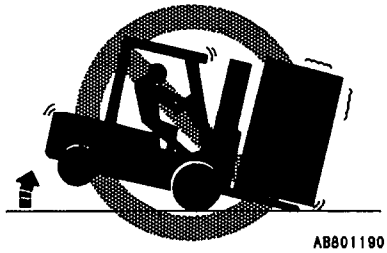
⚠ WARNING NO TOWING

If there is any problem with the brakes or steering system of your lift truck, do not use another lift truck to tow it.
There is danger that the lift truck may run away.

3. LOADING OPERATIONS

⚠ WARNING **NO OVERLOADING**

- Do not load the lift truck over the capacity set forth in the load capacity chart. If the rear wheels come off the ground because of overloading, the lift truck cannot travel or turn. There is also danger that it may tip.
- Always check the load capacity chart to confirm the loading capacity.



AB801190

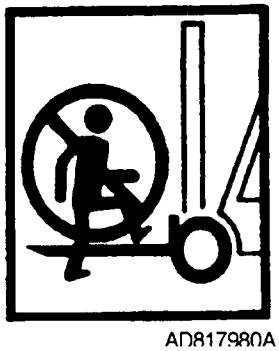
⚠ WARNING **DON'T GO UNDER FORKS**

- Never allow anyone to go under the load-engaging means or load when it is raised.
  The area under the forks is a danger area. If the forks come down, the person under the forks may be crushed, or seriously injured or killed.
- Never allow anyone to go under the load-engaging means or load even if it is elevated or sticked. It may fall down suddenly at any moment.

AD817970A

⚠ WARNING **DO NOT LIFT PEOPLE ON FORKS**

- Do not use the forks to lift people. If the person falls from the forks he/she may be seriously injured.



AD817980A

⚠ WARNING **BE CAREFUL NOT TO GET CAUGHT OR FALL**

- Never put your hands or feet into the mast structure. There is danger that you will get caught in moving parts and be seriously injured.

AB801320

- Do not use the mast as a ladder. If you slip, there is danger that you will fall.

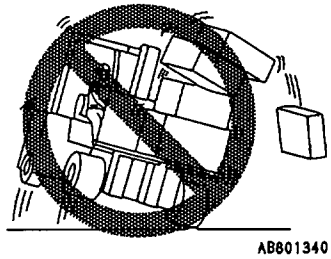
AB801330

⚠ WARNING **OPERATE FROM OPERATOR'S COMPARTMENT**

- Always operate the mast and forks from the operator's compartment.

⚠ WARNING **NO UNSTABLE LOADS**

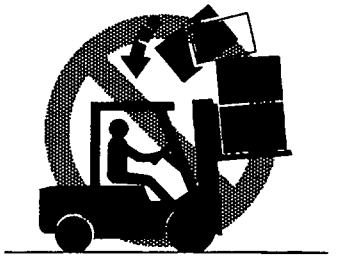
- Make sure that the center of gravity of the load is in line with the center of the lift truck. Do not carry loads off-center. There is danger that unbalanced loads may cause the lift truck to tip.
- Place the load so that it contacts the load backrest.
- Do not handle unstable loads. If there is danger that the load may fall off, secure it in position and take steps to prevent the load from collapsing or falling.
- When carrying stacked loads, tie with rope to prevent the load from falling.



AB801340

⚠ WARNING DO NOT LOAD ABOVE HEIGHT OF LOAD BACKREST

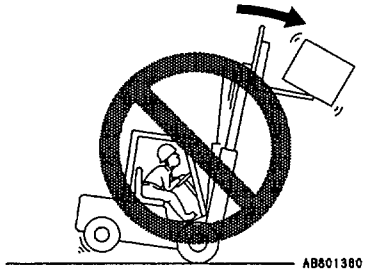
- Keep the height of the load within the height of the load backrest. Do not carry any load that is higher than the load backrest. If the load is higher than the load backrest, there is danger that it will fall back on top of the operator.
  This may lead to serious injury or death.



AB801350

⚠ WARNING DO NOT TILT MAST FORWARD WHEN LOADED

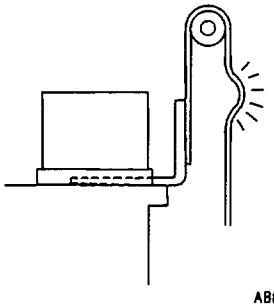
- Do not tilt the mast forward when the forks are loaded and raised. There is danger that the load may fall and that the lift truck may tip.
- Do not travel with the mast tilted forward.
- Do not load and unload on slopes.



AB801360

⚠ WARNING KEEP TENSION ON CHAIN

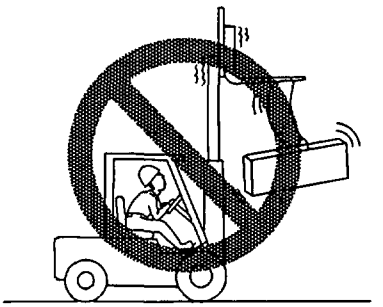
- If there is any slack in the chain, the mast rail or forks may catch in the load or a shelf, and there is danger that the load may fall and the lift truck tip.
  Always be careful that there is no slack in the chain when pulling the forks out from a pallet or shelf.



AB801370

⚠ WARNING USE ONLY FOR INTENDED PURPOSES

- Do not use the lift truck for anything other than the intended use (loading operations using the forks).
- Do not use the forks to open or close the doors of railroad cars or warehouses.
- Do not push any other vehicle.
- Do not hook ropes or cables on the forks and use the forks to lift loads.
- Do not use the drawbar pin for towing operations.



AB801380

⚠ WARNING LEVER OPERATION

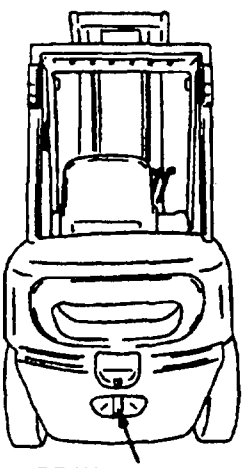
- Be careful not to operate the lever by mistake. There is danger that the forks or work equipment may cause serious injury.
- Do not operate the levers when getting off the lift truck.

⚠ WARNING USING DRAWBAR PIN

⚠ WARNING

Do not use the drawbar pin for towing other lift trucks, for being towed by other lift trucks, or for lifting operations.

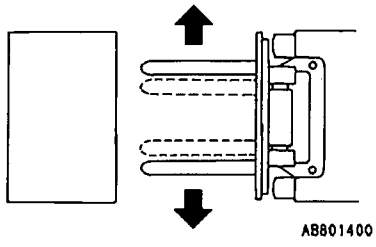
- The drawbar pin installed to the rear of the counterweight is used only to free the truck when the tires have become stuck in mud or in a ditch and the lift truck cannot move, or when loading the lift truck on to a trailer or truck.



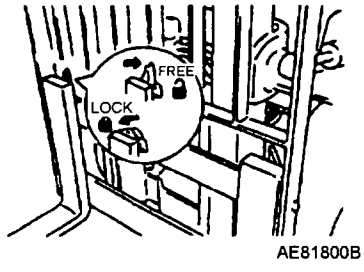
AE817998

⚠ WARNING **FIT FORKS SECURELY IN POSITION**

- When adjusting the position (width) of the forks, be careful not to get your hands caught.



- After adjusting, check that the forks are held securely in position by the fork stopper. If the forks are not held in position, there is a danger that the forks may move when the lift truck is traveling and the load may fall off.

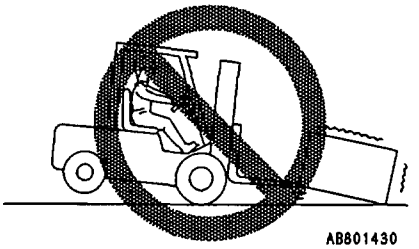


⚠ CAUTION **ADJUST CHAIN**

- Be sure the tension of the left and right chains is the same. (See CHECK BEFORE OPERATION). If the tension is not the same, the load will be unbalanced even if it is loaded correctly in the center, and there is danger that the lift truck may tip. (For details of adjustment, see page 2-26).

⚠ WARNING BE CAREFUL OF FORK TIPS

- Do not allow the tips of the forks to get close to people. The tips of the forks are pointed, so there is a risk that they may cause injury.
- Do not hook the tips of the forks under objects. If the forks slip out, there is danger that the lift truck or object may move unexpectedly.



AB801430

⚠ WARNING PEOPLE IN WORKING AREA

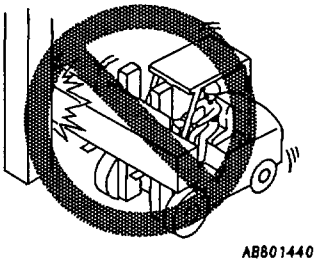
- Do not allow anyone except the signal person in the working area.
- Do not let any person or another lift truck come close during operation.
- When working with a signal person, always follow their instructions.

⚠ WARNING USE STRONG PALLETS AND SKIDS

- Always be sure that the pallets and skids have ample strength. If broken or damaged pallets or skids are used, there is a risk that the load may fall.

⚠ WARNING HANDLING LONG OR WIDE LOADS

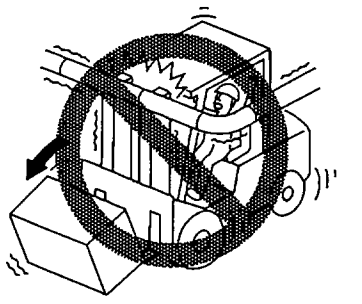
- Be extremely careful when carrying long or wide loads. Raise the load slowly and be careful not to touch anything in the surrounding area.
- Keep the load as low as possible and be sure to maintain the balance.
- When turning, operate slowly and be careful not to let the load move.



AB801440

WARNING **OVERHEAD OBJECTS**

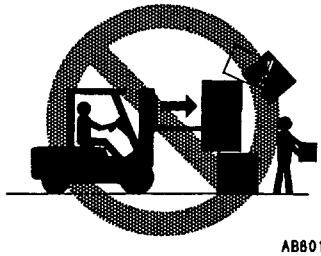
- Be careful not to let the mast, overhead guard or load contact electrical wiring, pipes, sprinklers or roof beams. If the truck hits such objects, there is a risk that the load will fall or the lift truck will tip. When the forks are raised, the mast height increases, so be particularly careful when the forks are raised.



AB801450

WARNING **NO PUSHING**

- Do not use the forks to push or pull loads. There is a risk that the load will be damaged or fall.



AB801460

WARNING **PRECAUTIONS WHEN LOADING / UNLOADING**

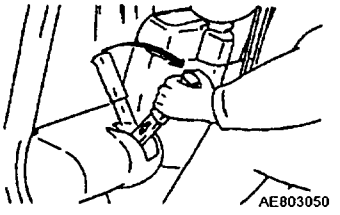
- Do not let anyone place a load on the forks.
- Do not let anyone remove a load directly from the forks.
- Standing on the forks is dangerous because the forks are slippery and the load may move.
- Do not use anyone to keep the load stable. The lift truck may move unexpectedly, causing the load to fall and crush the person.

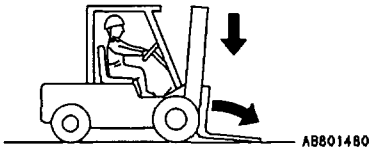
4. STOPPING AND PARKING

WARNING **PRECAUTIONS WHEN STOPPING OR PARKING**

Observe the following procedure when stopping or parking the lift truck:

1) Stop the lift truck on level ground.
2) Apply the parking brake securely to make sure that the lift truck cannot move.
3) Set the directional lever and the speed lever to neutral.
4) Lower the forks to the ground.
5) Turn the key switch OFF to stop the engine.
6) Remove the key from the key switch. Then get off the lift truck.



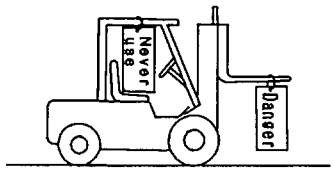


WARNING **PARKING**

- Park the lift truck in the specified place.
- Park the lift truck on a firm surface.
- Do not park near any emergency exit, stairway, fire extinguisher or other safety equipment. Park the lift truck in a place where it will not obstruct pedestrians or other vehicles.
- Never park the lift truck near any flammable object.
- When parking the lift truck on a slope, park as specified above (PRECAUTIONS WHEN STOPPING OR PARKING), then put blocks under the tires to prevent the lift truck from moving.
- Do not park near any holes for construction or elevator shafts. If LPG leaks, it can accumulate and cause fire or explosion.

⚠ WARNING PARKING MACHINE AFTER FAILURE

- If the lift truck has suffered a failure and the lift truck must be parked without lowering the forks, put markers on the tips of the forks and take steps to prevent pedestrians or other vehicles from hitting the forks.
- Select a parking place where people or vehicles do not pass, and stop the lift truck so that it is difficult for anyone to go under the forks. (The area under the forks is a DANGER zone).
- Place a stand or something similar under the inner mast rail or forks to prevent unexpected drop of the forks.
- Remove the key from the faulty lift truck and hang signs in the operator's compartment to prevent its use.



AB801498

⚠ WARNING ABRUPT LOWERING OF STUCK FORK

- Because a stuck fork may drop down unexpectedly, do not go under the fork when it is in this condition.
- Be very careful when dealing with this problem to prevent damage or injury, and warn those in the work area.

5. INSPECTION AND MAINTENANCE

⚠ WARNING **USE QUALIFIED PERSONNEL FOR INSPECTION AND MAINTENANCE**

- Only persons authorized by the owner or operator of the equipment and having proper certification (local or national) may carry out inspection, maintenance and repairs of the lift truck.
- If inspection, maintenance or repair work is carried out incorrectly, it is very dangerous.

⚠ WARNING **MAINTENANCE LOCATION**

- When carrying out inspection and maintenance, use a level, dry, dust-free area.
- If the work is carried out inside a building, make sure that there is ample ventilation.

⚠ WARNING **PRECAUTIONS FOR INSPECTION AND MAINTENANCE**

- To be prepared in the event of a fire, have a fire extinguisher nearby and make sure that you know how to use it.
- Before carrying out inspection, lower the forks to the ground and stop the machine.
- Do not run the engine unless it is necessary.
- Place the directional lever, speed lever and work equipment control levers in neutral.

⚠ WARNING **PRECAUTIONS WHEN CARRYING OUT INSPECTION AND MAINTENENCE**

- Wipe off any oil or grease. Immediately wipe up any oil that has leaked. If the lift truck is dirty, it becomes difficult or impossible to find cracks or other problems. Always clean the lift truck before starting inspection.
- Do not smoke or allow any flame to exist under any circumstances. Do not use any cloth which is soaked in fuel, flammable solvent, oil or grease. There is danger that it may catch fire.
- Wear suitable clothes for the job.
- Use suitable safety and protective equipment (hard hat, safety boots, safety glasses, gloves) for the job.
- When working on top of the lift truck, be careful not to fall.
- Do not put your feet under the forks.
- When opening or closing the floor plate or engine hood, be careful not to get your hands or body caught.
- When carrying out inspection with the forks raised, insert a stand under the inner mast to prevent the forks and mast from dropping.
- When carrying out the job with another worker, decide who is the leader and carry out the job in accordance with instructions from that person.
- After repairing, make sure that the trouble has been corrected by performing a trial run.
- During the trial run, start and operate the lift truck carefully because it is possible that the trouble has not been fully corrected or that defective parts have not been removed.

⚠ CAUTION USE SUITABLE TOOLS

- Always use tools that are suited for inspection and maintenance.
- It is extremely dangerous to use broken tools or tools designed for another purpose.

A0055120

⚠ WARNING REPLACE SAFETY CRITICAL PARTS PERIODICALLY

- Even if no abnormality is found, always replace safety critical parts periodically. As time passes, these parts deteriorate and may cause fire or failure in the work equipment system.
- However, if these parts show any abnormality before the replacement interval has passed, they should be repaired or replaced immediately.

⚠ WARNING PRECAUTIONS WITH HIGH TEMPERATURE COOLANT

- Immediately after using the lift truck, the engine coolant is at high temperature (HOT!) and high pressure. Do not remove the radiator cap under these conditions. Hot water may spurt out and cause burns.
- When removing the radiator cap, use a rag and turn it slowly to release the internal pressure.
- When checking the coolant level, stop the engine and wait for the engine to cool down before checking. For lift trucks equipped with a sub-tank or reservoir, check the level in the sub-tank.
- When adding water on lift trucks equipped with a sub-tank, add the water to the sub-tank.

A0055050

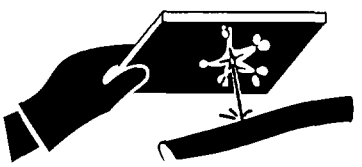
⚠ WARNING PRECAUTIONS WITH HIGH PRESSURE, HIGH TEMPERATURE OIL

- Immediately after using the lift truck, the oil is at high temperature. Do not drain the oil or replace the filter when the oil is hot. Hot oil may spurt out and cause burns.
- When carrying out inspection and maintenance, wait for the oil temperature to go down, and carry out the operation in the order given in this manual.
- Do not forget that the work equipment circuits are always under pressure. Do not add oil, drain oil or carry out maintenance or inspection before completely releasing the internal pressure. (For details on releasing the oil pressure, see page 3-37).
- If oil is leaking under high pressure from holes, it is dangerous if the jet of high-pressure oil hits your skin or eyes. Always wear safety glasses and thick gloves, and use a piece of cardboard or a sheet of plywood to check for oil leakage.
- Release the internal pressure before checking the accumulator piping.
- If you are hit by a jet of high-pressure oil, consult a doctor immediately.

