

VR60B/VR70B

VARIABLE REACH FORKLIFT

COMMUNICATION NO. 58821794

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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CORRECTIVE ACTION REQUEST (CAR)

IS THERE SOMETHING WRONG WITH THIS MANUAL?

YOU CAN HELP IMPROVE THIS MANUAL. IF YOU FIND ANY MISTAKES OR IF YOU KNOW OF A WAY TO IMPROVE THE PROCEDURES, PLEASE LET US KNOW.

The following form is for the use of the Distributor, Customer, Mechanic, and all other persons who use this manual and recognize beneficial ways to improve its purpose as a worthy reference. CARs are to be made in regards to, but not limited to; Safety, Operational Correctness, and Technical content. All CARs will be reviewed by the responsible Department at Ingersoll-Rand. Approved CARs will be distributed in a Service or Parts Letter immediately and then incorporated in the next scheduled change to the manual. An answer to the CAR, approved or disapproved, will be sent directly to the one submitting the CAR.

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1. Insert latest changed pages. Destroy superseded pages.
2. The portion of text affected by changes is indicated by a vertical line in the outer margins of the page.
3. Changes to illustrations are indicated by miniature pointing hands.
4. Changes to wiring diagrams are indicated by shaded areas.

REVISION LOG

**VR60B/VR70B
VARIABLE REACH FORKLIFT
OPERATION AND
MAINTENANCE MANUAL
COMMUNICATION NO.
58821794**

REVISION LEVEL	COMMUNICATION NUMBER	DATE
0 Original Issue	58821794	03-05-93

SECTION	PAGE NO.	REVISION LEVEL
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	Title Page	0
	CAR	0
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	i, ii	0
1	1-1 - 1-20	0
2	2-1 - 2-4	0
3	3-1 - 3-4	0
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8	8-1 - 8-22	0
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11	11-1 - 11-6	0
12	12-1 - 12-6	0
13	13-1 - 13-4	0
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16	16-1 - 16-2	0
17	17-1 - 17-2	0
18	18-1 - 18-4	0
	Warranty/Back Cover	0

A, B

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A, B

VR60B/VR70B Variable Reach Forklift
Operation and
Maintenance Manual
Communication No. 58821794

To easily locate the major sections in this manual, the first page of each major section is imprinted with a black square in a position corresponding to the section position listed on this page. To use the rapid index, hold the manual and spread the edges of the pages with the right thumb until the square is located which corresponds to the index position of the section desired. Then open the book. The contents of these sections are listed on the first page of each section.

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If any questions arise concerning this publication or others, contact your local distributor for the latest available information.

Contents of this manual are based on information in effect at the time of publication and are subject to change without notice.

SECTION

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Symbol Identification/Metric Conversion	3
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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

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OVERVIEW

Before you operate, maintain, or in any other way use this lift truck:

READ and STUDY both this Manual and the **Rough Terrain Forlift Safety Manual for Operators and Mechanics**. Know how to safely use the lift truck's controls and what you must do for safe maintenance.

ALWAYS wear or use the proper safety items required for your personal protection.

READ and UNDERSTAND the information about "NAMEPLATE" and "RATED CAPACITY CHART" in this Section of the Operation and Maintenance Manual.

MAKE SURE that a trained and qualified person will be operating the lift truck. A qualified person experienced in the operation of a rough terrain forklift truck MUST guide a new operator through several driving and load-handling operations before the new operator attempts to operate the lift truck alone.

If you have any questions about the safe use or maintenance of this lift truck, ask your supervisor or contact any Ingersoll-Rand distributor. NEVER GUESS—ALWAYS CHECK!

PRE-START INSPECTION

INSPECT your lift truck daily. Ensure that the routine maintenance and lubrication are being dutifully performed. Have any malfunctioning, broken, or missing parts corrected or replaced before use. DO NOT operate a damaged or poorly maintained lift truck. You risk lives when operating faulty equipment, INCLUDING YOUR OWN.

VERIFY that all instruction and safety labels are in place and readable. These are as important as any other equipment on the lift truck.

Continued

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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

PRE-START INSPECTION - CONT.

CLEAN any foreign material from the steps and operator's platform to reduce the danger of slipping.

NEVER fill the fuel tank with the engine running, while near an open flame, or when smoking. ALWAYS wipe up any spilled fuel.

CHECK for WARNING tags placed on the lift truck. DO NOT operate the lift truck until repairs have been made and the WARNING tags are removed by authorized personnel.

KNOW the location of the Emergency Shut-Down Control if the lift truck is so equipped.

ALWAYS know the capability and limitations of your equipment—speed, gradability, steering, and braking.

BE AWARE of the dimensions of your lift truck—height and width—as well as your transporter dimensions and weight.

WATCH for overhanging obstructions such as wires or tree limbs.

CHECK for any conditions that could be dangerous—holes, banks, underground culverts, manhole covers, water meter pits, curb and/or street boxes.

OPERATOR PROTECTION EQUIPMENT

The OVERHEAD GUARD is intended to offer reasonable protection to the operator from falling objects, but cannot protect from every possible impact. Therefore, it must not be considered a substitute for good judgment and care when handling loads. Do not remove the overhead guard.

ALWAYS fasten the seat belt. The seat belt provides a means to help the operator keep the head and torso substantially within the confines of the lift truck frame if a tipover occurs. This restraint system is intended to reduce the risk of the head and torso being trapped between the truck and the ground, but cannot protect the operator against all possible injury in a tipover.

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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

OPERATOR PROTECTION EQUIPMENT - CONT.

The LOAD BACKREST EXTENSION is installed to keep loose parts of the load from falling back toward the operator. It must be high enough, with openings small enough, to prevent the parts of the load from falling backwards.

STARTING

USE the hand rails and steps to get on and off the lift truck. ALWAYS maintain a three-point contact when climbing onto or off the lift truck.

READ and FOLLOW ALL instruction decals.

Seat belts and other OSHA-required safety equipment MUST be worn when operating the lift truck.

BEFORE you start the lift truck, ENSURE that the direction control lever is in "Neutral" (N).

BEFORE you start the lift truck, ENSURE that the parking brake is fully applied, with the lever in the locked position.

BEFORE you start the lift truck, ENSURE that no one is standing between the wheels and the frame.

START the engine from the operator's position only.

Jump-starting the engine is NOT RECOMMENDED. If you do jump-start, use EXTREME CAUTION. Prior to jump-starting, ENSURE:

Direction control lever is in "Neutral" (N).

A TRAINED OPERATOR is at the controls when the engine starts.

The parking brake is ON.

DO NOT use ether or other starting fluids for cold-weather starting. Use of starting fluids can cause severe engine damage to the Perkins engine. If the lift truck will not start in cold weather with the use of the cold start button (glow plug system), it must be moved to a warmer area for starting.

CHECK the operation of all the lift truck's systems, including transmission, brakes, and boom operation, before beginning work.

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

OPERATOR PROTECTION EQUIPMENT - CONT.

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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

OPERATING

ALWAYS make sure that no person or obstruction is in your line of travel **BEFORE** starting the lift truck in motion.

NEVER climb onto or off the lift truck while it is in motion.

REMAIN seated, with seat belt securely fastened, when operating the lift truck.

USE extreme caution and be observant when working in close quarters or congested areas.

OPERATE ONLY from the seated position. **NEVER** carry passengers.



DANGER



Hazardous voltage.

Will cause severe injury or death.

Keep boom away from power lines.

DO NOT work over or near electric power lines. This machine is not insulated. **DO NOT** operate this machine in any location where any part of it will come within 12 feet (3.66 meters) of any high-voltage lines.

KNOW the area in which you are working. Familiarize yourself with work site obstructions and any other potential hazards in the area.

KNOW and **USE** the hand signals required for particular jobs and know who has the responsibility for signaling.

DO NOT work in the vicinity of overhanging banks, or on grades that could cause the lift truck to slide or roll over.

Continued

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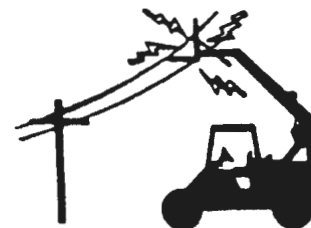
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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

OPERATING - CONT.

AVOID excessively steep slopes or unstable surfaces. If you must drive on a slope, keep the load low and proceed with extreme caution. DO NOT drive across excessively steep slopes under any circumstances.

AVOID turning on an incline, if at all possible. If it is necessary, use extreme caution and make the turn wide and SLOW.

KEEP your seat belt fastened at all times when operating the lift truck. If the lift truck should tip over:

- DO NOT JUMP; stay on the truck.
- HOLD firmly to the steering wheel.
- BRACE your feet.
- LEAN FORWARD and away from the impact.

ALWAYS look in all directions BEFORE changing your direction of travel.

DO NOT use your lift truck to lift people; it is not designed for such use.

TRAVEL SLOWLY WHEN TURNING. Lift trucks can tip over even at very slow speeds. The combination of speed and the sharpness of a turn can cause a tipover. A lift truck is less stable when the forks are elevated, with or without a load. A tipover can occur with an empty lift truck; in fact, the lift truck will actually tip over more easily when empty than when loaded with the load lowered. Rearward tilt of the carriage and load, off-center loads, and uneven or soft ground will aggravate these conditions.

KEEP a safe distance from the edge of docks, ramps, platforms, and other similar working surfaces.

KEEP a safe distance from the edges of excavations so that ground does not suddenly collapse and tip over the lift truck. Be careful when operating on slopes when the ground is soft or muddy so that the lift truck does not suddenly slide and tip over.

Coordinated steering provides the greatest maneuverability and is the mode of steering most often used. The lift truck must be completely stopped before the steering mode is changed. The wheels must be aligned for straight travel before another mode is selected. Use the front wheel (2-wheel) steering mode to align the wheels before another steering mode is selected.

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

OPERATING - CONT.

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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

OPERATING - CONT.

KEEP yourself and others away from the lift mechanism. NEVER permit anyone under or on the forks.