INCORRECT

A0055180

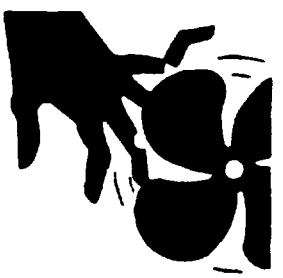
CORRECT



A0055190

⚠ WARNING ROTATING FAN AND BELT

- It is extremely dangerous if you or any tool touches or gets caught in the fan or fan belt when the fan is rotating. Never touch the fan when it is rotating.
- Always stop the engine before inspecting rotating parts.
- When inspecting the areas around rotating parts, do not allow anything to come close which may get caught.



AB801500A

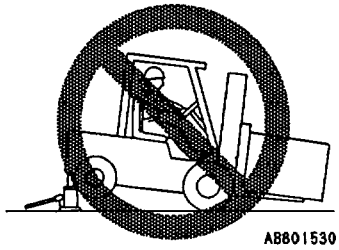
⚠ WARNING HANDLING TIRES

Disassembly and assembly of tires should be carried out by a tire dealer.
The tire pressure is extremely high, so caution is needed when handling tires.

- The wheel is fitted with mounting (lug) nuts. It also has rim nuts and bolts used to join the rim halves. When removing the tire from the lift truck, do not loosen the rim nuts and bolts. The tire is under high pressure, and there is a significant risk that the rim nuts and bolts may fly off. Relieve tire inflation pressure before removing.
- When the tires have been replaced, carry out a test drive and check again for any loose mounting bolts. If the tightening torque is low, tighten to the specified torque.

⚠ WARNING JACKING UP LIFT TRUCK (when checking or replacing tires)

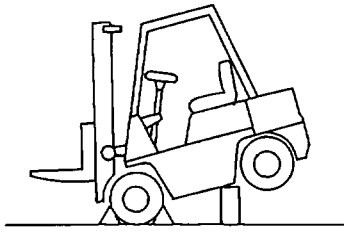
- Do not go under the fork lift truck when it is jacked up.
- Check the following before jacking up the lift truck. (For details, see page 3-41).
  1) Check that there is no one on the lift truck.
  2) Check that there is no load on the forks.
- When jacking up, stop when the tires come off the ground surface. Put blocks under both sides of the frame to prevent the lift truck from coming down.
- Put blocks under any tires contacting the ground to prevent the lift truck from moving.



AB801530

⚠ WARNING LIFTING LIFT TRUCK (when checking tires)

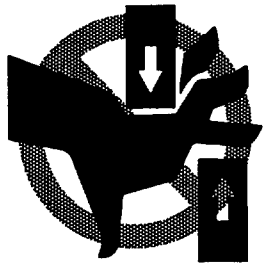
- Lift truck slinging work should be carried out by a qualified person who has completed a course in correct lifting methods.
- Fit wire ropes to the specified lifting points.
- When lifting the lift truck, check that the wire ropes have ample strength and are not damaged.
- Block the tires contacting the ground to prevent the lift truck from moving.
- Insert blocks to prevent the lift truck from coming down.
- Do not go under the lift truck during the lifting operation.
- If the specified lifting point is the counterweight, check that the counterweight mounting bolts are tightened to the specified torque before carrying out the lifting operation. Check also that there is no damage to the lifting portion on the counterweight.



AB801540

⚠ WARNING **BE CAREFUL NOT TO GET CAUGHT OR FALL**

- NEVER put your hands or feet into the mast structure. There is danger that you will get caught in moving parts and be seriously injured.



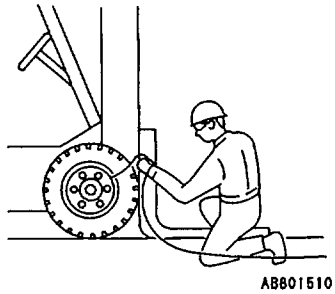
AB801320

- Do not use the mast as a ladder. If you slip, there is danger that you will fall.

AB801330

⚠ DANGER **CHECKING AND INFLATING TIRES**

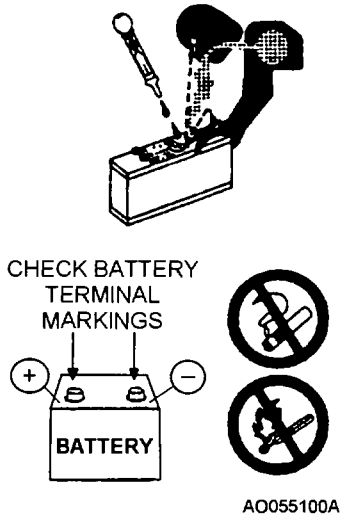
- If the tire inflation pressure is low, it will affect truck stability. However, do not inflate the tires immediately. The inflation pressure may have gone down because of damage to the rim. If the rim is damaged or cracked and the tires are inflated, there is danger that the rim will break when the tire is under high pressure, and this may cause personal injury or death.
- For safety, when checking tire pressure, place your body in front of the tread face of the tire. Do not check from the side face of the tire.
- Suitable qualifications are needed for tire inflation work. Always have the work carried out by properly qualified personnel.
- The tire inflation pressure on a forklift truck is several times higher than the pressure on an automobile. When the tires are being inflated, there is danger that dirt or dust may be thrown up by the compressed air and enter your eyes. Always wear safety glasses to protect your eyes.



AB801510

⚠ WARNING BATTERY HAZARD PREVENTION

- Battery electrolyte contains sulfuric acid and can quickly burn the skin and eat holes in clothing. If you spill electrolyte on yourself, immediately flush the area with a large quantity of water.
- Battery electrolyte can cause blindness if splashed into the eyes. If electrolyte gets into your eyes, flush them immediately with large quantities of water and consult a doctor at once.
- If you accidentally drink electrolyte, drink a large quantity of water or milk mixed with beaten egg white or vegetable oil. Call a doctor or poison control center immediately.
- When working with batteries, ALWAYS wear safety glasses or goggles.
- Batteries generate hydrogen gas. Hydrogen gas is highly EXPLOSIVE, and is easily ignited with a small spark or flame. Do not smoke or create any spark near a battery.
- Before working with batteries, stop the engine and turn the starting switch to the OFF position.
- When removing the battery, remove the cable from the negative (-) terminal first. When installing the battery, install the cable to the positive (+) terminal first. This prevents possible sparks or arcing between the positive terminal and the positive cable.
- Avoid short-circuiting the battery terminals through accidental contact with tools or other metal objects across the terminals.
- Tighten the battery terminals securely. Loose terminals can generate sparks and lead to an explosion.
- When removing or installing the battery, confirm which is the positive (+) terminal and which is the negative (-) terminal. Be careful not to connect the cables to the opposite / incorrect terminals.
- Tighten the battery caps securely.
- When cleaning the battery, leave the battery caps tightened.



AO055100A

⚠ WARNING DO NOT PUT METAL OBJECTS ON TOP OF BATTERY

- Never place any metal objects on top of the battery. There is danger that they will cause a short circuit and start a fire.

⚠ WARNING CHANGING LPG FUEL TANKS

- Only trained and certified personnel may change LPG tanks.
- Turn ignition switch to the OFF position.
- Change LPG tanks in designated and well ventilated area approved for this operation.
- Check LPG tank and lines for fuel leaks.
- Ensure no sparks, flame or ignition sources are present.
- Once the full tank is in place, ensure it is mounted correctly and securely. Check all connections.
- Do not attempt to start the truck until all LPG odor is gone.
- If the truck is hard to start, contact a certified mechanic to repair the problem. Tag the truck "Out of Service" until properly repaired.

WARNING **PRECAUTIONS WHEN CHARGING**

When the battery is charged, hydrogen gas is generated and the battery is heated by the chemical change. To prevent the danger of gas explosion, always do as follows:

- Carry out the charging operation in a well-ventilated place.
- Do not smoke or allow any flame.
- Start the charging operation when the temperature of the battery electrolyte is below 95° F (35° C). If the electrolyte temperature goes above 122° F (50° C) during the charging operation, wait for it to go down below 95° F (35° C) before starting charging operation again.
- When using a battery charger to charge the battery, take the battery caps off.

WARNING **STARTING WITH BOOSTER CABLES**

- ALWAYS wear safety glasses or goggles when starting the lift truck with booster (jumper) cables.
- When starting using the battery of another lift truck, do not allow the two lift trucks to touch.
- Stop the engine before connecting the cables.
- Be extremely careful not to let the cables get caught in the fan or fan belt.
- Connect the batteries in parallel; positive-to-positive and negative-to-negative. NEVER connect positive to negative.
- DO NOT short-circuit the starter terminals to start a forklift truck.

WARNING **DO NOT PUSH START**

- Do not push the lift truck to start the engine. There is danger that the lift truck may suddenly start and operate unexpectedly.

WARNING **HANDLING BRAKE FLUID**

It is dangerous if the brakes do not work because, in this condition, the lift truck cannot be stopped. Always do the following:

- Check the level of the brake fluid periodically.
- Always use the specified brake fluid.
- Check that the breather of the brake fluid reserve tank is not clogged.
- Be careful not to let dirt or dust get into the brake fluid reserve tank.

⚠ WARNING HANDLING ANTIFREEZE

- Antifreeze can be flammable. Keep away from flame when handling.
- Antifreeze is poisonous, so do not drink it. If you drink it by mistake, drink large amounts of water, vomit it out, and get medical attention immediately. Follow safety precautions on container.

⚠ CAUTION WASTE MATERIALS

- Obey appropriate laws and regulations when disposing of harmful items and materials such as oil, fuel, solvent, filters and batteries.

INCORRECT

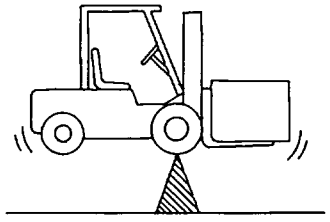
AB801580

6. STRUCTURE AND STABILITY OF THE LIFT TRUCK (TO PREVENT LIFT TRUCK FROM TIPPING)

To operate the lift truck safely, it is important to understand the structure and stability of the lift truck.

⚠ CAUTION STRUCTURE OF LIFT TRUCK

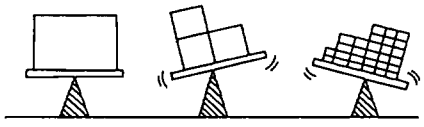
A forklift truck consists basically of the lifting mechanism (the forks and mast) at the front and the lift truck itself (with tires) at the rear.
The front wheels of the lift truck act as the fulcrum, and the center of gravity of the lift truck and center of gravity of the load are kept in balance.
The relationship between the position of the center of gravity of the lift truck and the center of gravity of the load is extremely important for maintaining the safety of the lift truck.



AB801570

⚠ CAUTION CENTER OF GRAVITY OF LOAD

The loads carried by forklift trucks come in various shapes (and weights) from boxes to planks and long objects. To judge the stability of the lift truck, it is important to distinguish the position of the center of gravity for loads of various shapes.

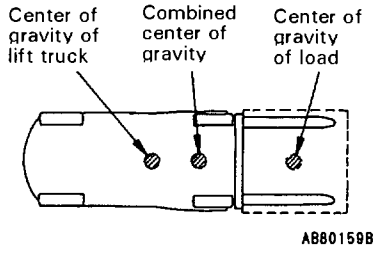


AB801580

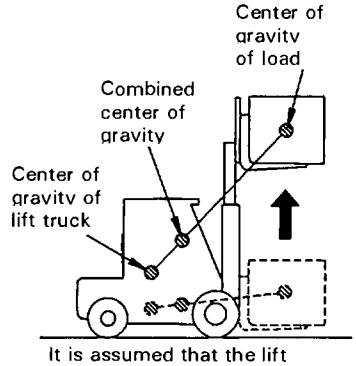
⚠ CAUTION CENTER OF GRAVITY AND STABILITY

The stability of the lift truck is determined by the position of the combined center of gravity resulting from the combination of the centers of gravity of the lift truck and the load.
When the lift truck is carrying no load, the center of gravity remains as it is, but when the lift truck is loaded, the combined center of gravity becomes the combination of the centers of gravity of both the lift truck and the load.
The position of the center of gravity of the load changes according to whether the mast is tilted forward or back or whether the mast is raised or lowered.
The position of the combined center of gravity of the lift truck is governed by the following factors:

- Size, weight, shape of load
- Lifting height
- Tilting angle of mast
- Inflation pressure of tires
- Acceleration, deceleration, turning radius
- Condition of road surface, angle of road
- Type of attachments



AB80159B

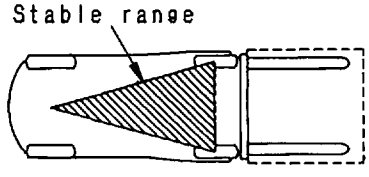


It is assumed that the lift truck body is constant. AB80160B

⚠ CAUTION STABLE RANGE OF CENTER OF GRAVITY

For the lift truck to be stable, the position of the combined center of gravity must be inside the triangle (stable range of center of gravity) formed by the ground contact points of the left and right front tires and the center of the rear axle.

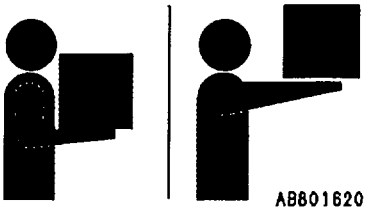
If the position of the overall center of gravity is in front of the front axle, the front tires will form the fulcrum and the lift truck will tip to the front. If the position of the combined center of gravity moves outside the triangle forming the stable area for the center of gravity, the lift truck will tip in the direction where the combined center of gravity moves outside of the triangle.



AB80161B

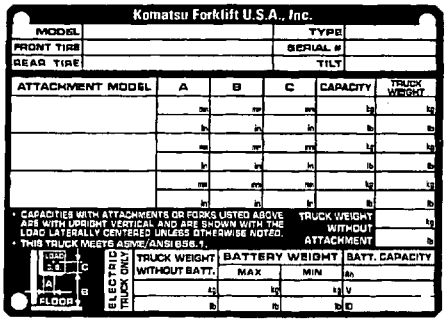
⚠ CAUTION MAXIMUM LOAD (weight and center of gravity of load)

The horizontal distance between the center of gravity of the load on the forks and the load backrest of the forks, or the front face of the forks (whichever is shorter), is called the load center.
The maximum load is the maximum weight of the load that can be loaded at the standard load center. The relationship between the maximum load and the load center is given in the load capacity charts on the nameplate on the lift truck. If the load center moves to the front of the forks, the overall center of gravity also moves to the front, so this means that the load must be reduced.



⚠ CAUTION ALLOWABLE LOAD

The allowable load is stamped on the nameplate to show the relationship regarding the position of the load center, the height of the fork and the maximum load. Before loading the forks, check that the load and load center are within the permitted range on the stamped allowable load.
If the shape of the load is complex, set it so that the heaviest part of the load is at the center of the forks and set the load close to the load backrest.
If the forks are loaded more than the allowable value, the drive wheels will float during travel and the steering system will not work. This is very dangerous. Furthermore, the lift truck will tip over easily under this condition. Therefore, be sure to keep the load below the allowable value and prop-

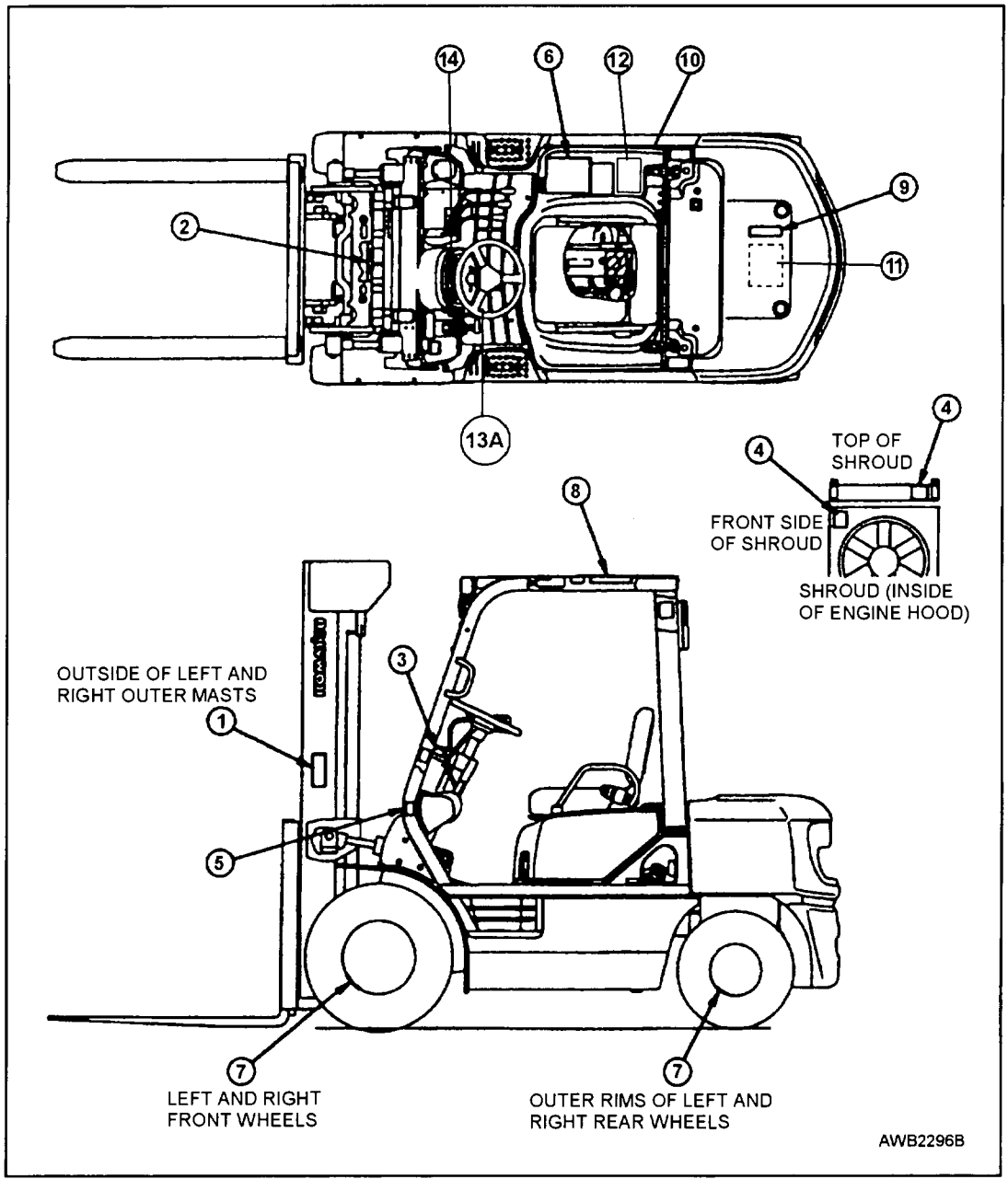


⚠ WARNING SPEED AND ACCELERATION

If a stationary object is not subjected to external force, it will remain stationary. In the same way, if a moving object is not subjected to external force, it will continue to move at the same speed. This is called inertia.
Because of inertia, a force is applied towards the rear when the lift truck starts to move, and is applied towards the front when the lift truck stops. If the brakes are applied suddenly, there is danger of a large force being applied towards the front which may make the lift truck tip or the load come off the forks.
When the lift truck is turned, a centrifugal force is applied to the outside from the center of the turn. This force pushes the lift truck to the outside and makes it tip. The range of stability to the left and right is particularly small, so it is necessary to reduce speed when turning, in order to prevent the lift truck from tipping. If the lift truck is traveling with a raised load, the position of the overall center of gravity is high, so the danger of tipping to the front, left or right becomes greater.

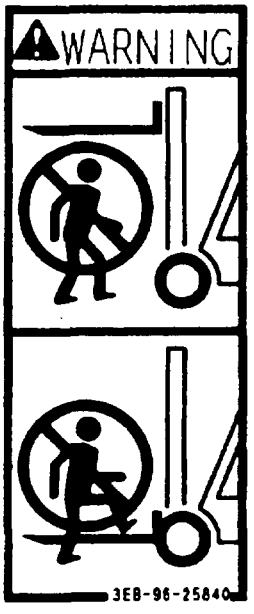
SAFETY LABEL LOCATIONS

Keep these labels clean. If a label (decal) comes off, stick it on again in the same location or replace with a new one. Treat all labels (decals) in the same way whether they are safety related or not.



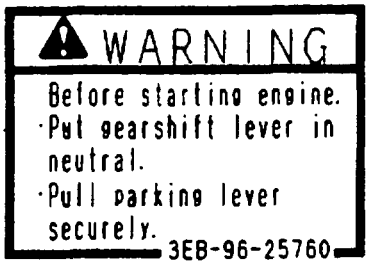
See following pages for labels corresponding to numbered locations in Figure above.

1. Prohibit the operator from riding on the forks and lifting or lowering himself. Never enter the area under the forks. (Part No. 3EB-96-25840)



2. Do not put your hand on the mast! (Warning to avoid getting hand caught) (Part No. 3EB-96-25850)

3. Caution before operating machine. (Part No. 3EB-96-25760)



4. Never touch fan when rotating. (Part No. 3EB-96-25770)

5. No one is permitted to ride the lift truck together with the operator. (Part No. 3EB-96-25740)

6. **Warning for operation (Decal)**
   (Part No. 3EB-96-25720)

⚠ WARNING

SERIOUS INJURY OR DEATH MAY RESULT IF YOU FAIL TO FOLLOW THESE PRECAUTIONS!

Before Operating

- Do not operate or repair truck unless trained and authorized.
- Read and understand all warnings and instructions in manuals and on truck before operating.
- Contact forklift dealer for replacement manuals.
- Check truck before use. If truck is in need of repair, do not operate until restored to safe condition.
- Do not start truck if fuel is leaking or has leaked.

While Operating

- Operate truck only from operator's seat.
- Keep truck under control at all times.
- Do not overload truck. Check capacity plate for load weight and load center.
- Avoid any sudden starts, stops, turn or change of direction.
- Obey traffic safety rules. Yield right-of-way to pedestrians.
- Keep clear view of travel path. If load being carried blocks forward view, travel with load trailing.
- Slow down and sound horn when vision is blocked.
- Watch clearances, especially forks, mast, overhead guard and tailswing area.
- Slow down for turns and on uneven or slippery surfaces.
- Avoid running over loose objects.
- Never angle or turn on incline.
- Travel with load uphill when loaded.
- Travel with lifting mechanism downhill when empty.
- Secure dockboard or bridgeplate properly.
- Do not exceed rated capacity.
- Use special care when operating on dockboard or bridgeplate.
- Do not handle unstable loads or loosely stack loads.
- Do not handle loads higher than load backrest.
- Space forks as far as load permits.
- Be sure load is centered and forks are completely under load.
- Never tilt load with mast tilted forward.
- Do not tilt forward when elevated except to pick up or deposit load.
- Travel load or lifting mechanism low and tilted back.
- Tipover can occur if operated improperly.
- Do not jump if truck begins to tip over. Hold on firmly and lean away from point of impact. Avoid being trapped between truck and ground.

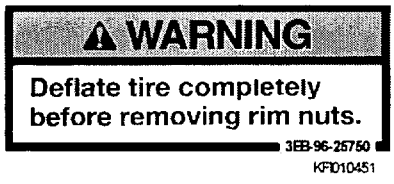
General Precautions

- Allow no one to stand or pass under or near load or lifting mechanism.
- Never place any part of body into mast structure, between mast and truck or outside truck.
- Do not carry passengers on any part of truck.
- Lift no one under any circumstances.
- Do not operate without overhead guard and load backrest.
- Fill fuel or charge battery only in specified place.
- Stop engine when fueling and avoid open flame or sparks, and provide adequate ventilation.
- Keep vent caps clear when charging battery.
- Disconnect battery during servicing.

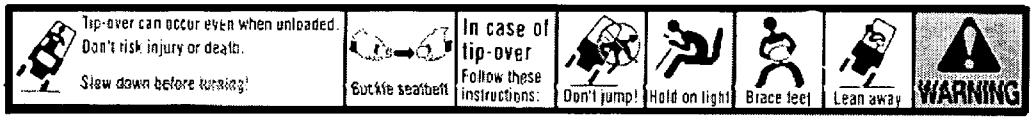
After Operating

- Before getting off truck, shift F-R lever and high-low lever (clutch-type) to neutral position, fully lower lifting mechanism and pull parking lever securely.
- Shut off power when leaving truck unattended.
- Block wheels when parking on incline.

7. **Warning for use of split rim (Only pneumatic tires)(Decal)**
   (Part No. 3EB-96-25750)

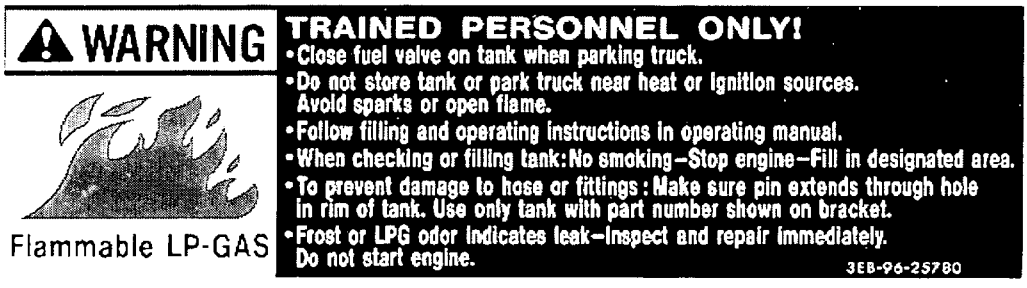


8. Prevention of tip-over (Decal)
(Parts No. 3EB-96-25730)



KAC010449

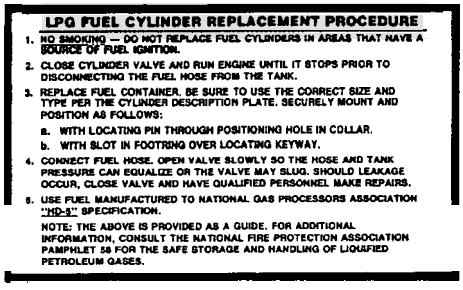
9. Warning for handling LPG/FLAMMABLE GAS (Decal)
(Part No. 3EB-96-25780)



KF1010448

10. "NO JUMP START" Decal (Part No. 09842-A0481)
Located top center of starter solenoid.

11. LPG TANK CHANGE INSTRUCTIONS DECAL (On LPG Tank Bracket Base Plate)



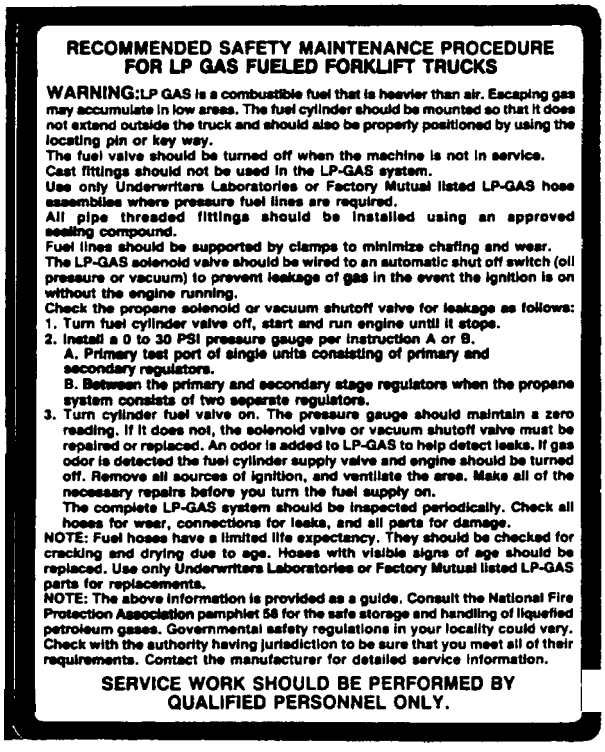
LPG FUEL CYLINDER REPLACEMENT PROCEDURE

1. NO SMOKING — DO NOT REPLACE FUEL CYLINDERS IN AREAS THAT HAVE A SOURCE OF FUEL IGNITION.
2. CLOSE CYLINDER VALVE AND RUN ENGINE UNTIL IT STOPS PRIOR TO DISCONNECTING THE FUEL HOSE FROM THE TANK.
3. REPLACE FUEL CONTAINER. BE SURE TO USE THE CORRECT SIZE AND TYPE PER THE CYLINDER DESCRIPTION PLATE. SECURELY MOUNT AND POSITION AS FOLLOWS:
   a. WITH LOCATING PIN THROUGH POSITIONING HOLE IN COLLAR.
   b. WITH SLOT IN FOOTRING OVER LOCATING KEYWAY.
4. CONNECT FUEL HOSE. OPEN VALVE SLOWLY SO THE HOSE AND TANK PRESSURE CAN EQUALIZE OR THE VALVE MAY SLUG. SHOULD LEAKAGE OCCUR, CLOSE VALVE AND HAVE QUALIFIED PERSONNEL MAKE REPAIRS.
5. USE FUEL MANUFACTURED TO NATIONAL GAS PROCESSORS ASSOCIATION "HD-5" SPECIFICATION.

NOTE: THE ABOVE IS PROVIDED AS A GUIDE. FOR ADDITIONAL INFORMATION, CONSULT THE NATIONAL FIRE PROTECTION ASSOCIATION PAMPHLET 58 FOR THE SAFE STORAGE AND HANDLING OF LIQUIFIED PETROLEUM GASES.

KFOM0003

12. LPG SAFETY MAINTENANCE DECAL (Right side of seat on hood upper surface)



RECOMMENDED SAFETY MAINTENANCE PROCEDURE FOR LP GAS FUELED FORKLIFT TRUCKS

WARNING: LP GAS is a combustible fuel that is heavier than air. Escaping gas may accumulate in low areas. The fuel cylinder should be mounted so that it does not extend outside the truck and should also be properly positioned by using the locating pin or key way.

The fuel valve should be turned off when the machine is not in service.

Cast fittings should not be used in the LP-GAS system.

Use only Underwriters Laboratories or Factory Mutual listed LP-GAS hose assemblies where pressure fuel lines are required.

All pipe threaded fittings should be installed using an approved sealing compound.

Fuel lines should be supported by clamps to minimize chafing and wear.

The LP-GAS solenoid valve should be wired to an automatic shut off switch (oil pressure or vacuum) to prevent leakage of gas in the event the ignition is on without the engine running.

Check the propane solenoid or vacuum shutoff valve for leakage as follows:

1. Turn fuel cylinder valve off, start and run engine until it stops.
2. Install a 0 to 30 PSI pressure gauge per instruction A or B.
   A. Primary test port of single units consisting of primary and secondary regulators.
   B. Between the primary and secondary stage regulators when the propane system consists of two seperate regulators.
3. Turn cylinder fuel valve on. The pressure gauge should maintain a zero reading. If it does not, the solenoid valve or vacuum shutoff valve must be repaired or replaced. An odor is added to LP-GAS to help detect leaks. If gas odor is detected the fuel cylinder supply valve and engine should be turned off. Remove all sources of ignition, and ventilate the area. Make all of the necessary repairs before you turn the fuel supply on.

The complete LP-GAS system should be inspected periodically. Check all hoses for wear, connections for leaks, and all parts for damage.

NOTE: Fuel hoses have a limited life expectancy. They should be checked for cracking and drying due to age. Hoses with visible signs of age should be replaced. Use only Underwriters Laboratories or Factory Mutual listed LP-GAS parts for replacements.

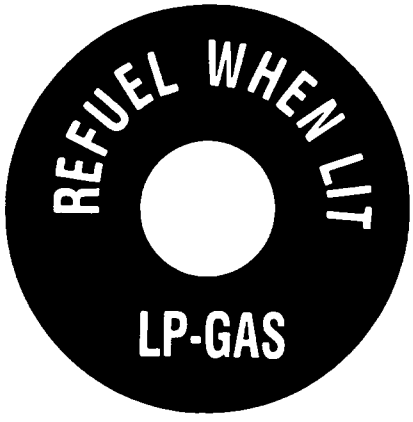
NOTE: The above information is provided as a guide. Consult the National Fire Protection Association pamphlet 58 for the safe storage and handling of liquefied petroleum gases. Governmental safety regulations in your locality could vary. Check with the authority having jurisdiction to be sure that you meet all of their requirements. Contact the manufacturer for detailed service information.