NEVER put head, arms, hands, or legs through the boom mechanism nor near the forks or carriage. This rule applies not only to the operator, but also a helper. A helper must not be near the load or lift mechanism when the operator is attempting to handle a load. The lift mechanism has moving parts with close clearances that can cause serious injury.

DO NOT move the direction control lever (transmission) to the opposite position (FWD to REV or REV to FWD) when the lift truck is moving.

WATCH for pedestrians at all times. Do not drive up to anyone standing in front of an object. Use extra care at crossroads, doorways, and other locations where pedestrians can step into the path of travel of the lift truck. Slow down when approaching blind intersections or turns and sound the horn. The horn can alert pedestrians that there is a vehicle in the area and to be alert to possible danger.

AVOID bumps, holes, soft ground, slick spots, and loose materials that can cause the lift truck to swerve or tip. If such areas cannot be avoided, go slowly. Always make sure you pick the smoothest route for your lift truck.

NEVER indulge in stunt driving or horseplay.

ALWAYS operate the lift truck at a speed that will permit it to be brought to a stop in a safe manner.

DO NOT tow or push the lift truck, except as explained under "TOWING" in SECTION 5 - OPERATING INSTRUCTIONS of this manual.

DO NOT run the engine in a closed building for an extended length of time. EXHAUST FUMES CAN KILL.

LOAD HANDLING

MAKE SURE you understand the Rated Capacity Chart(s) and the operation of the boom before a load is lifted.

ENSURE that you are using the proper Rated Capacity Chart for the boom attachment fitted to the lift truck at the moment.

Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

OPERATING - CONT.

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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

LOAD HANDLING - CONT.

HANDLE only loads within the rated capacity as shown on the Rated Capacity Chart(s). This rated capacity represents the maximum load that can be lifted for the boom extensions when the lift truck is on a hard, level surface. However, such factors as weak floors, uneven terrain, soft ground, special load-handling attachments, or loads having a high center of gravity can mean that the safe working load is less than the rated capacity. When such conditions exist, the operator must reduce the load so that the lift truck will remain stable.

USE the frame leveling function to compensate for uneven terrain when operating on a side slope. Use the level indicator to make sure the lift truck is level before raising the boom. DO NOT use the frame leveling function when the load is raised.

DO NOT attempt to use the lift truck as an endloader. The lift truck is designed for lifting loads, NOT for digging or excavating.

INSPECT the load to be lifted. Lift the load and lower the load only on stable level ground. If a load must be handled several times, put stacking blocks under the load. Handle only stable loads. A load can have unstable items that can easily shift and fall on someone. DO NOT handle a load if any part of it is likely to fall. If a suspended load must be lifted, DO NOT permit it to swing freely; use a tether to control its movement.

MAKE SURE that the floor or surface can hold the weight of the lift truck and the load.

MAKE SURE that the surface or structure onto which you are placing the load is capable of supporting the load safely.

REMEMBER that although the lift truck's overhead guard provides a degree of protection from falling objects to the operator, other personnel in the area have no such protection. Keep all persons out of the area where they could be injured by a falling load or a tilting lift truck.

STOPPING

ALWAYS park the lift truck on solid, level ground. If this is not possible, always park the lift truck at a right angle to the slope, set the parking brake, and chock the wheels.

Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

LOAD HANDLING - CONT.

HANDLE only loads within the rated capacity as shown on the Rated Capacity Chart(s). This rated capacity represents the maximum load that can be lifted for the boom extensions when the lift truck is on a hard, level surface. However, such factors as weak floors, uneven terrain, soft ground, special load-handling attachments, or loads having a high center of gravity can mean that the safe working load is less than the rated capacity. When such conditions exist, the operator must reduce the load so that the lift truck will remain stable.

USE the frame leveling function to compensate for uneven terrain when operating on a side slope. Use the level indicator to make sure the lift truck is level before raising the boom. DO NOT use the frame leveling function when the load is raised.

DO NOT attempt to use the lift truck as an endloader. The lift truck is designed for lifting loads, NOT for digging or excavating.

INSPECT the load to be lifted. Lift the load and lower the load only on stable level ground. If a load must be handled several times, put stacking blocks under the load. Handle only stable loads. A load can have unstable items that can easily shift and fall on someone. DO NOT handle a load if any part of it is likely to fall. If a suspended load must be lifted, DO NOT permit it to swing freely; use a tether to control its movement.

MAKE SURE that the floor or surface can hold the weight of the lift truck and the load.

MAKE SURE that the surface or structure onto which you are placing the load is capable of supporting the load safely.

REMEMBER that although the lift truck's overhead guard provides a degree of protection from falling objects to the operator, other personnel in the area have no such protection. Keep all persons out of the area where they could be injured by a falling load or a tilting lift truck.

STOPPING

ALWAYS park the lift truck on solid, level ground. If this is not possible, always park the lift truck at a right angle to the slope, set the parking brake, and chock the wheels.

Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

STOPPING - CONT.

AVOID leaving the operator's platform with the engine running. ALWAYS move the direction control lever to "Neutral" (N), apply the parking brake, pull the fuel shut-off control (if so equipped), turn the ignition switch to OFF, and lock all lockable compartments.

USE proper flags, barriers, and warning devices, especially when parking in areas of traffic.

MAINTENANCE

AVOID, whenever possible, servicing, cleaning, or examining the lift truck with the engine running.

AVOID, whenever possible, servicing or providing maintenance to the lift truck unless the wheels are adequately chocked.

NEVER fill the fuel tank with the engine running, while near an open flame, or when smoking. ALWAYS wipe up any spilled fuel.

AVOID removing the pressurized radiator cap until the engine's cooling system has cooled.

DO NOT alter the engine governor settings from those indicated in the engine manual and the engine option plate.

ALWAYS replace damaged or lost decals. Refer to the Parts Manual for the proper location and part number of all decals.

DISCONNECT the battery cables when working on the electrical system or when welding on the lift truck.

BE SURE the battery area is well-ventilated (clear of fumes) should it become necessary to connect a jump battery or battery charger. Fumes from the battery can ignite by a spark and explode.

IF battery charging is required, be sure the battery charger is "Off" when making the connections.

BE SURE the correct battery polarity is observed (negative [-] to negative [-] and positive [+] to positive [+]) when connecting to a battery charger or jumper cable.

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

STOPPING - CONT.

AVOID leaving the operator's platform with the engine running. ALWAYS move the direction control lever to "Neutral" (N), apply the parking brake, pull the fuel shut-off control (if so equipped), turn the ignition switch to OFF, and lock all lockable compartments.

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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

TRANSPORTING AND HAULING

DO NOT attempt to load the lift truck on the transporter without knowledge and experience with the operation of the lift truck.

ALWAYS use a ramp when loading the lift truck on the transporter. Be sure ramps are of adequate strength, low angle, and proper height.

USE proper chock blocks in front and rear of the wheels of the transporter when loading the lift truck.

BE SURE to approach the transporter loading ramps squarely to make sure the lift truck does not drop off the side of the ramp.

KEEP the transporter deck clean of clay, oil, ice, frost, or any other material that can become slippery.

USE proper chock blocks in front and rear of the lift truck wheels.

SHUT the engine OFF, apply the parking brake, and lock all lockable compartments.

ALWAYS know the overall height of the lift truck and hauling vehicle. Observe height and weight regulations and overhead objects to be sure you can safely pass beneath them.

When roading your lift truck on a public access, obey all traffic regulations and be sure that the proper clearance flags, lights, and warning signs, including the "Slow Moving Vehicle" emblem, are properly displayed. Know your approximate stopping distance at any given speed. Never turn corners at excessive speeds. Look in all directions before reversing your direction of travel.

WARNING

A loose lift truck can shift or fall while being transported.

Tie down the lift truck securely before moving the hauling vehicle or transporter.

1. Position the lift truck on the transporter or hauling vehicle centered from side to side and apply the parking brake.

Continued
1-9

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

TRANSPORTING AND HAULING

DO NOT attempt to load the lift truck on the transporter without knowledge and experience with the operation of the lift truck.

ALWAYS use a ramp when loading the lift truck on the transporter. Be sure ramps are of adequate strength, low angle, and proper height.

USE proper chock blocks in front and rear of the wheels of the transporter when loading the lift truck.

BE SURE to approach the transporter loading ramps squarely to make sure the lift truck does not drop off the side of the ramp.

KEEP the transporter deck clean of clay, oil, ice, frost, or any other material that can become slippery.

USE proper chock blocks in front and rear of the lift truck wheels.

SHUT the engine OFF, apply the parking brake, and lock all lockable compartments.

ALWAYS know the overall height of the lift truck and hauling vehicle. Observe height and weight regulations and overhead objects to be sure you can safely pass beneath them.

When roading your lift truck on a public access, obey all traffic regulations and be sure that the proper clearance flags, lights, and warning signs, including the "Slow Moving Vehicle" emblem, are properly displayed. Know your approximate stopping distance at any given speed. Never turn corners at excessive speeds. Look in all directions before reversing your direction of travel.

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1. Position the lift truck on the transporter or hauling vehicle centered from side to side and apply the parking brake.

Continued
1-9

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

TRANSPORTING AND HAULING - CONT.

2. With adequate chains or cables and blocks, secure the lift truck to the deck of the hauling vehicle or transporter to meet ICC or local regulations.

NAMEPLATE

Each lift truck **MUST** have a Nameplate and a Rated Capacity Chart. The nameplate provides specific information about the lift truck. Refer to Figure 1-1. The Nameplate also refers the operator to the Rated Capacity Chart. The Rated Capacity Chart is near the boom controls and shows the maximum loads that can be handled at different extensions and heights of the boom when the lift truck is on level ground. (The description of the Rated Capacity Chart follows below.)

If the lift truck equipment does not match the description of the equipment shown on the Nameplate and the Rated Capacity Chart, the lift truck **MUST NOT** be operated until its capacity is known.

When a lift truck is shipped incomplete from the factory, the Nameplate is covered by a decal as shown in Figure 1-2. **DO NOT** operate your lift truck if it has this kind of decal. Contact your Ingersoll-Rand distributor for rough terrain lift trucks to obtain a complete Nameplate.