SERVICE WORK SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

KFOM0004

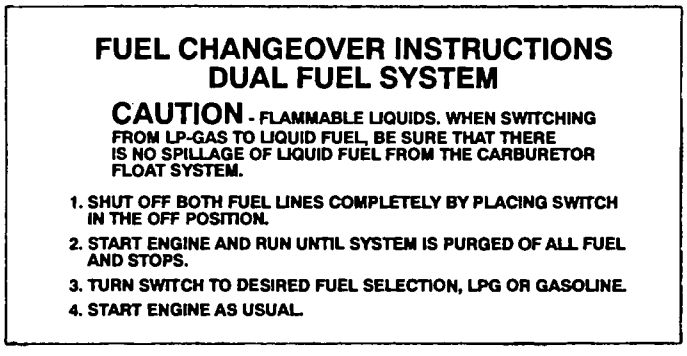
13. LPG FUEL SYSTEM DECALS

A. LPG LOW FUEL ALARM LIGHT (On dashboard to left of steering column)(OP)



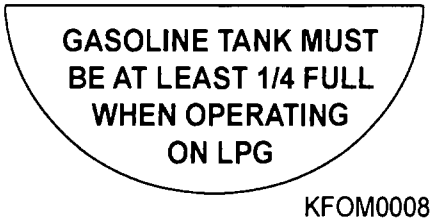
KFOM0006

B. DUAL-FUEL SYSTEM FUEL CHANGE-OVER INSTRUCTIONS (On Air Cleaner housing) (Not illustrated in Fig. AWB2296B)



KFOM0007

14. FUEL LEVEL REQUIREMENTS - GASOLINE AND LPG (On dashboard over Fuel Gauge)(Dual-Fuel applications only)



KFOM0008

KFOM0009

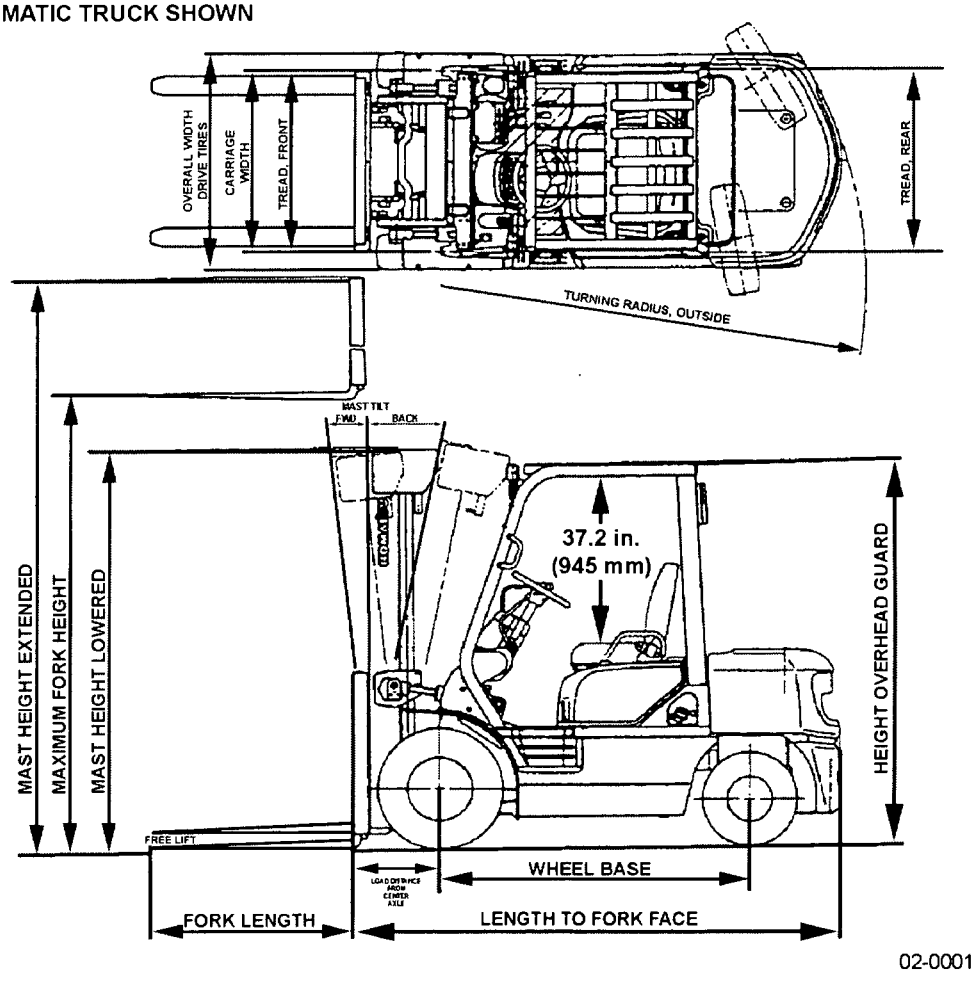
SPECIFICATIONS - MAST DATA & FEATURES - INDOOR & OUTDOOR TRUCKS

FG15HC-17 **FG18HT-17**

FG15HT-17 **FG18ST-17**

FG15ST-17

PNEUMATIC TRUCK SHOWN



SPECIFICATIONS - MAST DATA & FEATURES (CON'T)

MAXIMUM FORK HEIGHT in. (mm)	MAST HEIGHT in. (mm)*		FREE LIFT in. (mm)*
	Lowered in. (mm)	Extended* in. (mm)	
"Free View" FG15/18-17 2-Stage Free View (FV)			
106.0 (2,690)	74.5 (1,890)	154.0 (3,910)	5.5 (140)
116.0 (2,945)	79.5 (2,020)	164.0 (4,165)	5.5 (140)
128.0 (3,250)	85.5 (2,170)	176.0 (4,470)	5.5 (140)
2-Stage Full Free View (FFV)			
106.0 (2,690)	74.5 (1,890)	154.0 (3,910)	26.5 (670)
116.0 (2,945)	79.5 (2,020)	164.0 (4,165)	31.5 (800)
128.0 (3,250)	85.5 (2,170)	176.0 (4,470)	37.5 (950)
3-Stage Full Free View (TFV)			
158.5 (4,025)	75.5 (1,920)	206.5 (5,245)	27.5 (700)
170.5 (4,330)	79.5 (2,020)	218.5 (5,550)	31.5 (775)
188.5 (4,790)	85.5 (2,170)	236.5 (6,010)	37.5 (950)
198.5 (5,040)	89.5 (2,275)	246.5 (6,260)	41.5 (1,055)
216.5 (5,500)	97.5 (2,475)	264.5 (6,720)	49.5 (1,255)
235.5 (5,980)**	106.5 (2,705)	283.5 (7,200)	58.5 (1,485)

NOTE: Specifications for 4-Stage Full Free View (QFV) masts are not indicated. Please consult your authorized dealer for information and availability.

** Cushion Trucks Only

TRUCK DATA - PNEUMATIC TIRE LIFT TRUCKS (OUTDOOR)

	FG15HC-17	FG15HT-17	FG18HT-17
GENERAL			
Power Type	Gasoline	Gasoline	Gasoline
Operation Type	Sit Down	Sit Down	Sit Down
Capacity @ 24 in. (600 mm) Load Center * lbs. (kg)	3,000 (1,360)	3,000 (1,360)	3,500 (1,580)
Load Distance from Center Axle (2-Stage) in. (mm)	15.8 (400)	15.8 (400)	15.8 (400)
Load Distance from Center Axle (3-Stage) in. (mm)	15.9 (405)	15.9 (405)	15.9 (405)
Wheelbase in. (mm)	54.1 (1,375)	54.1 (1,375)	54.1 (1,375)
WEIGHT			
Service Weight (inc. 2-Stage STD Mast/Forks lbs. (kg)	5,860 2,660)	5,930 (2,690)	6,380 (2,895)
TIRES			
Tire Type	Pneumatic	Pneumatic	Pneumatic
Tire Size - Front	6.50 - 10 - 10PR (I)	6.50 - 10 - 10PR (I)	6.50 - 10 - 10PR (I)
Tire Size - Rear	5.00 - 8 - 8PR (I)	5.00 - 8 - 8PR (I)	5.00 - 8 - 8PR (I)
Number of Wheels - Front / Rear x = Driven	2x / 2	2x / 2	2x / 2
Tread (Center of Tires) - Front / Rear in. (mm)	35.0 (890) / 35.0 (890)		
DIMENSIONS			
Tilting Angle, 2-Stage (FV) Masts, Forward / Backward °	6 / 8	6 / 8	6 / 8
Tilting Angle, 3-Stage (TFV) Masts, Forward / Backward °	6 / 6	6 / 6	6 / 6
Mast Height - Lowered - 2-Stage Mast in. (mm)	85.5 (2,170)	85.5 (2,170)	85.5 (2,170)
Mast Height - Extended - 2-Stage Mast † in. (mm)	176.0 (4,470)	176.0 (4,470)	176.0 (4,470)
Maximum Fork Height - 2-Stage STD Mast ** in. (mm)	128.0 (3,250)	128.0 (3,250)	128.0 (3,250)
Free Lift Height - 2-Stage STD Mast in. (mm)	5.5 (140)	5.5 (140)	5.5 (140)
Height Overhead Guard in. (mm)	79.7 (2,025)	79.7 (2,025)	79.7 (2,025)
Length to Fork Face - 2-Stage Mast in. (mm)	87.6 (2,225)	87.6 (2,225)	89.0 (2,260)
Length to Fork Face - 3-Stage Mast in. (mm)	87.7 (2,230)	87.7 (2,230)	89.1 (2,265)
Overall Width at Drive Tires in. (mm)	42.1 (1,070)	42.1 (1,070)	42.1 (1,070)
Forks - Thickness x Width x Length in. (mm)	1.6 x 4.0 x 42.0 (40 x 100 x 1,070)		
Carriage Width / ITA Class in. (mm)	41.0 (1,040) / II	41.0 (1,040) / II	41.0 (1,040) / II
Ground Clearance under Mast in. (mm)	5.5 (140)	5.5 (140)	5.5 (140)
Ground Clearance - Center of Wheelbase in. (mm)	5.3 (135)	5.3 (135)	5.3 (135)
Right Angle Stacking Aisle (2-Stage Mast) †† in. (mm)	92.4 (2,345)	92.4 (2,345)	93.8 (2,380)
Right Angle Stacking Aisle (3-Stage Mast) †† in. (mm)	92.4 (2,345)	92.4 (2,345)	93.9 (2,385)
Turning Radius - Outside in. (mm)	76.6 (1,945)	76.6 (1,945)	78.0 (1,980)
PERFORMANCE			
Travel Speed, Forward - Loaded / Unloaded mph (k/hr.)	11.5 (18.5) / 12.1 (19.5)	11.8 (19.0) / 12.4 (20.0)	
Lifting Speed - Loaded / Unloaded (2-Stage) fpm (mm/s)	135 (685) / 138 (700)		123 (625) / 126 (640)
Lifting Speed - Loaded / Unloaded (3-Stage) fpm (mm/s)	132 (670) / 136 (690)		116 (590) / 120 (610)
Lowering Speed - Loaded / Unloaded (2-Stg) fpm (mm/s)	98 (500) / 89 (450)		96 (490) / 89 (450)
Lowering Speed - Loaded / Unloaded (3-Stg) fpm (mm/s)	96 (490) / 79 (400)		98 (500) / 69 (350)
Maximum Drawbar Pull - Loaded lbs. (kN)	3,210 (15.4)	3,730 (16.6)	3,730 (16.6)
Maximum Gradeability - Loaded / Unloaded at 1 mph %	31 / 23	39 / 23	35 / 21
Service Brake - Operation / Control	Foot / Hydraulic	Foot / Hydraulic	Foot / Hydraulic
Parking Brake - Operation / Control	Hand / Mechanical	Hand / Mechanical	Hand / Mechanical
Steering Type	Hydrostatic Power	Hydrostatic Power	Hydrostatic Power

TABLE CONTINUED ON NEXT PAGE

		FG15HC-17	FG15HT-17	FG18HT-17
DRIVE				
Battery Voltage / Capacity (20 hour rating)	V/Ah	12 / 41	12 / 41	12 / 41
Engine Model		K21	K21	K21
Rated Output (SAE Gross)	HP (kW) @ rpm	60.1 (45) @ 2,950	60.1 (45) @ 2,950	65.7 (49) @ 2,900
Maximum Torque (SAE Gross)	lb.ft (Nm) @ rpm	115 (156) @ 1,600	115 (156) @ 1,600	145 (197) @ 1,600
No. of Cylinders / Displacement	cu. in. (cm^3)	4 / 126 (2,065)		
Cylinder Bore x Stroke	in. (mm)	3.5 (89) x 3.3 (83)		
Fuel Tank Capacity	U.S. gallons (liters)	9.8 (37)		
OTHER				
Relief Pressure - Maximum	psi (bar)	2,650 (182.7)	2,650 (182.7)	2,650 (182.7)
Hydraulic Tank Capacity	U.S. gallons (liters)	8.2 (31)	8.2 (31)	8.2 (31)
Clutch		Dry Clutch	Torque Converter	
Transmission		Synchromesh	TORQFLOW	
Air Cleaner Type		Cyclone	Cyclone	Cyclone

NOTE: Most values shown in this publication are rounded. Therefore, direct conversion between metric and English or Imperial may be slightly different than displayed in this table. The performance of the machines is affected by the condition of the vehicle and how it is equipped as well as the nature and condition of the operating area. If these specifications are critical or if your needs exceed the specifications shown here, discuss the proposed application with your authorized dealer.

• Optional masts, attachments, longer load dimensions and higher lifting heights may result in derating of the capacity. Contact your authorized dealer.

** Other mast heights available. See MAST DATA CHART for other mast heights. Contact your authorized dealer.

† Includes 48 in. (1,220 mm) high Load Backrest. Contact your authorized dealer for additional information.

†† Add load length and clearance. Contact your authorized dealer.

TRUCK DATA - CUSHION TIRE LIFT TRUCKS

	FG15ST-17	FG18ST-17
GENERAL		
Power Type	Gasoline	Gasoline
Operation Type	Sit Down	Sit Down
Capacity @ 24 in. (600 mm) Load Center * lbs. (kg)	3,000 (1,360)	3,500 (1,580)
Load Distance from Center Axle (2-Stage) in. (mm)	15.4 (390)	15.4 (390)
Load Distance from Center Axle (3-Stage) in. (mm)	15.4 (390)	15.4 (390)
Wheelbase in. (mm)	47.2 (1,200)	47.2 (1,200)
WEIGHT		
Service Weight (inc. 2-Stage STD Mast/Forks lbs. (kg)	5,940 (2,695)	6,450 (2,925)
TIRES		
Tire Type	Cushion	Cushion
Tire Size - Front	18.0 x 6 x 12 1/8	18.0 x 6 x 12 1/8
Tire Size - Rear	14 x 4 1/2 x 8	14 x 4 1/2 x 8
Number of Wheels - Front / Rear x = Driven	2x / 2	2x / 2
Tread (Center of Tires) - Front / Rear in. (mm)	32.1 (815) / 32.1 (815)	
DIMENSIONS		
Tilting Angle, 2-Stage (FV) Masts, Forward / Backward °	7 / 7	7 / 7
Tilting Angle, 3-Stage (TFV) Masts, Forward / Backward °	7 / 5	7 / 5
Mast Height - Lowered - 2-Stage Mast in. (mm)	83.5 (2,120)	83.5 (2,120)
Mast Height - Extended - 2-Stage Mast † in. (mm)	176.0 (4,470)	176.0 (4,470)
Maximum Fork Height - 2-Stage STD Mast ** in. (mm)	128.0 (3,250)	128.0 (3,250)
Free Lift Height - 2-Stage STD Mast in. (mm)	5.5 (140)	5.5 (140)
Height Overhead Guard in. (mm)	77.6 (1,970)	77.6 (1,970)
Length to Fork Face - 2-Stage Mast in. (mm)	79.3 (2,015)	80.9 (2,055)
Length to Fork Face - 3-Stage Mast in. (mm)	79.3 (2,015)	80.9 (2,055)
Overall Width at Drive Tires in. (mm)	38.0 (965)	38.0 (965)
Forks - Thickness x Width x Length in. (mm)	1.6 x 4.0 x 42.0 (40 x 100 x 1,070)	
Carriage Width / ITA Class in. (mm)	37.0 (940) / II	37.0 (940) / II
Ground Clearance under Mast in. (mm)	3.5 (90)	
Ground Clearance - Center of Wheelbase in. (mm)	4.0 (100)	
Right Angle Stacking Aisle (2-Stage Mast) †† in. (mm)	83.3 (2,115)	85.1 (2,160)
Right Angle Stacking Aisle (3-Stage Mast) †† in. (mm)	83.3 (2,115)	85.1 (2,160)
Turning Radius - Outside in. (mm)	67.9 (1,725)	69.7 (1,770)
PERFORMANCE		
Travel Speed, Forward - Loaded / Unloaded mph (k/hr.)	10.3 (16.5) / 10.3 (16.5)	10.3 (16.5) / 10.3 (16.5)
Lifting Speed - Loaded / Unloaded (2-Stage) fpm (mm/s)	135 (685) / 138 (700)	123 (625) / 126 (640)
Lifting Speed - Loaded / Unloaded (3-Stage) fpm (mm/s)	132 (670) / 136 (690)	116 (590) / 120 (610)
Lowering Speed - Loaded / Unloaded (2-Stg) fpm (mm/s)	98 (500) / 89 (450)	97 (490) / 89 (450)
Lowering Speed - Loaded / Unloaded (3-Stg) fpm (mm/s)	97 (490) / 79 (400)	98 (500) / 69 (350)
Maximum Drawbar Pull - Loaded lbs. (kN)	4,610 (20.5)	4,610 (20.5)
Maximum Gradeability - Loaded %	41 / 20	37 / 18
Service Brake - Operation / Control	Foot / Hydraulic	Foot / Hydraulic
Parking Brake - Operation / Control	Hand / Mechanical	Hand / Mechanical
Steering Type	Hydrostatic Power	Hydrostatic Power

TABLE CONTINUED ON NEXT PAGE

		FG15ST-17	FG18ST-17
DRIVE			
Battery Voltage / Capacity (20 hour rating)	V/Ah	12 / 41	12 / 41
Engine Model		K21	K21
Rated Output (SAE Gross)	HP (kW) @ rpm	60.1 (45) @ 2,950	60.1 (45) @ 2,950
Maximum Torque (SAE Gross)	lb.ft (Nm) @ rpm	115 (156) @ 1,600	115 (156) @ 1,600
No. of Cylinders / Displacement	cu. in. (cm^3)	4 / 126 (2,065)	4 / 126 (2,065)
Cylinder Bore x Stroke	in. (mm)	3.5 (89) x 3.3 (83)	3.5 (89) x 3.3 (83)
Fuel Tank Capacity	U.S. gallons (liters)	6.6 (25)	6.6 (25)
OTHER			
Relief Pressure - Maximum	psi (bar)	2,650 (182.7)	2,650 (182.7)
Hydraulic Tank Capacity	U.S. gallons (liters)	5.8 (22)	5.8 (22)
Clutch		Torque Converter	Torque Converter
Transmission		TORQFLOW	TORQFLOW
Air Cleaner Type		Cyclone	Cyclone

NOTE: Most values shown in this publication are rounded. Therefore, direct conversion between metric and English or Imperial may be slightly different than displayed in this table. The performance of the machines is affected by the condition of the vehicle and how it is equipped as well as the nature and condition of the operating area. If these specifications are critical or if your needs exceed the specifications shown here, discuss the proposed application with your authorized dealer.