WARNING

DO NOT add to or modify the lift truck. Any change to the lift truck or its equipment can change the lifting capacity. The lift truck must be rated as equipped and the nameplate must show the new capacity rating.

RATED CAPACITY CHART

The capacity of the lift truck changes as the boom is raised or extended. The Rated Capacity Chart is found near the boom controls and shows the capacity of the lift truck at different load positions. Refer to Figure 1-3. When loads are being moved, the operator must refer to the Rated Capacity Chart. The rated capacity of the lift truck is also determined by the location of the center of gravity of the load. The Rated Capacity Chart defines the load capacity only when the lift truck is on a level and stable surface.

Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

TRANSPORTING AND HAULING - CONT.

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Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

NAMEPLATE AND RATED CAPACITY CHART - CONT.

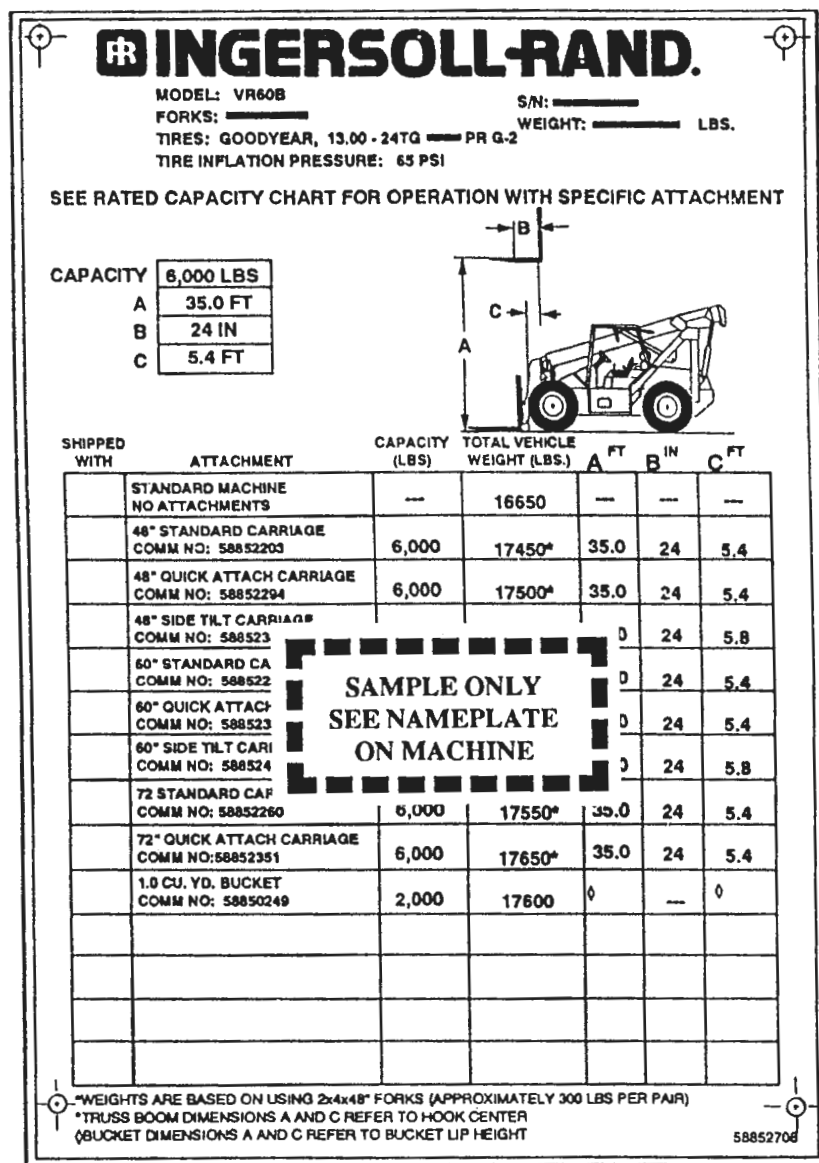


Figure 1-1. VR60B/VR70B Nameplate
 SAMPLE ONLY—SEE NAMEPLATE ON MACHINE

Continued
 1-11

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

NAMEPLATE AND RATED CAPACITY CHART - CONT.

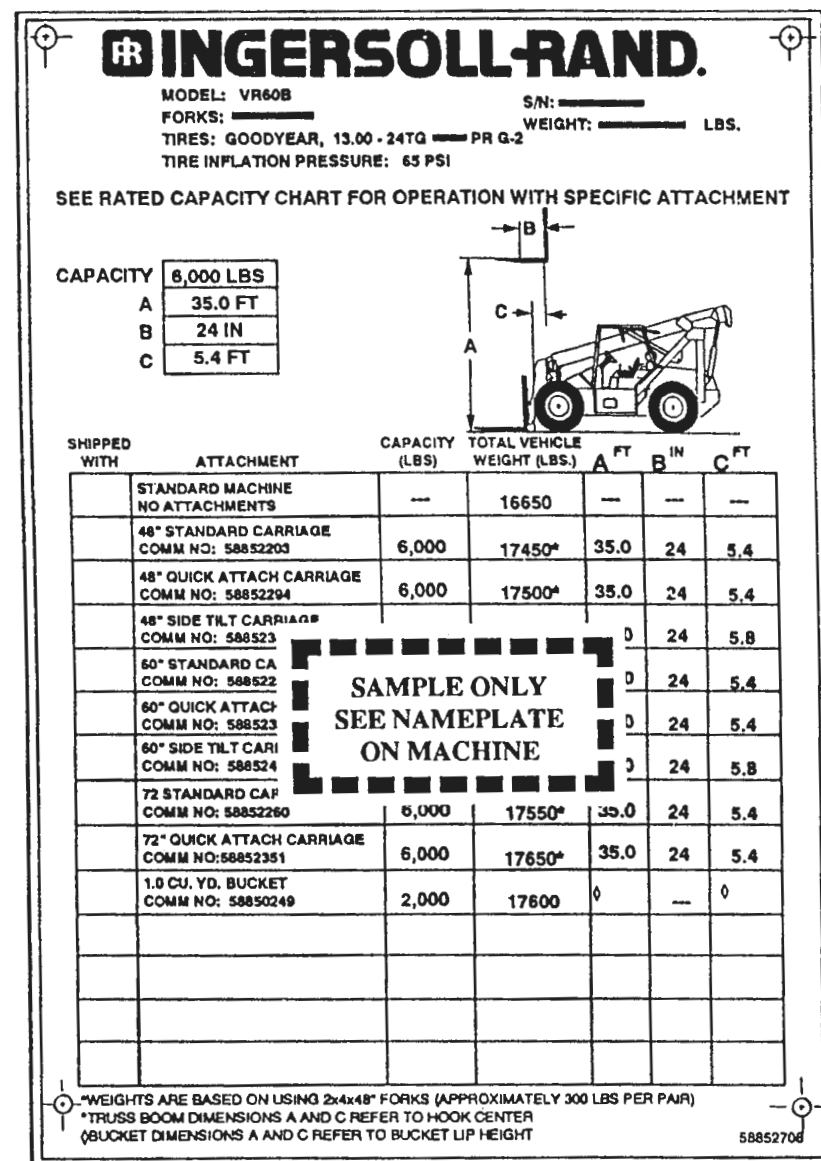


Figure 1-1. VR60B/VR70B Nameplate
 SAMPLE ONLY—SEE NAMEPLATE ON MACHINE

Continued
 1-11

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

NAMEPLATE AND RATED CAPACITY CHART - CONT.

TRUCK MODEL
Serial no.
Approx. weight

NOTICE TO USER

This unit was shipped incomplete from factory. The U.S.A. Occupational Safety and Health Act of 1970 and other national safety codes require the installation of a completed nameplate showing unit configuration and rated capacity. Completed nameplates may be obtained through your dealer.

Figure 1-2. Incomplete Nameplate Decal

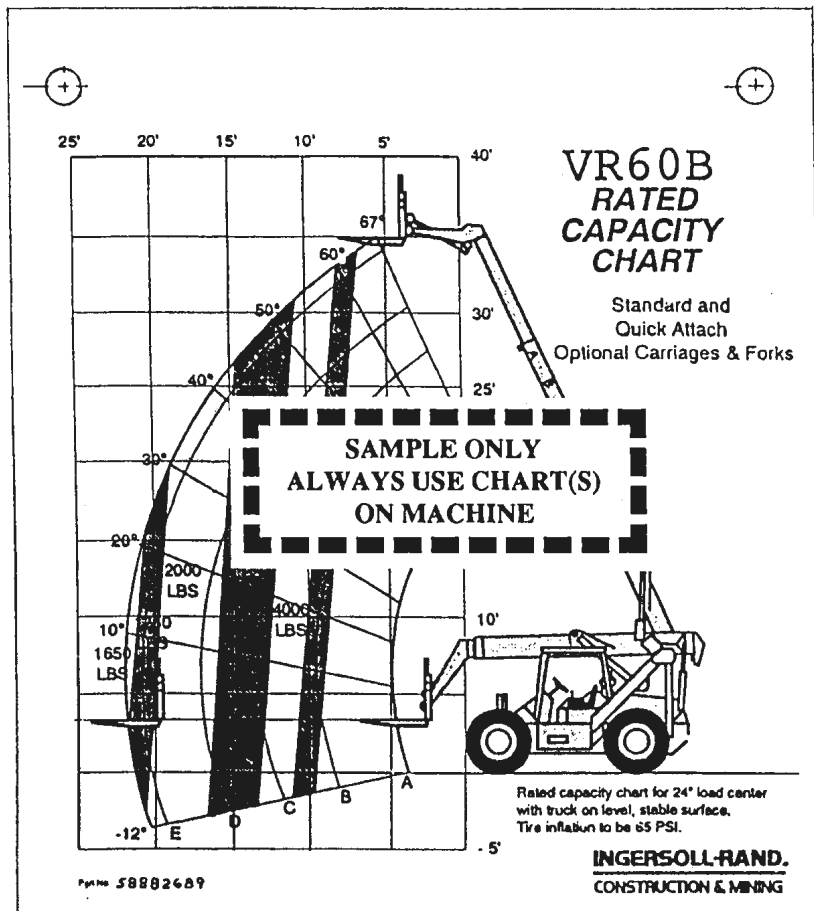


Figure 1-3. VR60B/VR70B Rated Capacity Chart
SAMPLE ONLY—USE CHART(S) ON MACHINE

Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

NAMEPLATE AND RATED CAPACITY CHART - CONT.