* Optional masts, attachments, longer load dimensions and higher lifting heights may result in derating of the capacity. Contact your authorized dealer.

** Other mast heights available. See MAST DATA CHART for other mast heights. Contact your authorized dealer.

† Includes 48 in. (1,220 mm) high Load Backrest. Contact your authorized dealer for additional information.

†† Add load length and clearance. Contact your authorized dealer.

PERIODIC REPLACEMENT OF CONSUMABLE PARTS

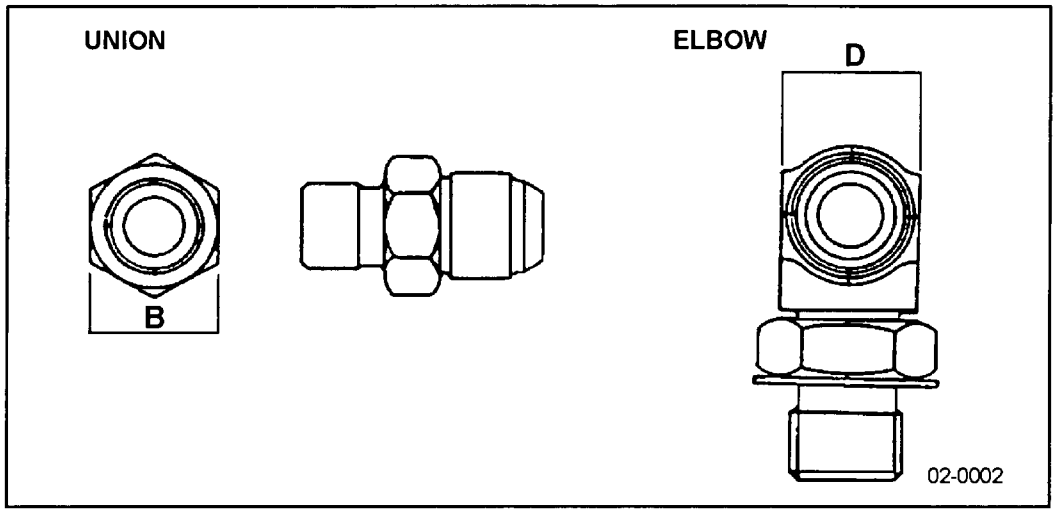
For operational safety, always perform specified periodic maintenance, and be sure to replace all consumable parts listed in the table below following the recommended schedule.
These parts may deteriorate in time and are susceptible to wear. It is difficult to estimate the degree of wear at the time of your periodic maintenance, therefore, even if no wear is apparent, always replace the items with new parts within the scheduled period.
Consumable parts must certainly be replaced sooner than the recommended intervals if wear, damage or malfunction occurs earlier. An effective and timely inspection and maintenance program will reveal such conditions before more serious damage occurs to the truck.

No.	Part Name	Period of Replacement
1	Brake Master Cylinder and Wheel Cylinder caps and dust seals	Every 1 year
2	Brake hoses and tubes	Every 1 to 2 years
3	Brake reservoir tank and tube	Every 2 to 4 years
4	Power steering hose	Every 2 years
5	Stop lamp switch (Oil pressure type)	Every 2 years
6	Fuel hoses	Every 2 to 4 years
7	Rubber parts of power steering assembly	Every 2 years
8	Lift chain(s)	Every 2 to 4 years
9	Load handling hoses	Every 1 to 2 years

STANDARD TIGHTENING TORQUE FOR PIPE JOINTS

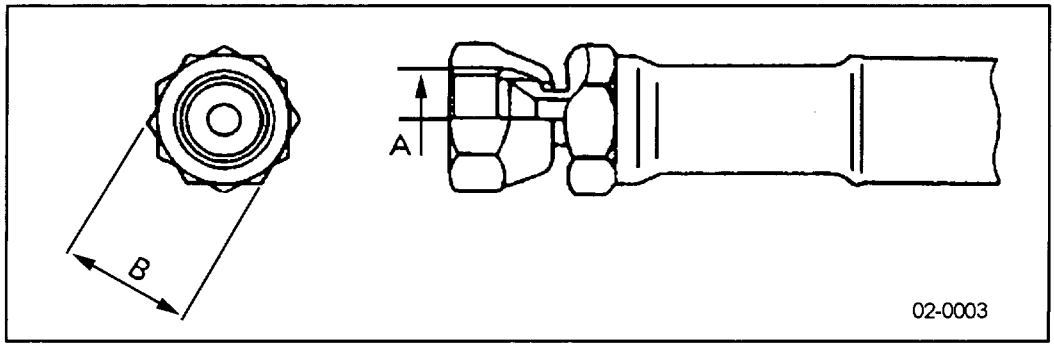
Elbows, nipples and unions

Width across Flats B (mm)	22	30	36
Width D (mm)	19	22	30
Tightening Torque ft/lbs. (Nm) (kgfm)	21.7 - 28.9 (29.4 - 39.2) (3 - 4)	57.9 - 75.9 (78.5 - 103) (8 - 10.5)	86.8 - 119.3 (117.7 - 161.8) (12 - 16.5)
Port Size (in.)	3/4 - 16 UNF	7/8 - 14 UNF	--
Tightening Torque Nm (kgfm)	50.6 - 54.3 (68.6 - 73.6) (7 - 7.5)	57.9 - 61.4 (78.5 - 83.3) (8 - 8.5)	--



High-pressure rubber hoses, pipes and sleeve nuts

Width across flats B (mm)	19	24	27	32	36
Bore A (mm)	14	18	22	24	30
Tightening Torque ft/lbs. (Nm) (kgfm)	14.5 - 21.7 (19.6 - 29.4) (2 - 3)	17.3 - 50.6 (23.5 - 68.6) (3 - 7)	43.4 - 72.4 (58.8 - 98.1) (6 - 10)	79.7 - 123.2 (108 - 167) (11 - 17)	108.4 - 151.9 (147 - 206) (15 - 21)

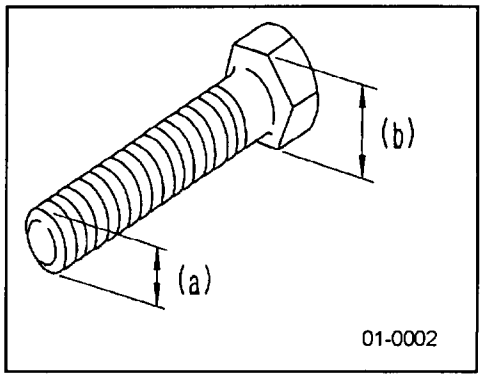


STANDARD TIGHTENING TORQUE FOR BOLTS

For unspecified bolts and nuts, use the torque values specified in this list.

Select a proper torque value corresponding to the width across the flats (b) of the bolt or nut.

When replacing bolts and nuts, always use the manufacturer's specified part(s) of the same size and strength as the original parts.



Thread diameter of bolt - in. (mm) (a)	Width across flat - in. (mm) (b)	Tightening Torque		
		lb./ft	Nm	kgfm
.236 (6)	.394 (10)	9.73 ± 1.03	13.2 ± 1.4	1.35 ± 0.15
.315 (8)	.512 (13)	23.2 ± 2.10	31.4 ± 2.9	3.20 ± 0.30
.394 (10)	.669 (17)	48.5 ± 5.00	65.7 ± 6.8	6.70 ± 0.70
.472 (12)	.748 (19)	82.6 ± 7.20	112 ± 9.8	11.5 ± 1.00
.551 (14)	.866 (22)	131 ± 14.0	177 ± 19	18.0 ± 2.00
.630 (16)	.945 (24)	206 ± 21	279 ± 29	28.5 ± 3.00
.709 (18)	1.06 (27)	282 ± 29	383 ± 39	39.0 ± 3.00
.787 (20)	1.18 (30)	405 ± 43	549 ± 58	56.0 ± 6.00
.866 (22)	1.26 (32)	549 ± 58	745 ± 78	76.0 ± 8.00
.945 (24)	1.42 (36)	684 ± 72	927 ± 98	94.5 ± 10.0
1.06 (27)	1.61 (41)	973 ± 100	1,320 ± 140	135 ± 15
1.18 (30)	1.81 (46)	1,270 ± 140	1,720 ± 190	175 ± 20
1.30 (33)	1.97 (50)	1,630 ± 180	2,210 ± 240	225 ± 25
1.42 (36)	2.16 (55)	2,030 ± 210	2,750 ± 290	280 ± 30
1.54 (39)	2.36 (60)	2,420 ± 250	3,280 ± 340	335 ± 35

SERVICE DATA - GASOLINE ENGINE TRUCKS - PNEUMATIC

Component	Check Item		Unit	FG15-17	FG18-17
ENGINE					
ENGINE	Engine Model		--	K21	K21
	Idling Speed		rpm	700	
	Maximum Speed		rpm	No Load = 3,600 (Instantaneous) Continuous Load = 3,000	
	Torque Converter Stall Speed		rpm	2,100 ± 100 rpm	
	Compression		psi / rpm (MPa / rpm)	178 / 250 (1.2 / 250)	
LUBRICATING / COOLING SYSTEMS	Engine Oil Capacity		qts. (L)	3.91 (3.7) w/ Filter / 3.59 (3.4) w/o Filter	
	Engine Oil Pressure @ 178° F (80° C)		psi (kPa)	Idle: 14.22 (98) At 2,000 rpm: 39.8 - 45.5 (274 - 313)	
	Coolant Capacity / Radiator Cap Press.		qts. / L	2.4 (9.1) / 12.8 psi (0.9 kg/cm^2)	
	Fan Belt Tension		in. (mm)	0.47 - 0.55 (12 - 14) Finger Pressure (98N)	
FUEL SYSTEM	Fuel Type		--	Unleaded Regular Gasoline (89+ Octane)	
	Injection Timing		BTDC°	Variable - Controlled by ECU	
	Injection Order		--	4 - 2 - 1 - 3	
	Injection Pressure		psi (Nm)	50.8 PSI (350 KPa)	
	Fuel Tank Capacity		gal (L)	9.8 (37)	
INTAKE / EXHAUST SYSTEMS	Valve Clearance	Intake	in. (mm)	.015 (0.38) w/ Engine Warm	
		Exhaust	in. (mm)	.015 (0.38) w/ Engine Warm	
ELECTRICAL SYSTEM	Spark Plug Gap		in. (mm)	.035 (0.9)	
	Spark Plug Type		--	P/N 22401-FU412	
	Ignition Timing		BTDC° / rpm	0° / 700	
	Firing Order		--	1 - 3 - 4 - 2	
	Battery Electrolyte Specific Gravity		--	Minimum 1,240	
POWER TRAIN					
TORQUE CONVERTER	Stall Speed		rpm	2,100 ± 100 rpm	
	Inlet Port Oil Pressure		psi / rpm	91.4 - 156.6 (0.63 - 1.08) / 1,000 127.6 - 177.0 (0.88 - 1.22) / 2,000	
	Outlet Port Oil Pressure		psi (MPa)	35.5 - 63.8 (0.245 - 0.440)	
TORQFLOW TRANSMISSION	Relief Pressure		psi (MPa)	153.74 (1.06)	
	Clutch Actuation Pressure		psi / rpm (MPa / rpm)	91.4 - 156.6 / 1,000 (0.63 - 1.08 / 1,000) 127.6 - 176.9 / 2,000 (0.88 - 1.22 / 2,000)	
	Lubricating Oil Pressure		psi (MPa)	14.5 - 56.6 (0.1 - 0.39)	
	Oil Capacity		qts. (L)	12.68 (12) Including Torque Converter	
DIFFERENTIAL	Oil Capacity	TORQFLOW	qts. (L)	6.34 (6)	
		Clutch Type	qts. (L)	13.74 (13) inc. Direct Drive Trans.	

Continued

Component	Check Item		Unit	FG15-17	FG18-17
TRAVEL SYSTEM					
TIRES	Inflation Pressure	Front tires	psi (MPa)	98.6 (0.68)	
		Rear tire(s)	psi (MPa)	98.6 (0.68)	
	Tread Depth		in. (mm)	Minimum .063 (1.6) (at tread width 1/4)	
HUB NUT	Tightening Torque	Front Wheels	lb./ft (Nm)	113.6 - 180.1 (154 - 245)	
		Rear Wheels	lb./ft (Nm)	61.2 - 108.4 (83 - 147)	
RIM MATING NUT	Tightening Torque	Front Wheels	lb./ft (Nm)	64.9 - 90.7 (88 - 123)	
		Rear Wheels	lb./ft (Nm)	43.5 - 54.6 (59 - 74)	
STEERING / BRAKING SYSTEMS					
POWER STEERING RELIEF VALVE	Relief Pressure		psi (MPa)	1,073.3 (7.4)	
STEERING WHEEL	Play		in. (mm)	1.2 - 2.4 (30 - 60)	
STEERING AXLE	Minimum Turning Radius		in. (mm)	76.6 (1,945)	78.0 (1,980)
	Support Thrust Clearance		in. (mm)	0.028 (0.7)	
CLUTCH PEDAL	Play		in. (mm)	0.12 - 0.2 (3 - 5)	
INCHING PEDAL	Play		in. (mm)	0.08 - 0.12 (2 - 3)	
	Interconnected Travel		in. (mm)	1.85 - 2.09 (47 - 53)	
BRAKE PEDAL	Play		in. (mm)	0.51 - 0.67 (13 - 17)	
	Pedal Height when Depressed		in. (mm)	3.15 - 3.54 (80 - 90)	
BRAKE	Brake Fluid Capacity		qts. (L)	.158 (015)	
	Parking Brake Operating Force		lbf (N)	55.1 (245)	
	Torque for Back Plate Mtg. Bolt		lb./ft(Nm)	108.4 - 144.5 (147 - 196)	
BRAKE	STOPPING DISTANCES	Unloaded	ft (m)	14.76 (4.5)	
		Loaded		6.56 (2.0)	
LOADING SYSTEM					
FORK	Thickness at Fork Root		in. (mm)	1.26 (32) Minimum	1.34 (34) Minimum
	Difference in Height		in. (mm)	0.6 (15) Maximum	
	Amount of Opening at Tip		in. (mm)	1.4 (35) Maximum	
CHAIN	Length of 17 Links		in. (mm)	13.1 (332) Maximum	
CYLINDER	Hydraulic Drift (Lift Cylinder)		in. (mm)	20 (50) Maximum / 15 Minutes	
	Hydraulic Drift (Tilt Cylinder)		in. (mm)	1.8 (45) Maximum / 15 Minutes	
MAIN RELIEF VALVE	Relief Pressure		psi (MPa)	2,610 (18)	
HYDRAULIC SYSTEM	Oil Capacity		gal (L)	9.25 (35)	

SERVICE DATA - GASOLINE ENGINE LIFT TRUCKS - CUSHION

Component	Check Item		Unit	FG15S-17	FG18S-17
ENGINE					
ENGINE	Engine Model		--	K21	K21
	Idling Speed		rpm	700	
	Maximum Speed		rpm	No Load = 3,600 (Instantaneous) Continuous Load = 3,000	
	Torque Converter Stall Speed		rpm	2,100 ± 100 rpm	
	Compression		psi / rpm (MPa / rpm)	178 / 250 (1.2 / 250)	
LUBRICATING / COOLING SYSTEMS	Engine Oil Capacity		qts. (L)	3.91 (3.7) w/ Filter / 3.59 (3.4) w/o Filter	
	Engine Oil Pressure @ 178°F (80°C)		psi (kPa)	Idle: 14.22 (98) At 2,000 rpm: 39.8 - 45.5 (274 - 313)	
	Coolant Capacity / Radiator Cap Pressure		qts. (L)	2.4 (9.1) / 12.8 psi (0.9 kgf/cm^2)	
	Fan Belt Tension		in. (mm)	0.47 - 0.55 (12 - 14) Finger Pressure (98N)	
FUEL SYSTEM	Fuel Type		--	Unleaded Regular Gasoline (89+ Octane)	
	Injection Timing		BTDC°	Variable - Controlled by ECU	
	Injection Order		--	4 - 2 - 1 - 3	
	Injection Pressure		psi (MPa)	50.8 PSI (350 KPa)	
	Fuel Tank Capacity		gal (L)	6.6 (25)	
INTAKE / EXHAUST SYSTEMS	Valve Clearance	Intake	in. (mm)	.015 (0.38) w/ Engine Warm	
		Exhaust	in. (mm)	.015 (0.38) w/ Engine Warm	
ELECTRICAL SYSTEM	Spark Plug Gap		in. (mm)	.035 (0.9)	
	Spark Plug Type		--	P/N 22401-FU412	
	Ignition Timing		BTDC°/rpm	0° / 700	
	Firing Order		--	1 - 3 - 4 - 2	
	Battery Electrolyte Specific Gravity		--	Minimum 1,240	
POWER TRAIN					
TORQUE CONVERTER	Stall Speed		rpm	2,100 ± 100 rpm	
	Inlet Port Oil Pressure		psi / rpm	91.4 - 156.6 (0.63 - 1.08) / 1,000 127.6 - 177.0 (0.88 - 1.22) / 2,000	
	Outlet Port Oil Pressure		psi (MPa)	35.5 - 63.8 (0.245 - 0.440)	
TORQFLOW TRANSMISSION	Relief Pressure		psi (MPa)	153.74 (1.06)	
	Clutch Actuation Pressure		psi / rpm (MPa / rpm)	91.4 - 156.6 / 1,000 (0.63 - 1.08 / 1,000) 127.6 - 176.9 / 2,000 (0.88 - 1.22 / 2,000)	
	Lubricating Oil Pressure		psi (MPa)	14.5 - 56.6 (0.1 - 0.39)	
	Oil Capacity		qts. (L)	12.68 (12) Including Torque Converter	
DIFFERENTIAL	Oil Capacity	TORQFLOW	qts. (L)	6.34 (6)	
		CLUTCH TYPE	qts. (L)	13.74 (13) Inc. Direct Drive Trans.	