TRUCK MODEL
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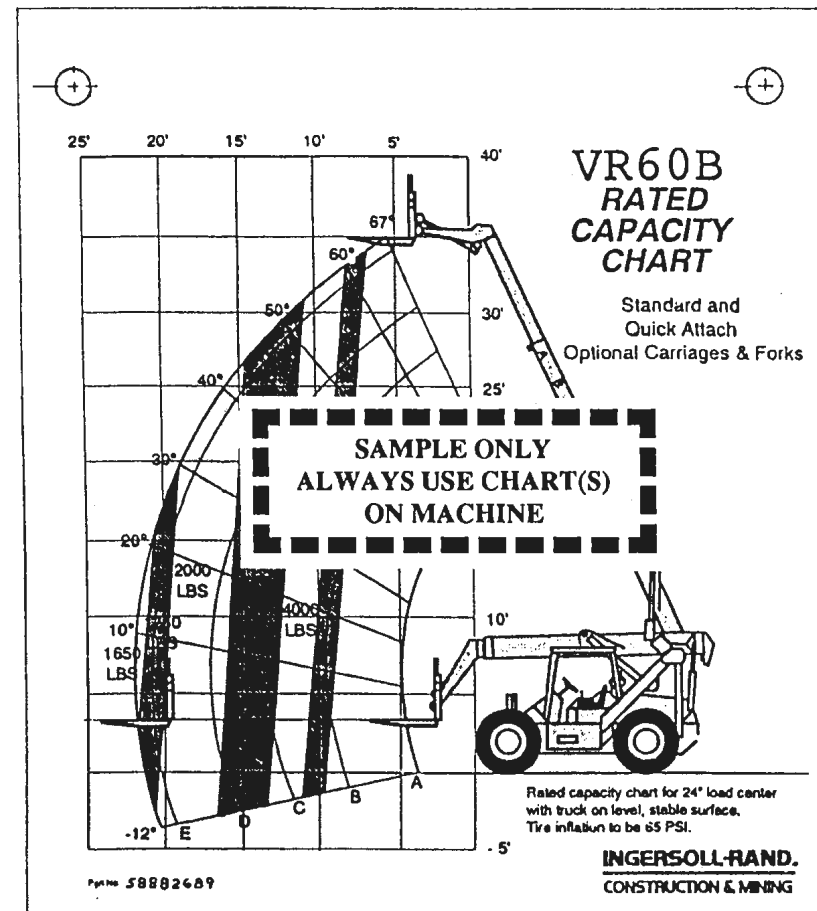


Figure 1-3. VR60B/VR70B Rated Capacity Chart
SAMPLE ONLY—USE CHART(S) ON MACHINE

Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

RATED CAPACITY CHART - CONT.

An angle indicator on the right front outer boom shows the boom angle to the chassis of the lift truck. The boom angle is shown on the Rated Capacity Chart by lines marked in degrees (°) extending away from the lift truck. Curved lines on the Rated Capacity Chart show the position of the load center of the load, at various angles, as the boom is extended. These lines are lettered A to F. These same letters are installed along the operator's side of the boom. When the boom is extended, the boom extension indicator (red arrow) will point at the letters on the boom.

The weight of the load must be known by the operator before the load is lifted to make sure that the load is within the capacity of the lift truck as shown on the Rated Capacity Chart. When the load is lifted, the load is always raised with the boom retracted. Raise the boom to the required angle so that it can be extended to the point where the load will be stacked. See the boom angle on the boom angle indicator and find that angle on the Rated Capacity Chart. Find the letter on the Rated Capacity Chart that shows the extension of the boom permitted for the weight of the load being lifted. The point where the lines cross for the required boom extension and the boom angle is the maximum lifting capacity for those conditions.

Loads shown on the Rated Capacity Chart are based on the load center being two feet (.6 meter) above and two feet (.6 meter) forward of the horizontal forks as indicated by dimensions "B" and "C" on the Nameplate.



WARNING

Always raise the boom with the boom retracted. Raise the boom to the angle where the boom can be extended to the point where the load will be stacked or lifted. Then extend the boom to stack or lift the load. When the boom is raised, the load center can move away from the lift truck.

If the load is larger than the "standard" 48-inch cube or if the weight of the load is not evenly distributed, the weight of the load must be less than the capacity shown on the Rated Capacity Chart.

Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

RATED CAPACITY CHART - CONT.

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Continued

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

RATED CAPACITY CHART - CONT.



WARNING

Raise the boom only when the lift truck is on a stable surface. If the surface breaks or the tires sink into the surface, the lift truck can tip over.



WARNING

Your lift truck may be equipped with several different Rated Capacity Charts to accommodate different boom attachments. **MAKE SURE** that the Rated Capacity Chart you are using corresponds to the boom attachment fitted to the lift truck at the moment.

The rated capacities shown on each Rated Capacity Chart are for a lift truck on a level surface.



WARNING

DO NOT add to or modify the lift truck. Any change to the lift truck or its equipment can change the lifting capacity. The lift truck must be rated as equipped and the nameplate must show the new capacity rating.

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

RATED CAPACITY CHART - CONT.



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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES



HAZARDOUS SUBSTANCE PRECAUTION

The following information is provided to assist the owners and operators of Ingersoll-Rand Road Machinery Equipment. Further information may be obtained by contacting your Ingersoll-Rand Road Machinery Equipment Distributor.

The following substances are used in the manufacture of this machine and may be hazardous to health if used incorrectly.

SUBSTANCE	PRECAUTION
Antifreeze (Water-cooled engine)	Avoid ingestion, skin contact, and breathing fumes.
Hydraulic Oil	Avoid ingestion, skin contact, and breathing fumes.
Engine Lubricating Oil	Avoid ingestion, skin contact, and breathing fumes.
Preservative Grease	Avoid ingestion, skin contact, and breathing fumes.
Rust Preventative	Avoid ingestion, skin contact, and breathing fumes.
Engine Fuel	Avoid ingestion, skin contact, and breathing fumes.
Battery Fluid	Avoid ingestion, skin contact, and breathing fumes.
SAE Gear Oil	Avoid ingestion, skin contact, and breathing fumes.

The following substances may be produced during the operation of this machine and may be hazardous to health.

SUBSTANCE	PRECAUTION
Engine Exhaust Fumes	Avoid breathing.
Engine Exhaust Fumes	Avoid buildup of fumes in confined spaces.
Electric Motor Dust (Brushes/Insulation)	Avoid breathing during maintenance.
Brake Lining Dust *	Avoid breathing during maintenance.

*Only on machines with dry axle brakes.

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES



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Rust Preventative	Avoid ingestion, skin contact, and breathing fumes.
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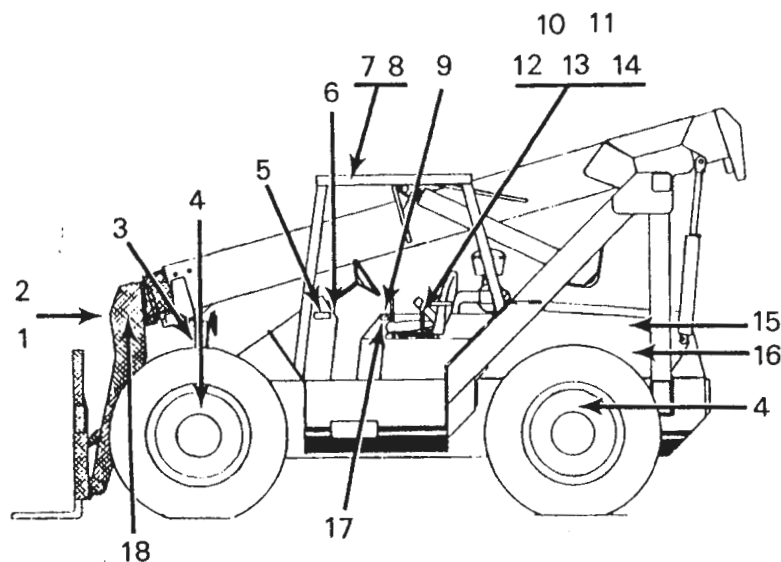
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SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

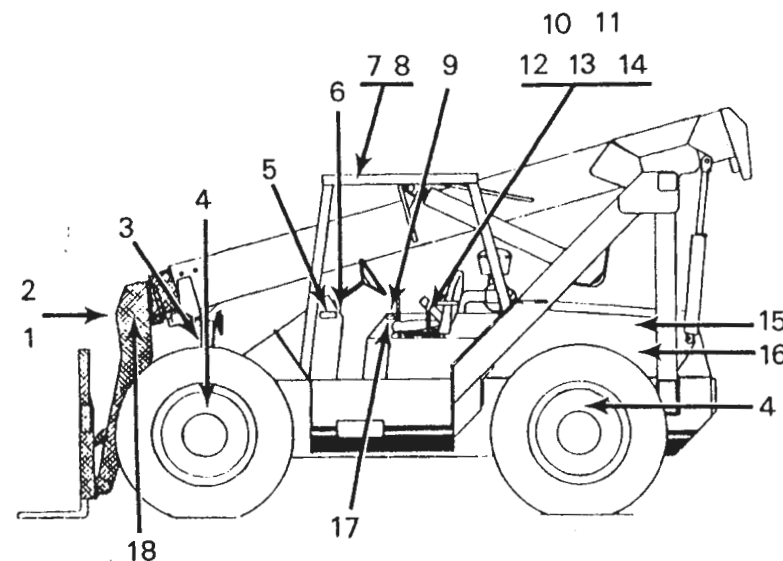


REF. NO	DECAL	NO. REQ'D.	LOCATION
1	WARNING: Falling Load...	1	Upright Carriage
2	WARNING: Falling from Forks...	1	Upright Carriage
3	WARNING: Block Axle/Frame...	1	Frame Level Cyl.
4	WARNING: Crush Area	4	Behind Wheels
5	CAUTION: No Riders	2	Both Sides
6	Low Brake Pressure (VR60/70 ONLY)	1	Instrument Panel
7	Overhead Guard Plate	1	Overhead Guard
8	DANGER: Rollover	2	Overhead Guard
9	WARNING: Improper Maintenance	1	Battery Box
10	Rated Capacity Chart(s)	1	Console
11	Nameplate	1	Console
12	OSHA/Nameplate	1	Console
13	WARNING: General Operation	1	Console
14	DANGER: Voltage	1	Console
15	CAUTION: Radiator Cap	1	Engine
16	WARNING: Rotating Fan	2	Fan Shroud
17	WARNING: Frame Level	1	Console
18	WARNING: Shifting Carriage...	2	Carriage Sides