Continued

Component	Check Item		Unit	FG15S-17	FG18S-17
TRAVEL SYSTEM					
TIRES	Inflation Pressure	Front tires	psi (MPa)	N/A	
		Rear tire(s)	psi (MPa)	N/A	
	Tread Depth		in. (mm)	N/A	
HUB NUT	Tightening Torque	Front Wheels	lb./ft (Nm)	115.8 - 180.7 (157 - 245)	
		Rear Wheels	lb./ft (Nm)	N/A	
RIM MATING NUT	Tightening Torque	Front Wheels	lb./ft (Nm)	N/A	
		Rear Wheels	lb./ft (Nm)	N/A	
STEERING / BRAKING SYSTEMS					
POWER STEERING RELIEF VALVE	Relief Pressure		psi (MPa)	1,073.3 (7.4)	
STEERING WHEEL	Play		in. (mm)	1.2 - 2.4 (30 - 60)	
STEERING AXLE	Minimum Turning Radius		in. (mm)	67.9 (1,725)	69.7 (1,770)
	Support Thrust Clearance		in. (mm)	0.028 (0.7)	
CLUTCH PEDAL	Play		in. (mm)	.12 - .20 (3 - 5mm)	
INCHING PEDAL	Play		in. (mm)	0.08 - 0.12 (2 - 3)	
	Interconnected Travel		in. (mm)	1.85 - 2.09 (47 - 53)	
BRAKE PEDAL	Play		in. (mm)	0.51 - 0.67 (13 - 17)	
	Pedal Height when Depressed		in. (mm)	3.15 - 3.54 (80 - 90)	
BRAKE	Brake Fluid Capacity		qts. (L)	.158 (0.15)	
	Parking Brake Operating Force		lbf (N)	55.1 (245)	
	Torque for Back Plate Mtg. Bolt		lb./ft(Nm)	108.4 - 144.5 (147 - 196)	
BRAKE	STOPPING DISTANCES	Unloaded	ft. (m)	14.7 (4.5)	
		Loaded		6.56 (2.0)	
LOADING SYSTEM					
FORK	Thickness at Fork Root		in. (mm)	1.26 (32) Minimum	1.34 (34) Minimum
	Difference in Height		in. (mm)	0.6 (15) Maximum	
	Amount of Opening at Tip		in. (mm)	1.4 (35) Maximum	
CHAIN	Length of 17 Links		in. (mm)	13.1 (332) Maximum	
CYLINDER	Hydraulic Drift (Lift Cylinder)		in. (mm)	20 (50) Maximum / 15 Minutes	
	Hydraulic Drift (Tilt Cylinder)		in. (mm)	1.8 (45) Maximum / 15 Minutes	
MAIN RELIEF VALVE	Relief Pressure		psi (MPa)	2,650 (18.2)	
HYDRAULIC SYSTEM	Oil Capacity		gal (L)	9.25 (35)	

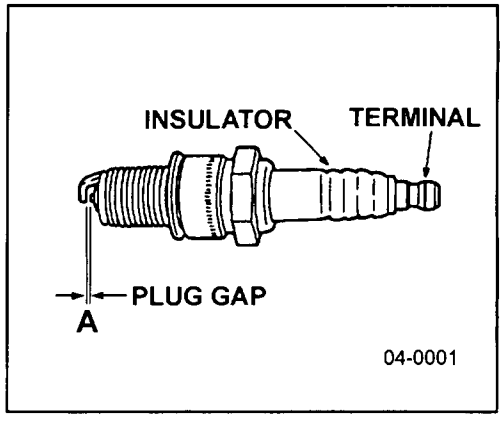
ADJUSTING IGNITION TIMING

Ignition timing is automatically set at 0° by the Electronic Control Unit (ECU) and it is not adjustable.

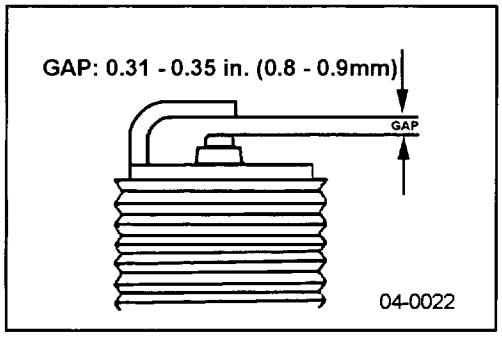
With the Special Service Tool (SST) attached and operating, the ignition timing may be temporarily changed for diagnostic purposes, but once the SST is disconnected from the unit, the ignition timing will default back to 0°.

ADJUSTING SPARK PLUG GAP

1. Using a proper spark plug removal tool, remove the spark plug(s).
2. Carefully remove any soot or carbon buildup adhered to the spark plug tip and surrounding area.
3. If the plug is burned or shows electrode damage, replace the spark plug(s).
4. Measure the gap (A) with a gap gauge.
5. Set spark plug gap to **.031 - .035 in. (0.8 - 0.9 mm)**



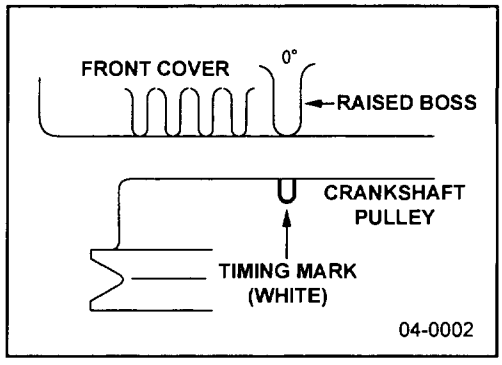
Spark Plugs - (Replace every 18 months/3,600 hours)	
Part Number	22401-FU412



ADJUSTING VALVE CLEARANCE

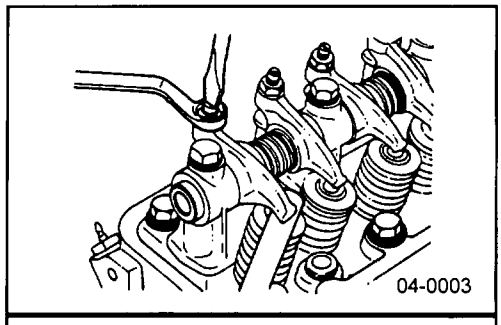
1. Remove the cylinder head (valve) cover.
2. Rotate the crankshaft aligning the timing mark (white dot) on the crankshaft pulley with the raised boss on the front cover as shown at right.
3. Check that No. 1 cylinder or No. 4 cylinder is at piston compression Top Dead Center (TDC). Both intake and exhaust valves for that cylinder should be fully closed at TDC.
4. Adjust valve clearance starting with the valves for the cylinder at TDC.

NOTE: When No. 1 cylinder is at TDC:
Adjust the valve clearance of the valves marked **"X"**

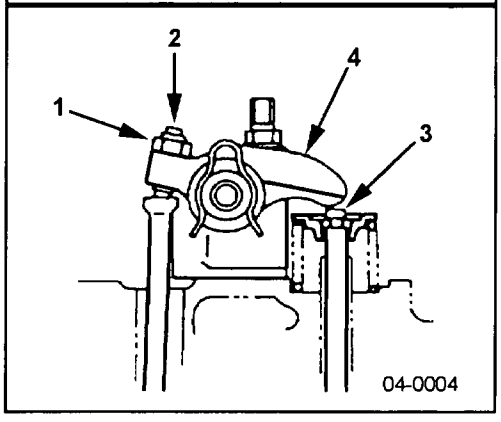


ENGINE FIRING ORDER: 1 - 3 - 4 - 2								
Cylinder No.	**1**		**2**		**3**		**4**	
Exhaust valve	X		X		O		O	
Intake valve		X		O		X		O

in the table above. Then rotate the crankshaft one revolution clockwise (facing the pulley) and adjust the clearance on the valves marked "O" in the table.
When No. 4 cylinder is at TDC:
Adjust the valve clearance of the valves marked **"O"** in the table above. Then rotate the crankshaft one revolution clockwise and adjust the valves marked with an **"X"**.


04-0003

5. Loosen the locknut (1) of adjustment screw (2). Then adjust the clearance between valve stem (3) and rocker arm (4) using a straight bladed screwdriver on the adjustment screw. When properly adjusted, the feeler gauge should have a snug, sliding fit, but should not grab or bind the gauge.
6. After adjusting the clearance to specification, tighten the locknut, while holding the adjusting screw in position, to lock down the adjustment screw (See Fig. 04-0003). Recheck the clearance.
7. Reinstall the two valve cover bolts and washers and tighten to **10 - 11.6 ft/lbs (13.7 - 15.7 Nm)**.



04-0004

⚠ CAUTION

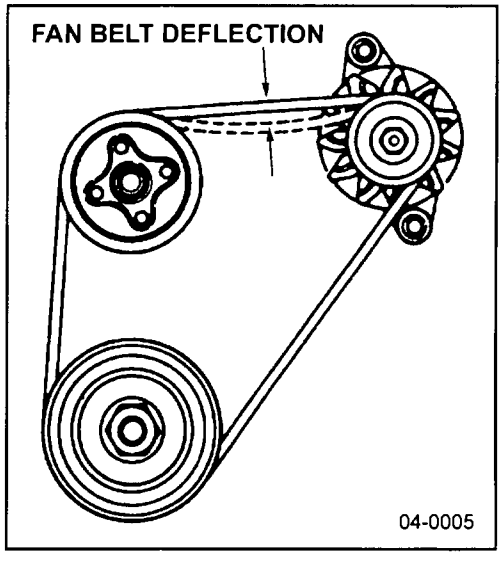
The valve clearance must be finally adjusted when the engine is fully warmed up. Adjusting the valves in a cold state after assembly will make final adjustments easier.

ADJUSTMENT OF FAN BELT

Inspect and adjust fan (accessory) belt with engine stopped.

1. Visually check for damage, cracks, wear and oil smears.
2. Ensure that the belt is not bottoming out in the pulley.
3. Check belt deflection by pressing on the belt at the center between the pulleys.

Pressing Force	**22 lbf (98N) (10 kg)**
Fan Belt Deflection	**.43 - .51 in. (11 - 13 mm)**

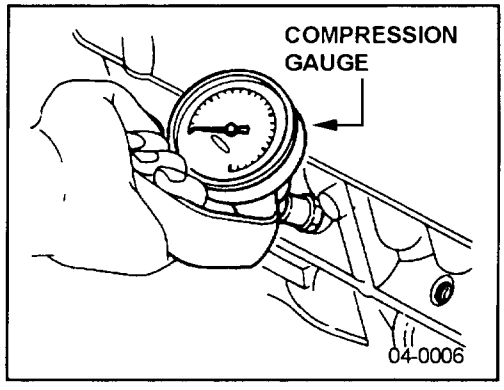


04-0005

MEASURING ENGINE CYLINDER COMPRESSION

1. Start the engine and fully warm it up until the coolant water temperature reaches **167° - 185°F (75° - 85°C)**.
2. Stop the engine
3. Release the fuel pressure..
4. Remove the spark plugs.
5. Screw the end of the compression gauge into the cylinder spark plug hole to be measured.
6. Set the throttle valve to the fully open position.
7. Depress the throttle (accelerator) pedal to the fully open position.
8. Crank the engine over and read the gauge.

NOTE: Keep the engine cranking rpm at about 250. This is normal cranking rpm at full charge. Complete the compression measurement process as quickly as possible.



Standard Compression Pressure	
K21	178 psi (1,230 kPa / 250 rpm)

9. The compression pressure differences between cylinders must not exceed 14.2 psi @ 250 rpm. If any cylinder produces an extremely low compression pressure reading, put a small amount of oil into the cylinder through the spark plug hole and remeasure.
   - **If the pressure rises after adding oil to the cylinder, the piston ring is worn or damaged.**
   - **If the pressure remains unchanged after adding oil, the valve is stuck or is not sealing correctly.**
   - **If low compression pressure is observed in two adjacent cylinders and the pressure is not restored after adding oil to those cylinders, the head gasket is leaking. In this case, oil and water may enter into the combustion chamber.**
   - **If the engine RPM is not in the specified range (250 rpm), check the battery specific gravity.**

MEASURING HYDRAULIC DRIFT ON LIFT & TILT CYLINDERS

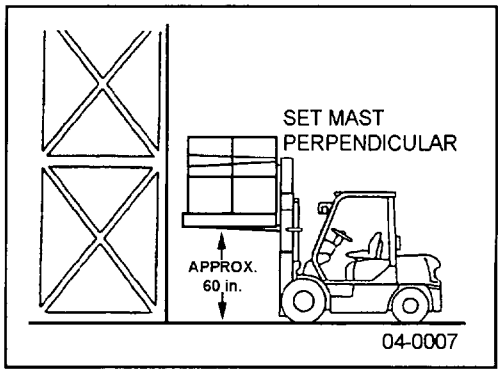
⚠ CAUTION

PRECAUTIONS WHEN MEASURING DRIFT

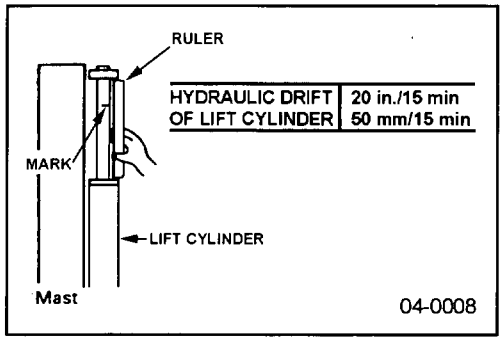
- **When measuring drift, never allow anyone to go under the load.**
- **Do not put your feet on the mast stays or dashboard or climb up when measuring the hydraulic drift of the lift cylinder. There is a DANGER that you may get your hands or feet caught in the mast.**
- **Always use a strong, stable stand when measuring.**
- **Before measuring, check that the hydraulic oil level is correct and that the hydraulic oil is not dirty or mixed with any other brand of oil.**
- **Always carry out the measurement on flat horizontal ground in front of a strong platform which will support the truck if it should tip over towards the front.**

MEASURING PROCEDURE

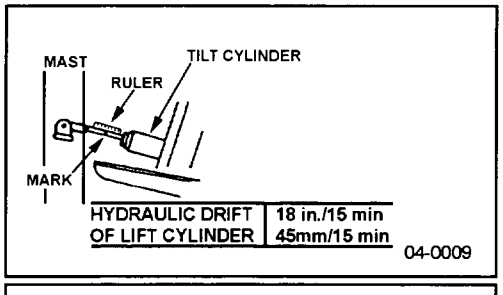
1. Place a load on the lifting forks equal to or slightly less than the specified lifting capacity of the truck.
2. Secure the load to the lift truck with wire.
3. Bring the truck to a stop about **20 in. (500mm)** in front of the platform.
4. Operate the lift and tilt repeatedly to bring the oil temperature to **122°F (50°C)**.
5. Raise the load about **60 in. (1,500mm)** and set the mast perpendicular to the ground.



6. Wait for 3 minutes. Then place a ruler against the lift cylinder piston rod and make a mark.
7. Measure the hydraulic drift over the next 15 minutes.

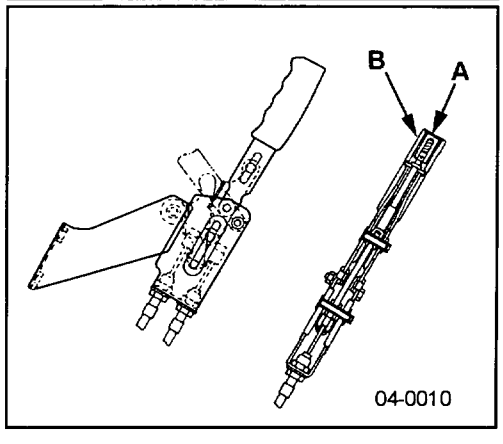


8. Wait for 3 minutes. Then place a ruler against the tilt cylinder piston rod and make a mark.
9. Measure the hydraulic drift over the next 15 minutes.



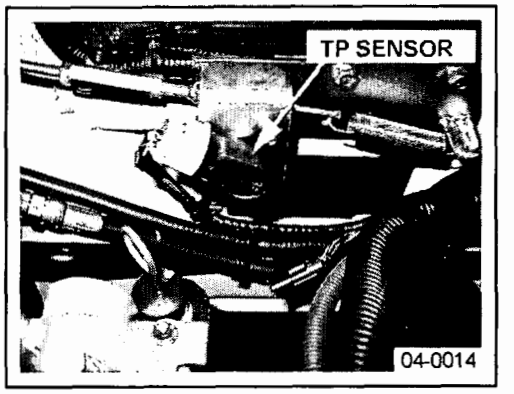
ADJUSTING THE PARKING BRAKE LEVER

1. Release the parking brake (lever in forward position).
2. Using a screwdriver, press down on the adjustment button (A). Keep it pushed down and rotate it to adjust the operating effort required to set the parking brake.
   Specified Force: 55 lb./f (245 N)(25 kg)
3. After adjusting, align the hexagonal portion of the adjustment button (A) to match the hexagonal hole in the tip of the grip (B). Remove the screwdriver.
4. With parking brake applied, check that the parking brake can hold the lift truck while stopped on a slope as shown in the table below.



Lift truck unloaded	10° slope or higher
Lift truck loaded	8.5° slope or higher

ADJUSTING THE ACCELERATOR PEDAL



The AX20 Series forklift trucks are equipped with an electronic Throttle Position Sensor (TPS) and an Accelerator Pedal Position Sensor (APPS). These sensors must be adjusted while using a Service Support Tool (SST) (Diagnostic Monitor).

The stopper bolt located on the floor plate directly beneath the toe-area of the pedal is factory preset at **1.93 in. (49mm)**.

With the stopper bolt at the specified height, the released pedal height should be **5.08 in. (129mm)**.

To adjust the Throttle Position Sensor to the proper voltage values, loosen the two adjuster screws on the TPS and gently rotate the TPS clockwise or counter-clockwise while observing the voltage readings on the SST. Once correct values have been achieved, tighten the two adjusting screws. (See next page). You may also be able to achieve the correct voltage values by adjusting the linkage rod. Simply loosen the two lock nuts and rotate the threaded union to shorten or lengthen the rod length.
NOTE: Do not disassemble the sensor.

THROTTLE POSITION SENSOR SYSTEM

(1) Service Tool Data Monitor Display

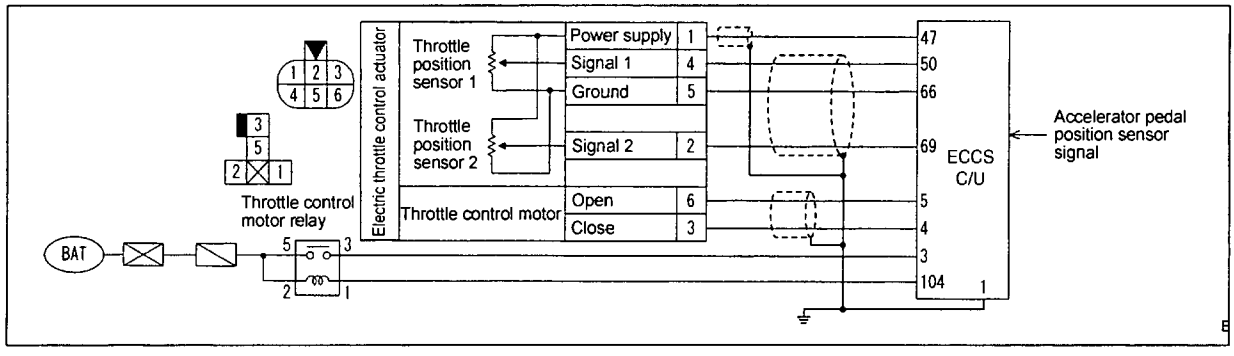
Monitor item	At idle after warming up	At approx. 2,000 rpm
ETC Throttle sensor 1 (pedal released)	Approx. 0.6V	Approx. 0.7V
ETC Throttle sensor 2 (pedal depressed fully)	Approx. 4.5V	Approx. 4.4V

(2) Control Unit Input/Output Signal Specifications

Measure voltage between terminals shown below and ground using a circuit tester.

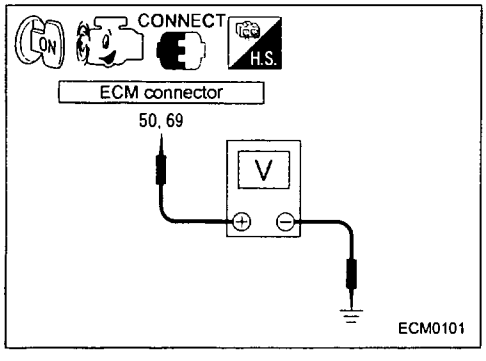
Terminal	Signal name	At idle after warming up	At approx. 2,000 rpm
66	Sensor ground (Throttle position sensor)	Approx. 0V	
47	Sensor power supply (Throttle position sensor)	Approx. 5V	
50	Throttle position sensor 1 (pedal released)	Approx. 0.6V	Approx. 0.7V
69	Throttle position sensor 2 (pedal depressed fully)	Approx. 4.5V	Approx. 4.4V

(3) Circuit Diagram



(4) Component Parts Inspection

THROTTLE POSITION SENSOR 1, 2 (ELECTRIC THROTTLE CONTROL ACTUATOR ASSEMBLY)



Check voltage between ECCS C/U terminal 50, 69 and ground.

TP 1 (terminal 50) - At idle after warm-up: About 0.60v
TP 1 (terminal 50) - IGN ON, engine OFF w/ pedal released: About 0.75v
TP 1 (terminal 50) - IGN ON, engine OFF w/ pedal depressed fully: About 0.75v
TP 1 (terminal 50) - At 2,000 rpm: About 0.70v
TP 2 (terminal 69) - At idle after warm-up: About 4.50v
TP 2 (terminal 69) - IGN ON, engine OFF w/ pedal released: About 4.35v
TP 2 (terminal 69) - IGN ON, engine OFF w/ pedal depressed: About 4.35v
TP 2 (terminal 69) - At 2,000 rpm: About 4.40v

- **Make sure that there is no moisture around connector when removing and installing throttle position sensor connector. If there are any water drops, completely wipe them off.**
- **Do not apply voltage to throttle position sensor terminal.**
- **Perform "Throttle Valve Closed Position Learning" if disconnecting connector. Perform "Throttle Valve Closed Position Learning and Idle Air Volume Learning" if replacing electric throttle control actuator. (See Publication TM100 - K21/K25 Engine Training Manual).**

ACCELERATOR PEDAL POSITION SENSOR

(1) Service Tool Data Monitor Display

Monitor item	At idle after warming up	At approx. 2,000 rpm
ETC Acceleration sensor 1	Approx. 0.6V	Approx. 0.65V
ETC Acceleration sensor 2	Approx. 0.3V	Approx. 0.35V

(2) Control Unit Input/Output Signal Specifications

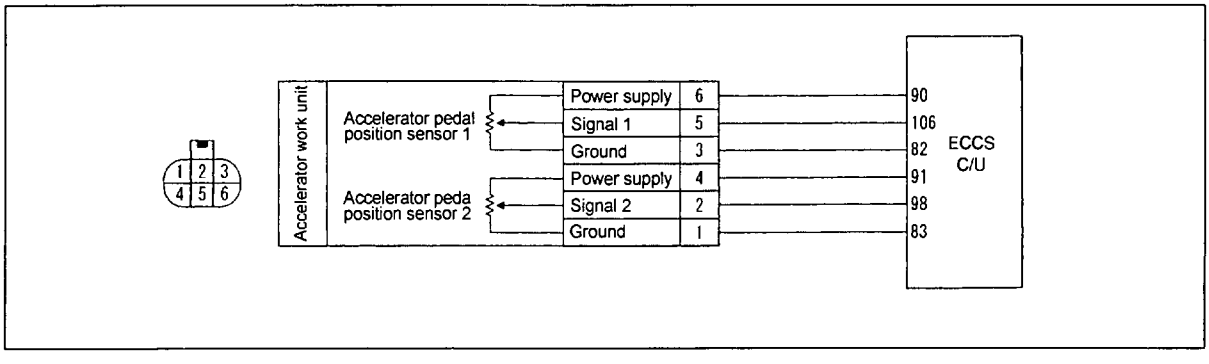
Measure voltage between terminals shown below and ground using a circuit tester.

Terminal	Signal name	At Idle	At approx. 2,000 rpm
90	Sensor power supply	Approx. 5V	
106	Accelerator pedal position sensor 1	Approx. 0.6V	Approx. 0.65V
82	Sensor ground	Approx. 0V	
91	Accelerator pedal position sensor 2 power supply	Approx. 2.5V	
98	Accelerator pedal position sensor 2	Approx. 0.3V	Approx. 0.35V
83	Accelerator pedal position sensor 2 ground	Approx. 0V	

- When the accelerator pedal is depressed slowly from the fully-closed position, the voltage must increase in proportion to the opening of the throttle. [Ignition switch ON (engine stopped)]

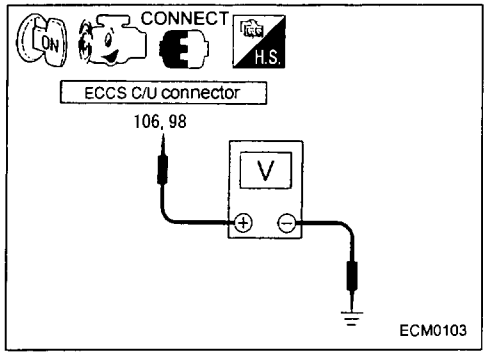
Terminal	Signal name	Ignition switch ON, engine stopped Accelerator pedal is fully released	Ignition switch ON, engine stopped Accelerator pedal is fully depressed
106	Accelerator pedal position sensor 1 signal	Approx. 0.6V	Approx. 4.2V
98	Accelerator pedal position sensor 2 signal	Approx. 0.3V	Approx. 2V

(3) Circuit Diagram



(4) Component Parts Inspection

ACCELERATOR PEDAL POSITION SENSORS (APPS) 1, 2 (ACCELERATOR WORK UNIT)

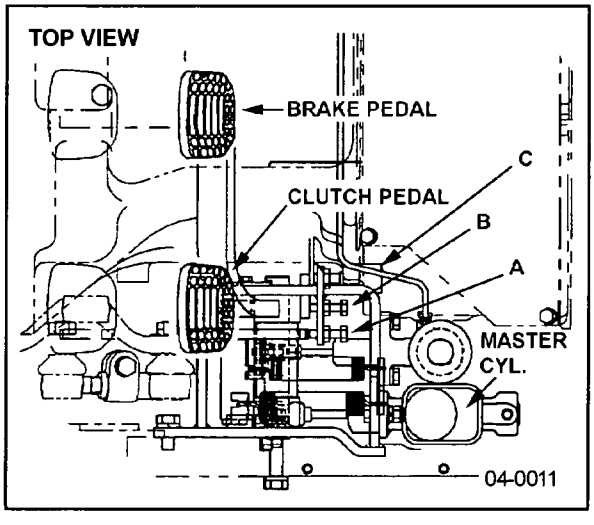


Check voltage between ECM terminal 106, 98 and ground.

APPS 1 (terminal 106) - At idle:	**About 0.60v**
APPS 1 (term. 106) - IGN ON, engine OFF w/ pedal depressed:	**About 0.60v**
APPS 1 (term. 106) - IGN ON, engine OFF w/ pedal released:	**About 4.20v**
APPS 1 (term. 106) - At 2,000 rpm:	**About 0.65v**
APPS 2 (term. 98) - At idle:	**About 0.30v**
APPS 2 (term. 98) - IGN ON, engine OFF w/ pedal released:	**About 0.30v**
APPS 2 (term. 98) - IGN ON, engine OFF w/ pedal depressed:	**About 2.00v**
APPS 2 (term. 98) - At 2,000 rpm:	**About 0.35v**

- **Do not apply voltage to accel. pedal sensor terminal.**
- **Do not disassemble accelerator work unit.**

ADJUSTING THE CLUTCH/BRAKE PEDAL (MANUAL TRANSMISSION)



Clutch Pedal

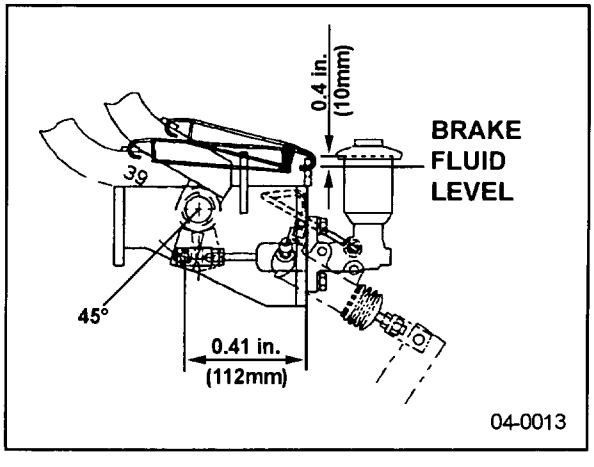
1. Adjust the clutch pedal stopper bolt (A) so that the released pedal height (See illustration) is **7.87 in. (200mm).**
2. Then loosen the locknut on the clutch master cylinder rod and adjust the rod to provide a pedal free play of **0.12 - 0.20 in. (3 - 5mm).**

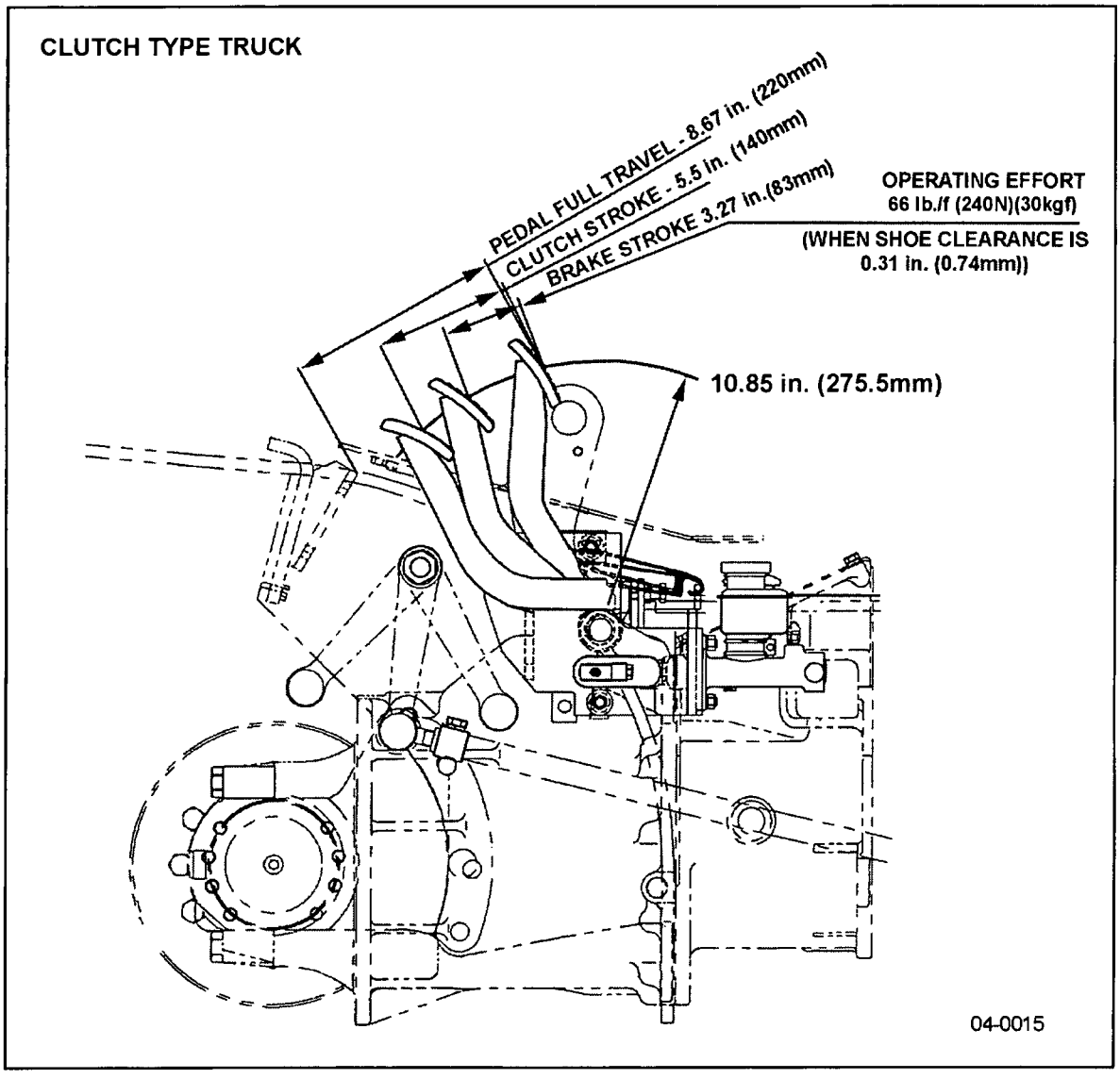
Brake Pedal

1. Adjust the brake pedal stopper bolt (B) so that so that the released pedal height is **8.67 in. (220mm).**
2. Then loosen the locknut on the brake master cylinder rod and adjust the rod to provide a pedal free play of **0.51 - 0.67 in. (13 - 17mm).**
3. Pedal depressed height should be **3.15 -3.54 in. (80 - 90 mm).**

Brake Fluid

3. Check the brake fluid level and add if necessary. **(DOT 3 brake fluid)**





MEASURING BRAKE STOPPING DISTANCE (BRAKING EFFECT)

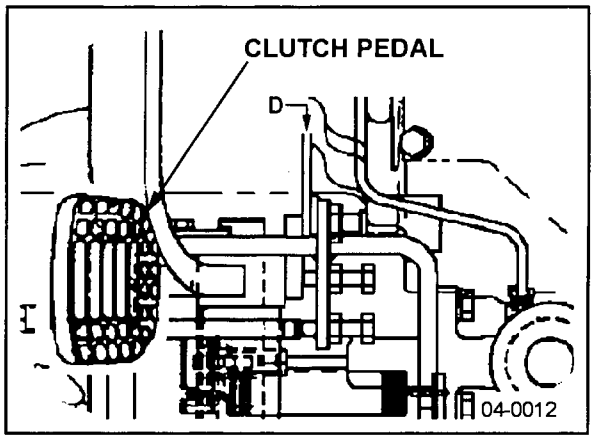
1. Using a qualified forklift truck driver, perform this test safely on a flat, dry, open paved surface.
2. Accelerate the truck to maximum speed, then stop the machine suddenly.
3 Check for steering wheel pull to the right or left.
4. Check for a "dragging" feel to the brakes.
5. Listen for abnormal noise or grinding.
6. Measure the stopping distance using an assistant. Stopping distances should be within specified limits shown in the table below.