Figure 1-4. Safety-Related Decals (Sheet 1 of 5)

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B



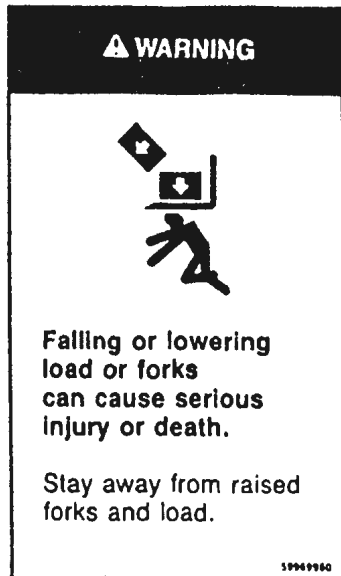
REF. NO	DECAL	NO. REQ'D.	LOCATION
1	WARNING: Falling Load...	1	Upright Carriage
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Figure 1-4. Safety-Related Decals (Sheet 1 of 5)

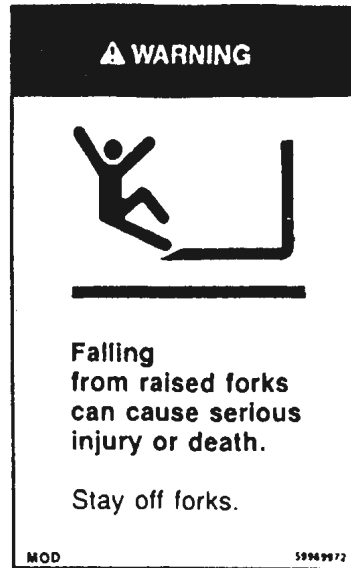
SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

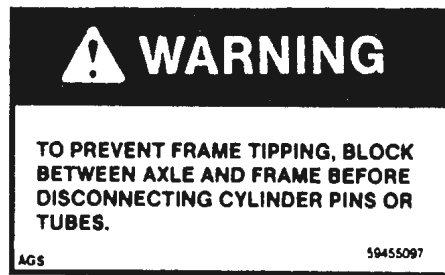
1. WARNING: Falling Load...



2. WARNING: Falling from Forks...



3. WARNING: Block Axle/Frame...



4. WARNING: Crush Area



5. CAUTION: No Riders

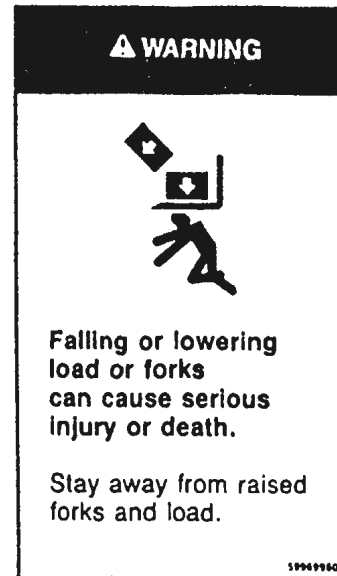


Figure 1-4. Safety-Related Decals (Sheet 2 of 5)

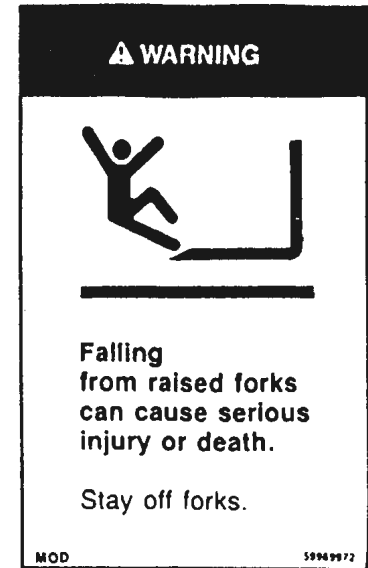
SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

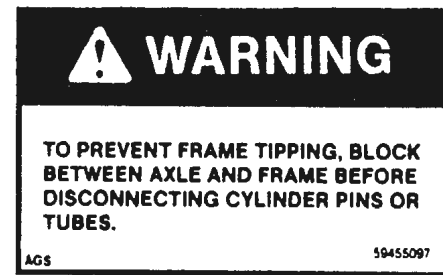
1. WARNING: Falling Load...



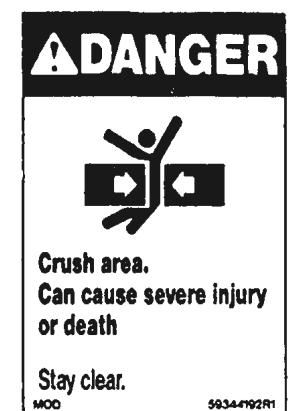
2. WARNING: Falling from Forks...



3. WARNING: Block Axle/Frame...



4. WARNING: Crush Area



5. CAUTION: No Riders



Figure 1-4. Safety-Related Decals (Sheet 2 of 5)

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

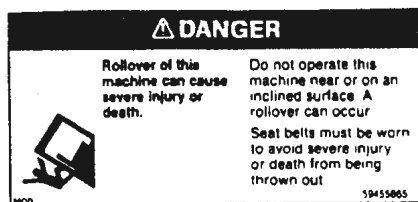
6. Low Brake Pressure (VR60/VR70 ONLY)

**LOW BRAKE
PRESSURE WARNING**

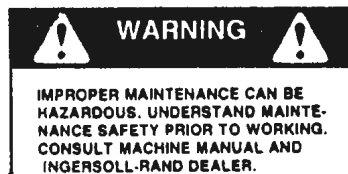
7. Overhead Guard Plate

Metal Plate; Not Shown

8. DANGER: Rollover



9. WARNING: Improper Maintenance



10. Rated Capacity Chart(s)

Rated Capacity Chart:
See Figure 1-3

11. Nameplate

Nameplate:
See Figure 1-1

12. OSHA/Nameplate

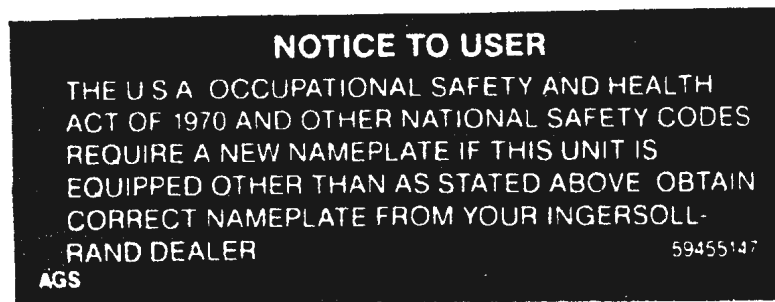


Figure 1-4. Safety-Related Decals (Sheet 3 of 5)

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

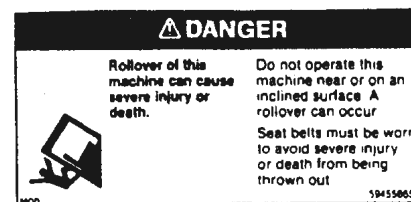
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**LOW BRAKE
PRESSURE WARNING**

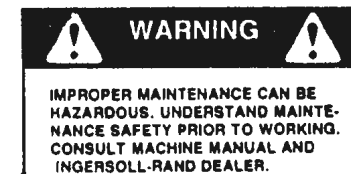
7. Overhead Guard Plate

Metal Plate; Not Shown

8. DANGER: Rollover



9. WARNING: Improper Maintenance



10. Rated Capacity Chart(s)

Rated Capacity Chart:
See Figure 1-3

11. Nameplate

Nameplate:
See Figure 1-1

12. OSHA/Nameplate

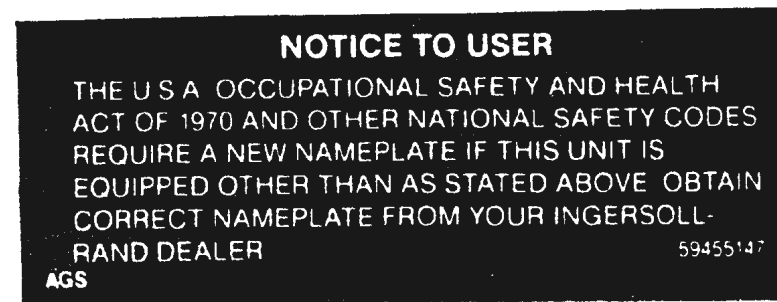


Figure 1-4. Safety-Related Decals (Sheet 3 of 5)

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

13. WARNING: General Operation

⚠ WARNING

FAILURE TO OBSERVE THE FOLLOWING RULES CAN CAUSE SERIOUS INJURY OR DEATH.

AUTHORIZED TRAINED OPERATOR ONLY.

KNOW THE EQUIPMENT — Know operating, inspection and maintenance instructions in the Operating Manual. Inspect lift truck before use. Use auxiliary equipment (attachments) for intended purpose only. Make sure the lift truck is equipped with overhead guard and load backrest adequate for the load.

KNOW YOUR LOADS — Do not lift or hit anything that can fall. Handle only stable loads which are within capacity (see Nameplate and Load Capacity Chart). Space forks as far apart as possible and center the load between forks. Keep load against carriage. Do not handle loads higher than the load backrest.

KNOW THE AREA — Inspect the work area. Avoid slopes, holes, soft ground, areas next to edges of excavations and docks, and overhead hazards. Make sure the floor strength, docks and ramps can hold the lift truck. Do not move lift truck if anyone is between lift truck and a stationary object. Keep arms, legs and head inside operator's compartment. Yield right-of-way to pedestrians. Observe jobsite rules. Be in complete control at all times.

LOOK WHERE YOU ARE GOING — Travel in reverse if necessary to see. Make sure tail swing area is clear. Sound horn at intersections. Watch clearances, especially overhead.

USE COMMON SENSE — No riders on any part of the lift truck. Avoid lifting people. An operator must always stay at the controls when lift truck is in use. Allow no one under or near lift mechanism. When leaving lift truck, lower the forks to the surface, set parking brake, and when parking, shut off power. Block wheels on inclines. Fill fuel tank only in designated area. Avoid sparks or open flame, provide ventilation. When adding fuel, turn off engine. Disconnect battery during servicing.

PROTECT YOURSELF. FASTEN YOUR SEAT BELT — Avoid sudden starts or stops. Level the frame when operating on an incline. Do not operate lift truck across an incline if the frame can not be fully leveled. Travel on inclines with load uphill, or when unloaded, with lift mechanism downhill. Always level the frame before raising the boom. Tilt slowly and smoothly. Lift or lower with upright or carriage vertical or tilted slightly back. Travel with carriage as low as possible and tilted back. Go slowly when turning - use special care when traveling without a load. **FAILURE TO FOLLOW THESE INSTRUCTIONS CAN CAUSE THE LIFT TRUCK TO TIP. IF THE TRUCK TIPS OVER, DO NOT JUMP OFF! HOLD FIRMLY TO STEERING WHEEL, BRACE YOUR FEET, AND LEAN FORWARD AND AWAY FROM THE POINT OF IMPACT.**

TRANSPORT SAFELY — Make sure the ramps can hold the lift truck. Make sure the ramps and trailer surfaces are clean so that the lift truck can not slide. Use blocks and tie-downs to make sure the lift truck can not fall from the trailer.

14. DANGER: Voltage

⚠ DANGER



Hazardous voltage.
Will cause severe injury or death.

Keep boom away from power lines.

4G5

1M72361

15. CAUTION: Radiator Cap

⚠ CAUTION



Hot and pressurized.
Will burn.

Remove cap slowly

4G5

1M72361

Figure 1-4. Safety-Related Decals (Sheet 4 of 5)

SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

13. WARNING: General Operation

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FAILURE TO OBSERVE THE FOLLOWING RULES CAN CAUSE SERIOUS INJURY OR DEATH.

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KNOW THE AREA — Inspect the work area. Avoid slopes, holes, soft ground, areas next to edges of excavations and docks, and overhead hazards. Make sure the floor strength, docks and ramps can hold the lift truck. Do not move lift truck if anyone is between lift truck and a stationary object. Keep arms, legs and head inside operator's compartment. Yield right-of-way to pedestrians. Observe jobsite rules. Be in complete control at all times.

LOOK WHERE YOU ARE GOING — Travel in reverse if necessary to see. Make sure tail swing area is clear. Sound horn at intersections. Watch clearances, especially overhead.

USE COMMON SENSE — No riders on any part of the lift truck. Avoid lifting people. An operator must always stay at the controls when lift truck is in use. Allow no one under or near lift mechanism. When leaving lift truck, lower the forks to the surface, set parking brake, and when parking, shut off power. Block wheels on inclines. Fill fuel tank only in designated area. Avoid sparks or open flame, provide ventilation. When adding fuel, turn off engine. Disconnect battery during servicing.

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Hazardous voltage.
Will cause severe injury or death.

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4G5

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Hot and pressurized.
Will burn.

Remove cap slowly

4G5

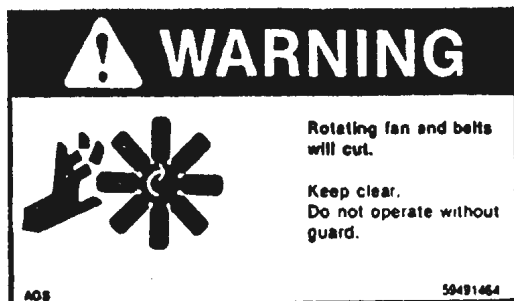
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Figure 1-4. Safety-Related Decals (Sheet 4 of 5)

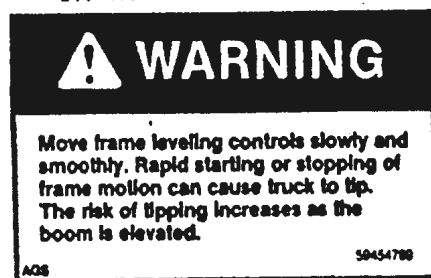
SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES

SAFETY-RELATED DECALS, VR60B/VR70B

16. WARNING: Rotating Fan



17. WARNING: Frame Level



18. WARNING: Shifting Carriage...

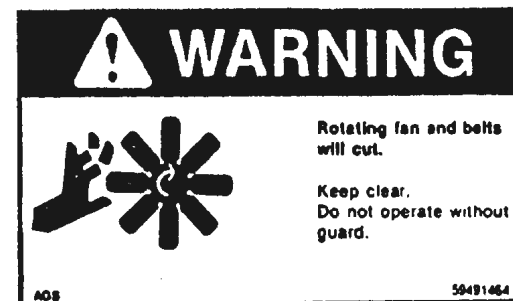


Figure 1-4. Safety-Related Decals (Sheet 5 of 5)

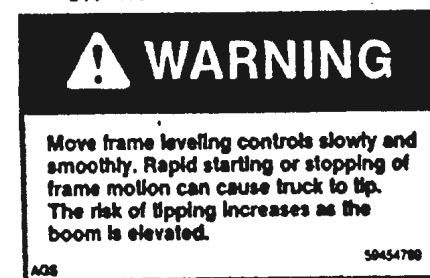
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16. WARNING: Rotating Fan



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Figure 1-4. Safety-Related Decals (Sheet 5 of 5)

SECTION 2- INTRODUCTION

Contents

General	1	Optional Equipment	1
Steering	1	Safe Operation	2

GENERAL

Congratulations! You have just acquired an Ingersoll-Rand Rough-Terrain Forklift, an application-designed product built with your needs in mind.

The VR60B and VR70B are variable-reach rough terrain lift trucks of the same design manufactured after March 1993. They are powered by a Perkins 1004.4 diesel engine. A three-speed powershift transmission is used to control speed and direction. Hydraulic brakes on all four wheels are used to stop the lift truck. The service brakes are a wet disc design installed in the planetary hubs of the axles. An inching brake function permits the operator greater lift speed for lifting loads while the position of the lift truck can be adjusted slowly for alignment of a load. The parking brake uses a disc-type caliper mounted on the front drive shaft at the transmission case and is applied with a control lever near the operator's seat. The hydraulic pump, mounted on the transmission, operates boom, brake, frame leveling, and steering functions.

STEERING

This series of lift trucks has three modes of steering:

- (1) **Front Wheel Only Steering** is normally used only when traveling on roads.
- (2) **Crab Steering** (all wheels turn in same direction) is used to move away from buildings or to escape from wheel ruts.
- (3) **Coordinated Steering** (rear wheels turn opposite of front wheels) provides the greatest maneuverability and is used most of the time.

OPTIONAL EQUIPMENT

The VR60B and VR70B can be ordered or equipped with options that permit auxiliary functions. Examples of these options are outriggers, winch, or side-tilt carriage. The information for the operation of these options must be available, read, and understood by the operator. The control levers for these auxiliary functions are normally found on the right side and towards the back of the operator's seat.

SECTION 2- INTRODUCTION

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General	1	Optional Equipment	1
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SECTION 2- INTRODUCTION

SAFE OPERATION

Safe operation depends on reliable equipment and the use of proper operating procedures. Performing the checks and service described in this manual will help keep your lift truck in good condition. These recommended operation procedures will help you to avoid unsafe practices.

Safety notes have been included throughout this manual to help you avoid injury and prevent damage to the equipment. These notes are not intended to cover all eventualities; it is impossible to anticipate and evaluate all possible methods of operation. Therefore, you are the only person who can guarantee safe operation and maintenance.

It is important that any procedure not specifically recommended in this manual be thoroughly evaluated from the standpoint of safety before it is implemented.

WARNING

Some illustrations in this manual may show guards or cover panels removed for purposes of clarity.

Always replace guards and cover panels before operating.

NOTE

Some illustrations in this manual show units with optional equipment installed. This optional equipment may be purchased from your local Ingersoll-Rand Road Machinery Equipment Distributor.

Some illustrations in this manual may be of prototype models. Production models may vary in some detail.

Continuing improvement and advancement of product design may cause changes to your lift truck that may not be included in this publication. Each publication is reviewed and revised as required to update and include these changes in later editions. Ingersoll-Rand reserves the right to modify or make changes within a specific model group without notice and without incurring any liability to retrofit units previously shipped from the factory. Contact your Ingersoll-Rand Road Machinery Equipment Distributor for non-routine maintenance that is not covered in this publication.

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SECTION 2- INTRODUCTION

SAFE OPERATION - CONT.

Record the Machine Serial Number, which is found on the Machine Serial Number Plate on the left side of the machine, immediately below the operator's compartment. Refer to Figure 2-1.