With truck unloaded	Within 14.7 ft. (4.5m) at 12.4 mph (20 km/h)
With truck loaded	Within 6.56 ft. (2.0m) at 6.2 mph (10 km/h)

ADJUSTING THE STOP LAMP SWITCH

1. After adjusting the brake pedal height, set the gap (D) to **0.02 - 0.06 in. (0.5 - 1.5mm)**.
2. Coat the sliding portion of the link with lithium grease.

Link Ratio	
Clutch/Brake Pedals	6.11



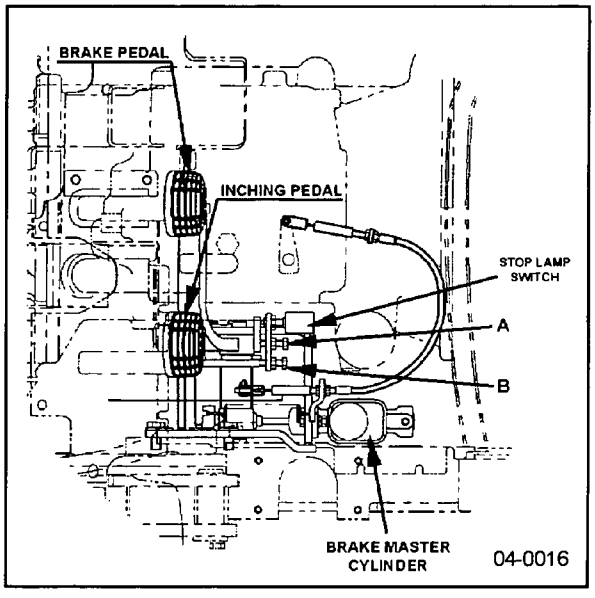
ADJUSTING THE INCHING / BRAKE PEDAL (TORQFLOW TRUCKS)

Brake Pedal

1. When assembling, coat the sliding portion of the link with lithium grease.
2. Set the brake pedal stopper bolt (A) so that the brake pedal released height is **7.8 in. (198mm)**.
3. Loosen the rod adjuster nut and rotate the rod to set the pedal play at **0.51 - 0.67 in. (13 - 17mm)**. Tighten the adjuster nut and recheck.

Inching Pedal

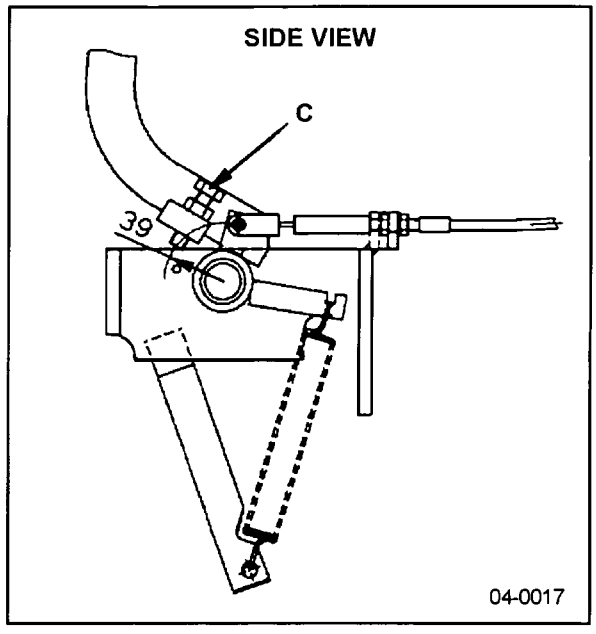
1. Adjust the inching pedal stopper bolt (B) to set the inching pedal released height at **8.16 in. (207mm)**.

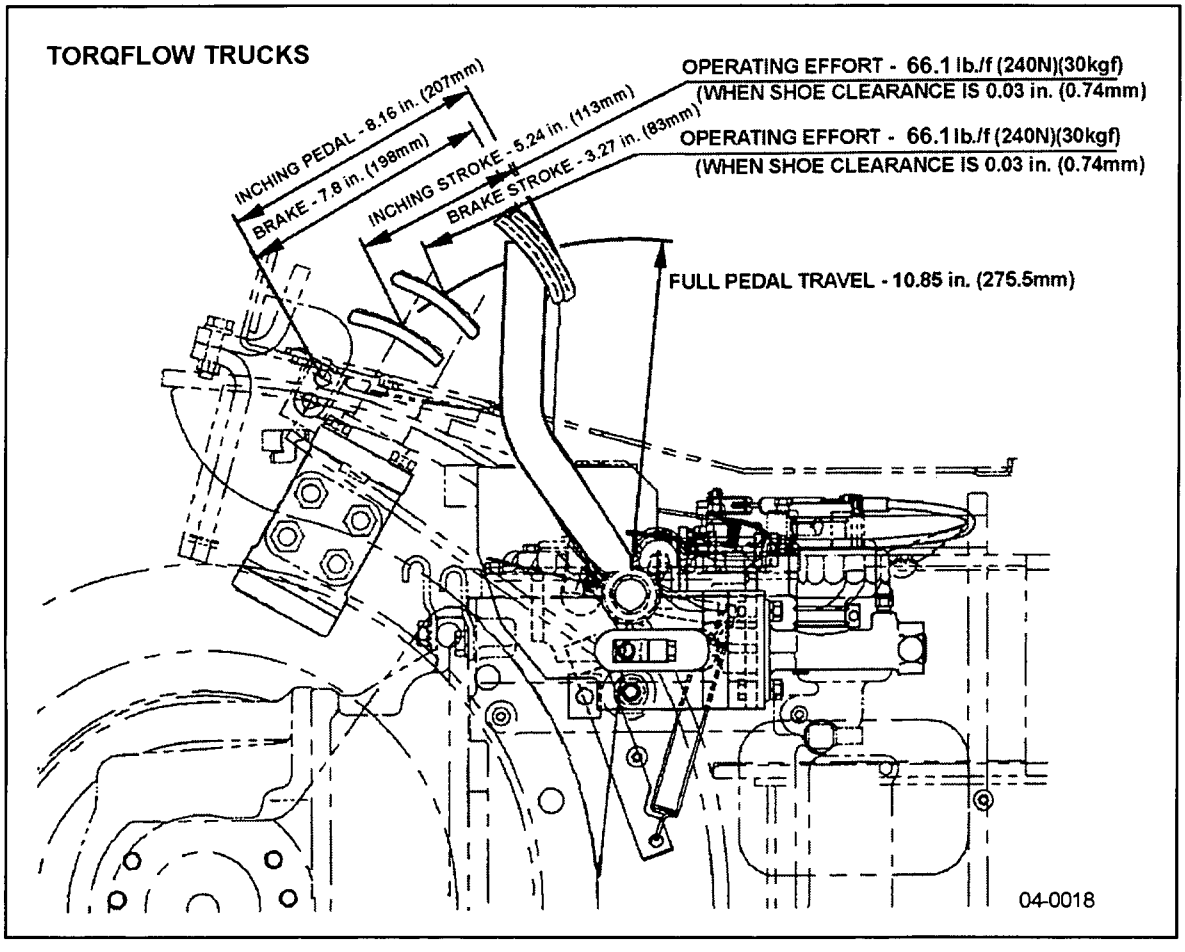


Inching Pedal/Brake Pedal Interconnected Travel

1. Adjust the stopper bolt (C) (See Figure 04-0017) to set the brake pedal so that it travels **1.85 - 2.09 in. (47 - 53mm)** down, from the released position, before interlocking with the inching pedal.

Link Ratios	
Inching Pedal	7.05
Brake Pedal	6.11





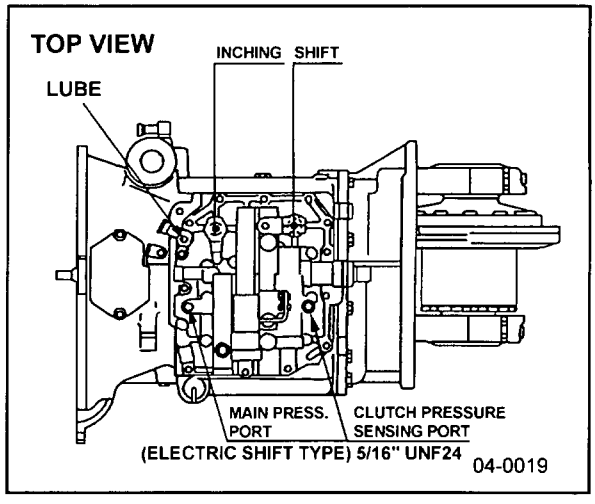
CHECKING TORQFLOW CLUTCH ACTUATION PRESSURE

⚠ WARNING

When carrying out the following tests and checks, apply the parking brake securely and block the lift truck wheels. Watch out for sudden lift truck movement.

1. Place the FORWARD/REVERSE (F/W) lever at the FORWARD or REVERSE position.
2. Fully depress the accelerator pedal and measure the pressure at the Clutch Pressure Sensing Port in the top of the transmission.
   (See Figure 04-0019).

	Units: psi (Mpa) (kgf/cm^2) / rpm
Clutch Actuation Pressure (Pedal Released)	91.4 - 156.6 (0.63 - 1.08) (6.5 - 11.0) / 1,000 127.6 - 177 (0.88 - 1.22) (9.0 - 12.5) / 2,000



NOTE: The pressures displayed in the table above refer to pressures measured with the Inching Pedal released. When the pedal is depressed, the pressures should all drop to zero.

CHECKING TORQUE CONVERTER STALL SPEED

NOTE: This operation raises the transmission fluid temperature rapidly. Do not continue this operation for more than a few seconds at a time.

1. Warm engine up to normal operating temperature.
2. Hold down brake pedal and place in gear.
3. Depress the accelerator pedal fully and run at maximum speed.
4. While at maximum speed, check the rpm with a tachometer.

K21 - Maximum Governed Speed	2,950 - 3,000 rpm
Torque Converter Stall Speed	2,100 ± 100 rpm
Main Pressure	92.5 psi (6.5 kgf/cm^2) /750 rpm 177.8 psi (12.5 kgf/cm^2) / 2,000 rpm
Lube Pressure	30 - 50 psi (2.1 - 3.5 kgf/cm^2)

TESTING SPECIFIC GRAVITY OF BATTERY ELECTROLYTE

⚠ WARNING

Precautions when handling a battery:

- **Battery electrolyte is dangerous. If it gets into your eyes or on your skin or clothing, wash it off with large amounts of fresh water quickly. If it gets into your eyes, seek medical attention immediately.**
- **WEAR ADEQUATE EYE AND HAND PROTECTION WHEN HANDLING BATTERIES AND WHEN CHECKING BATTERY ELECTROLYTE.**
- **Keep away from sparks, flames and any ignition source.**
- **To avoid gas explosions, do not smoke or cause a short circuit or spark near the battery. Do not lay tools or metal objects on top of the battery.**

1. Charge the battery and, after charging, check that the battery electrolyte fluid level is correct.
   If the electrolyte level in the battery is below the top of the electrode plates, add distilled water to the top of the plates. Do not overfill.
2. Check and clean battery caps and terminals.
3. Check the battery case for cracking, damage or stains caused by leakage. If you notice white, crusty deposits around the base of the battery or on the battery tray, there may be a leakage problem.
4. Using a Specific Gravity Meter and a thermometer, measure the specific gravity and temperature of the electrolyte. Write them down.
5. Insert the values obtained in Step 4 into the formula shown below, and calculate S_{20}.

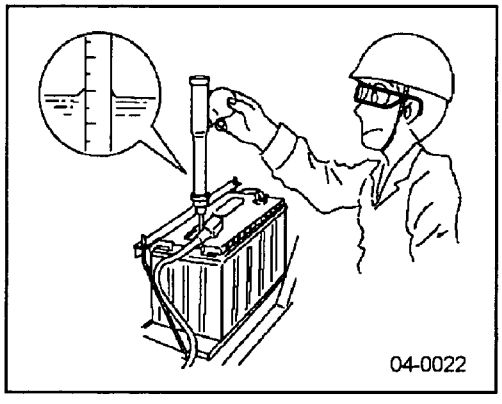
   S_{20} = St + 0.0007 (t - 20)

   S_{20}: Specific gravity at 68° F (20° C)

   St: Specific gravity (measured value) at t°C (actual measured temperature)

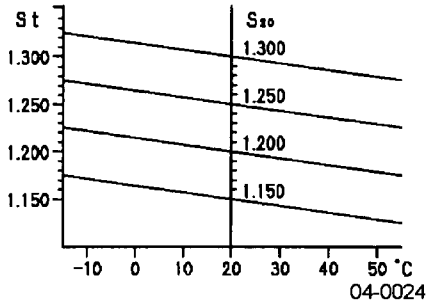
   t: Temperature of battery electrolyte as measured in the battery

   Normal value: S_{20} = 1.27 - 1.29


04-0022

If specific gravity is below **1.225**, check terminals, cables and charging system and repair as needed.

RELATIONSHIP BETWEEN SPECIFIC GRAVITY AND ELECTROLYTE TEMPERATURE



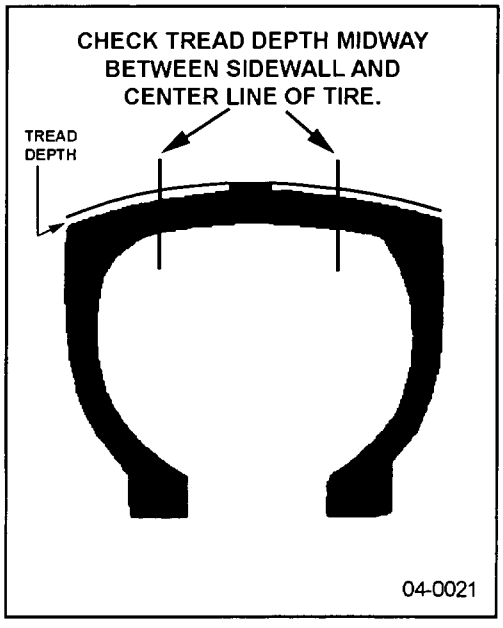
04-0024

CHECKING TIRES AND ADJUSTING PNEUMATIC TIRE PRESSURE

Check pneumatic tire pressure before each daily forklift operation using an accurate tire pressure gauge. Add or remove air from the tires as required to meet the specified pressure.

Front Tires	Rear Tire(s)
98.6 psi (0.68MPa) (7.0 kgf/cm^2)	98.6 psi (0.68MPa) (7.0 kgf/cm^2)

Check all tires for cuts and cracks in tread and sidewalls, abnormal wear (uneven or stepped wear), metal pieces and debris stuck in tires. Replace severely damaged or worn tires. Check tread depth and if the depth of tread is less than **0.63 in. (1.6mm)**, replace the tire(s).



MEASURING MINIMUM LEFT AND RIGHT TURNING RADIUS

NOTE: A qualified forklift truck driver must be used for this operation.

1. Attach a piece of chalk securely to the end of a stick or rod. Attach it to the outermost side of the counterweight with the chalk contacting the ground. Be sure to perform this operation on a clean, level surface so that the chalk mark can be observed.
2. Instruct the operator to turn the lift truck in the tightest right turn possible with the chalk marking a circle on the ground. In a different spot, perform the same operation while turning left.
3. Measure the diameter of the circles.
4. The measurements should fall within the specified limits in the table below.
5. Adjustments can be made by turning the stopper bolts. Loosen the jam nut and adjust the stopper bolt in or out as necessary to obtain the specified turning radius. Tighten the jam nut when done.

Trucks	Pneumatic Tire	Cushion Tire
1.5-ton	Within 76.6 in. (1,945mm) ± 5%	Within 67.9 in. (1,725mm) ± 5%
1.8-ton	Within 78.0 in. (1,980mm) ± 5%	Within 69.7 in. (1,770mm) ± 5%
Difference between right & left turn diameters		Within 3.9 in. (100mm)

MEASURE HYDRAULIC CONTROL VALVE RELIEF PRESSURE

1. Install an oil pressure gauge to the relief measurement port (A) as shown in the figure at right.
2. Raise the forks to maximum lifting height and measure the pressure when the oil is relieved.
3. The oil relief pressure reading should match the specified relief pressure specified in the table below.

Relief set pressure	2,625 psi (18.1 MPa) (185 kgf/cm^2)