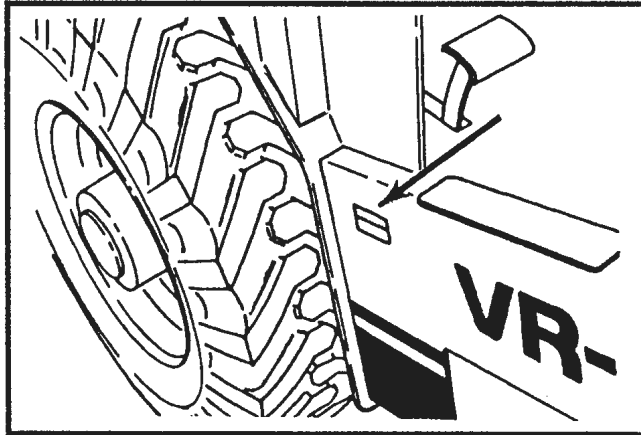


Figure 2-1. Machine Serial Number Plate

Check to ensure that both the Parts Manual and the Operation and Maintenance Manual are with the machine. The manual pouch is located on the back of the operator's seat. Refer to Figure 2-2. ALWAYS RETURN THE OPERATION AND MAINTENANCE MANUAL TO THE MANUAL POUCH WHEN YOU ARE FINISHED USING IT.

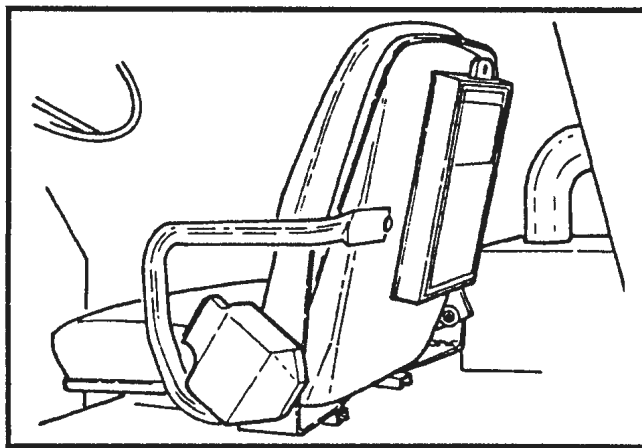


Figure 2-2. Manual Pouch

SECTION 2- INTRODUCTION

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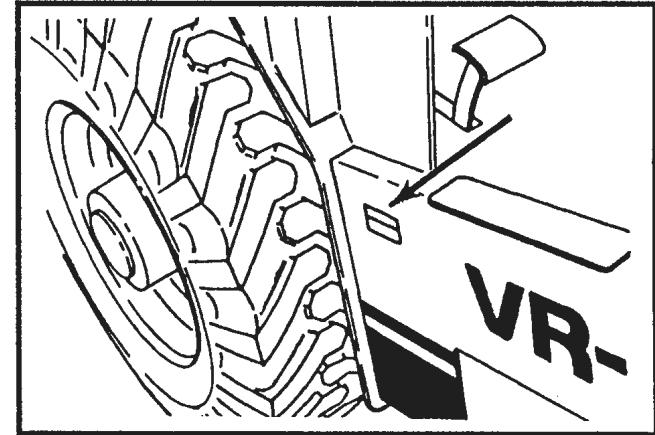


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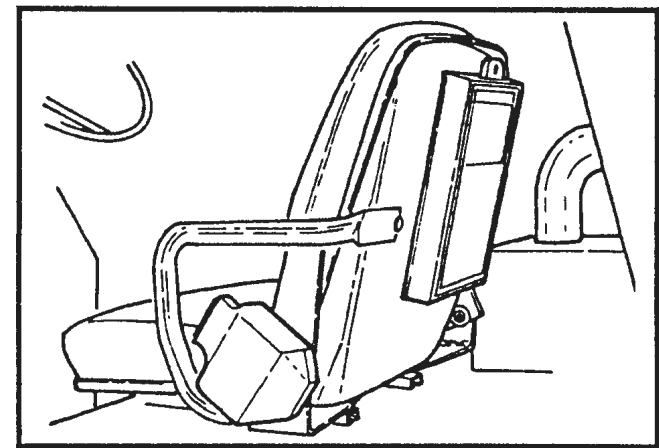


Figure 2-2. Manual Pouch

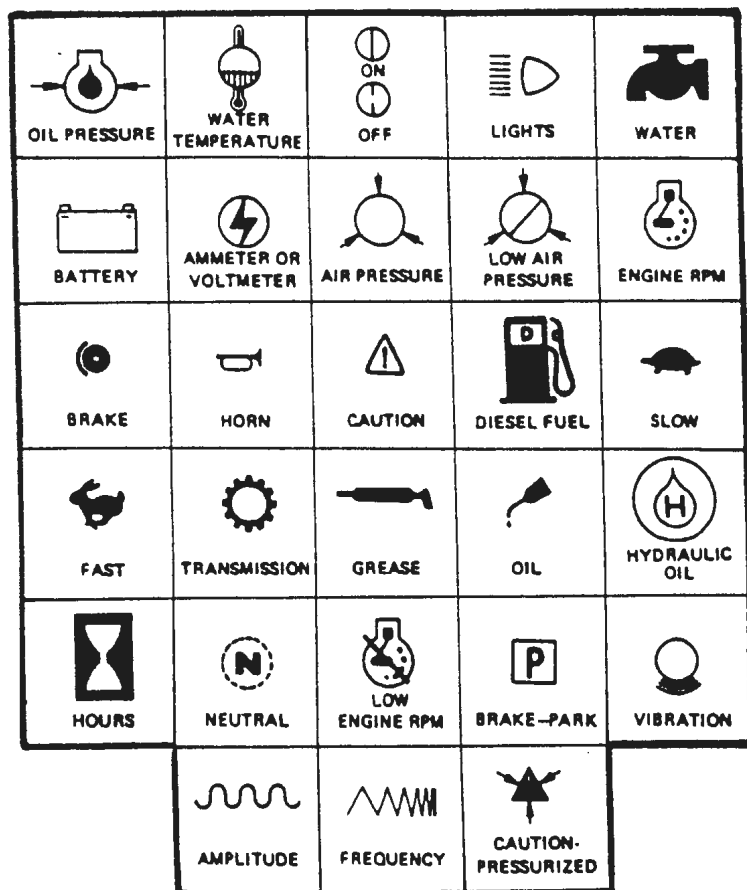
SECTION 3 - SYMBOL IDENTIFICATION/ METRIC CONVERSION

Contents

International Machine Symbols — 1 **Metric Conversion — 2**
International Highway Symbols — 2

INTERNATIONAL MACHINE SYMBOLS

The following explains the meaning of international symbols that may appear on your machine.



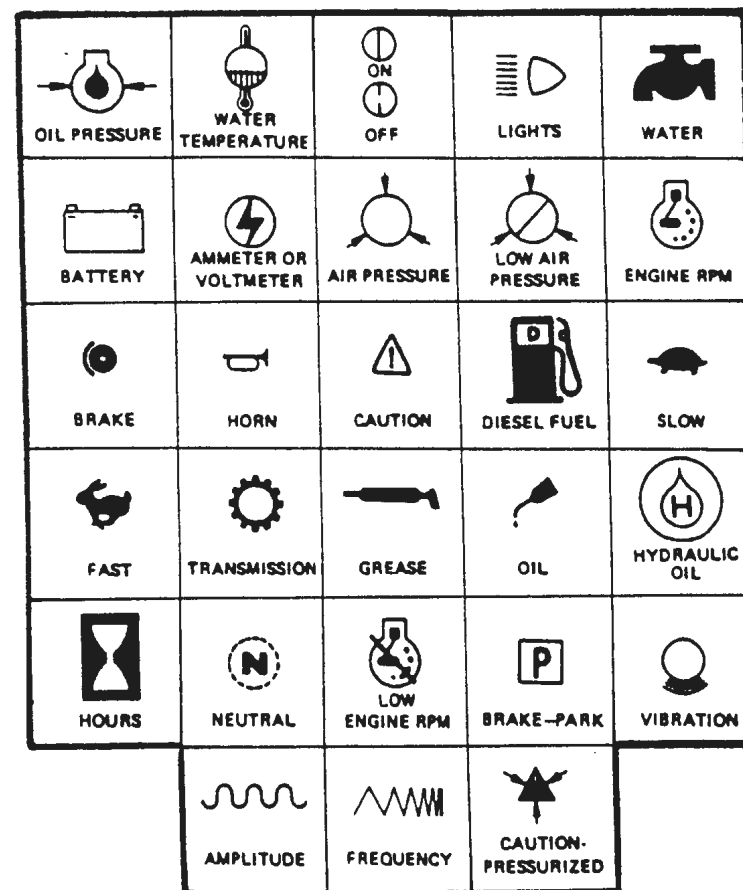
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SECTION 3 - SYMBOL IDENTIFICATION/METRIC CONVERSION

INTERNATIONAL HIGHWAY SYMBOLS

The following symbols may also appear in a yellow square  instead of in a red triangle.

					
ROAD BENDS	DANGEROUS BEND	DOUBLE BEND	DANGEROUS DESCENT	STEEP ASCENT	CARRIAGEWAY NARROWS
					
CARRIAGEWAY NARROWS	"END OF PRIORITY" SIGN	ONCOMING TRAFFIC HAS PRIORITY	PRIORITY OVER ONCOMING TRAFFIC	SWING BRIDGE	ROAD LEADS ONTO QUAY OR RIVERBANK
					
UNEVEN ROAD	RIDGE	DIP	SLIPPERY ROAD	LOOSE GRAVEL	NO ENTRY FOR POWER DRIVEN VEHICLES
					
NO ENTRY FOR VEHICLES EXCEEDING WIDTH	NO ENTRY FOR VEHICLES EXCEEDING LENGTH	FALLING ROCKS	PEDESTRIAN CROSSING	ROAD WORKS	LIGHT SIGNALS
					
TWO-WAY TRAFFIC	OTHER DANGERS	LEVEL CROSSING	LEVEL CROSSING	NO ENTRY	CLOSED TO ALL VEHICLES IN BOTH DIRECTIONS
					
INTERSECTION USER MUST GIVE WAY	INTERSECTION USER MUST GIVE WAY	INTERSECTION USER MUST GIVE WAY	"GIVE WAY" SIGN	"STOP SIGN" (NEW)	STOP SIGN (OLD)
					
"PRIORITY ROAD" SIGN	NO ENTRY FOR VEHICLES EXCEEDING WEIGHT	NO ENTRY FOR VEHICLE AXLE WEIGHT EXCEEDING	NO U-TURN	NO ENTRY FOR POWER DRIVEN VEHICLE	NO TURN DIRECTION SHOWN

SECTION 3 - SYMBOL IDENTIFICATION/METRIC CONVERSION

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SECTION 3 - SYMBOL IDENTIFICATION/METRIC CONVERSION

SECTION 3 - SYMBOL IDENTIFICATION/METRIC CONVERSION

METRIC CONVERSION

TO CONVERT	INTO	MULTIPLY BY
bars	pounds per sq. in.	14.50
bars	kilopascals	100.0
centigrade	Fahrenheit	$(C^{\circ} \times 9/5) + 32$
centimeters	inches	0.3937
centimeters	millimeters	10.0
circumference	radians	6.283
cubic centimeters	cubic inches	0.06102
degrees (angle)	radians	0.1745
degrees per second	revolutions per minute	0.1667
feet	meters	0.3048
feet per minute	meters per minute	0.3048
gallons	liters	3.785
Hertz	vibrations per minute	60.0
horsepower	kilowatts	0.7457
inches	centimeters	2.540
inches	millimeters	25.40
kilograms	pounds	2.205
kilograms-meter	pounds-foot	7.233
kilopascals	pounds per sq. in.	0.1450
kilopascals	bars	0.01
kilowatts	horsepower	1.341
liters	gallons (U.S. liquid)	0.2642
liters	pints (U.S. liquid)	2.113
liters	quarts (U.S. liquid)	1.057
meters	feet	3.281
meters	inches	39.37
meters per minute	feet per second	0.05468
miles per hour	kilometers per hour	1.609
millimeters	inches	0.03937

Continued

METRIC CONVERSION

TO CONVERT	INTO	MULTIPLY BY
bars	pounds per sq. in.	14.50
bars	kilopascals	100.0
centigrade	Fahrenheit	$(C^{\circ} \times 9/5) + 32$
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Continued

SECTION 3 - SYMBOL IDENTIFICATION/METRIC CONVERSION

METRIC CONVERSION - CONT.

TO CONVERT	INTO	MULTIPLY BY
Newtons	pounds	4.448
Newtons-meter	pounds-foot	0.737
pints (liquid)	liters	0.4732
pounds	kilograms	0.4536
pounds	Newtons	0.225
pounds-foot	kilograms-meter	0.138
pounds-foot	Newtons-meter	1.356
pounds per sq. in.	bars	0.06895
pounds per sq. in.	kilopascals	6.895
quarts (liquid)	liters	0.9463
radians	degrees	57.30
radians per second	revolutions per minute	9.549
revolutions per minute	degrees per second	6.0
revolutions per minute	radians per second	0.1047
temperature (°C) + 17.78	temperature (°F)	1.8
temperature (°F) - 32	temperature (°C)	5/9
tons (short)	tons (metric)	0.9078
vibrations per minute	Hertz	0.0167

SECTION 3 - SYMBOL IDENTIFICATION/METRIC CONVERSION

METRIC CONVERSION - CONT.

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SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

Contents	
Vandalism Protection —————	1
Level Indicator —————	1
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Range Selector —————	4
Horn —————	4
Engine Coolant	
Temperature Gauge —————	4
Engine Oil Pressure Gauge ———	4
Hourmeter —————	4
Voltmeter —————	4
Transmission Oil	
Temperature Gauge —————	4
Fuel Gauge —————	5
Low Brake Pressure	
Warning Indicator —————	5
Parking Brake Indicator —————	5
Hydraulic Filter Restriction	
Indicator —————	5
Cold Start Button —————	5
Key Switch —————	5
Parking Brake Lever —————	6
Boom Control Joystick —————	6
Fork Tilt Joystick —————	6
Frame Levelling Joystick —————	7
Steering Mode Selector Switch ———	7
Accelerator Pedal —————	8
Brake Pedal —————	8
Auxiliary Hydraulic Controls	
(Optional) —————	8

4

VANDALISM PROTECTION

The lift truck is equipped with vandalism protection in the form of a lockable cover for the instrument panel. When leaving the unit unattended, lock the lockable cover.

NOTE

All index numbers in the descriptions below refer to Figure 4-1, Operating Controls and Instruments.

NOTE

Gauge readings are given as a guide only. Engine and machine conditions can cause gauge readings to vary.

LEVEL INDICATOR

The Level Indicator (1) is located directly ahead of the operator on the upper crossmember of the overhead guard. The frame of the lift truck is level when the ball is centered in the indicator.

DIRECTION CONTROL LEVER

The Direction Control Lever (2) for the transmission is located at the far left side of the instrument panel. The lever has three positions: "Forward" (FWD), "Neutral" (N), and "Reverse" (REV). Move the Direction Control Lever to one of the direction positions for travel.

NOTE:

The Direction Control Lever must be in "Neutral" (N) before the engine can be started.

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Engine Oil Pressure Gauge ———	4
Hourmeter —————	4
Voltmeter —————	4
Transmission Oil	
Temperature Gauge —————	4
Fuel Gauge —————	5
Low Brake Pressure	
Warning Indicator —————	5
Parking Brake Indicator —————	5
Hydraulic Filter Restriction	
Indicator —————	5
Cold Start Button —————	5
Key Switch —————	5
Parking Brake Lever —————	6
Boom Control Joystick —————	6
Fork Tilt Joystick —————	6
Frame Levelling Joystick —————	7
Steering Mode Selector Switch ———	7
Accelerator Pedal —————	8
Brake Pedal —————	8
Auxiliary Hydraulic Controls	
(Optional) —————	8

4

VANDALISM PROTECTION

The lift truck is equipped with vandalism protection in the form of a lockable cover for the instrument panel. When leaving the unit unattended, lock the lockable cover.

NOTE

All index numbers in the descriptions below refer to Figure 4-1, Operating Controls and Instruments.

NOTE

Gauge readings are given as a guide only. Engine and machine conditions can cause gauge readings to vary.

LEVEL INDICATOR

The Level Indicator (1) is located directly ahead of the operator on the upper crossmember of the overhead guard. The frame of the lift truck is level when the ball is centered in the indicator.

DIRECTION CONTROL LEVER

The Direction Control Lever (2) for the transmission is located at the far left side of the instrument panel. The lever has three positions: "Forward" (FWD), "Neutral" (N), and "Reverse" (REV). Move the Direction Control Lever to one of the direction positions for travel.

NOTE:

The Direction Control Lever must be in "Neutral" (N) before the engine can be started.

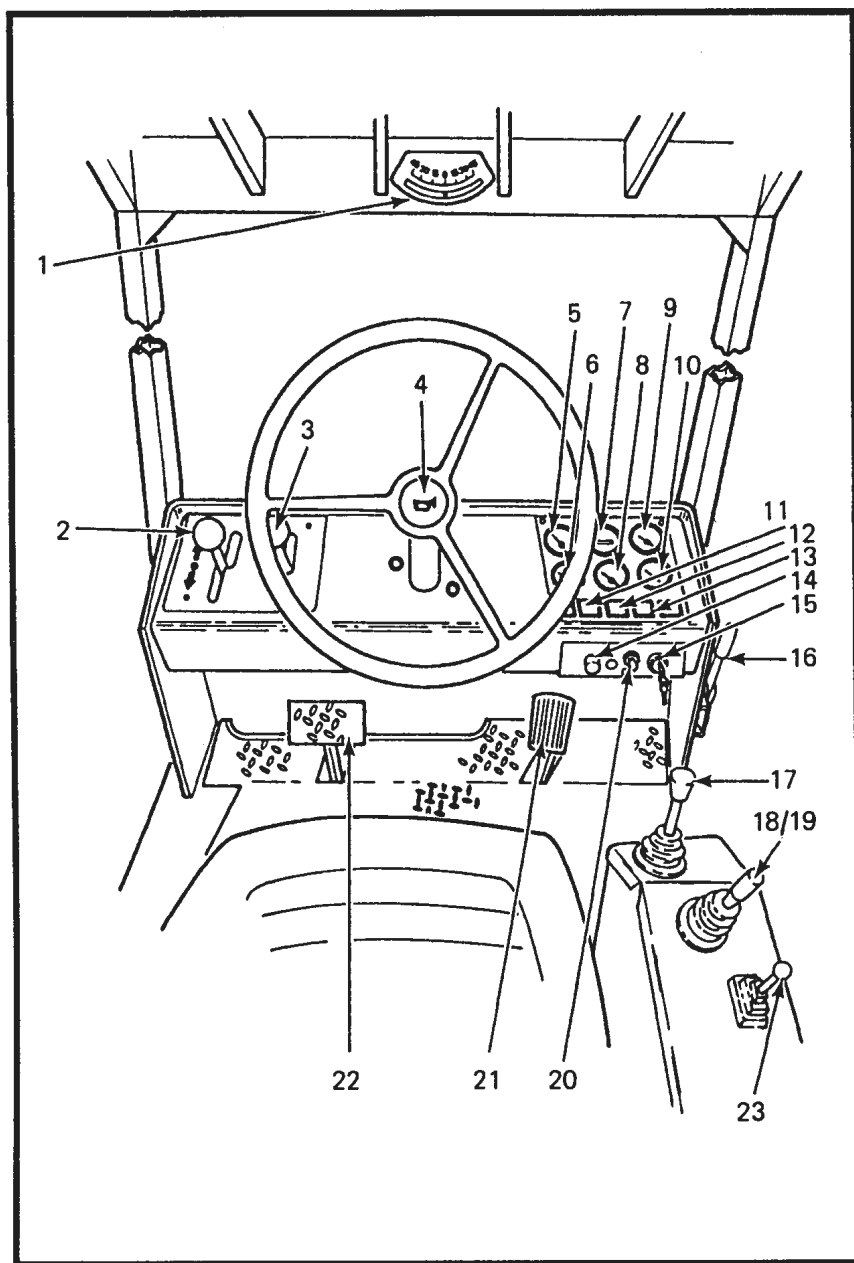


Figure 4-1. Operating Controls and Instruments (Sheet 1 of 2)

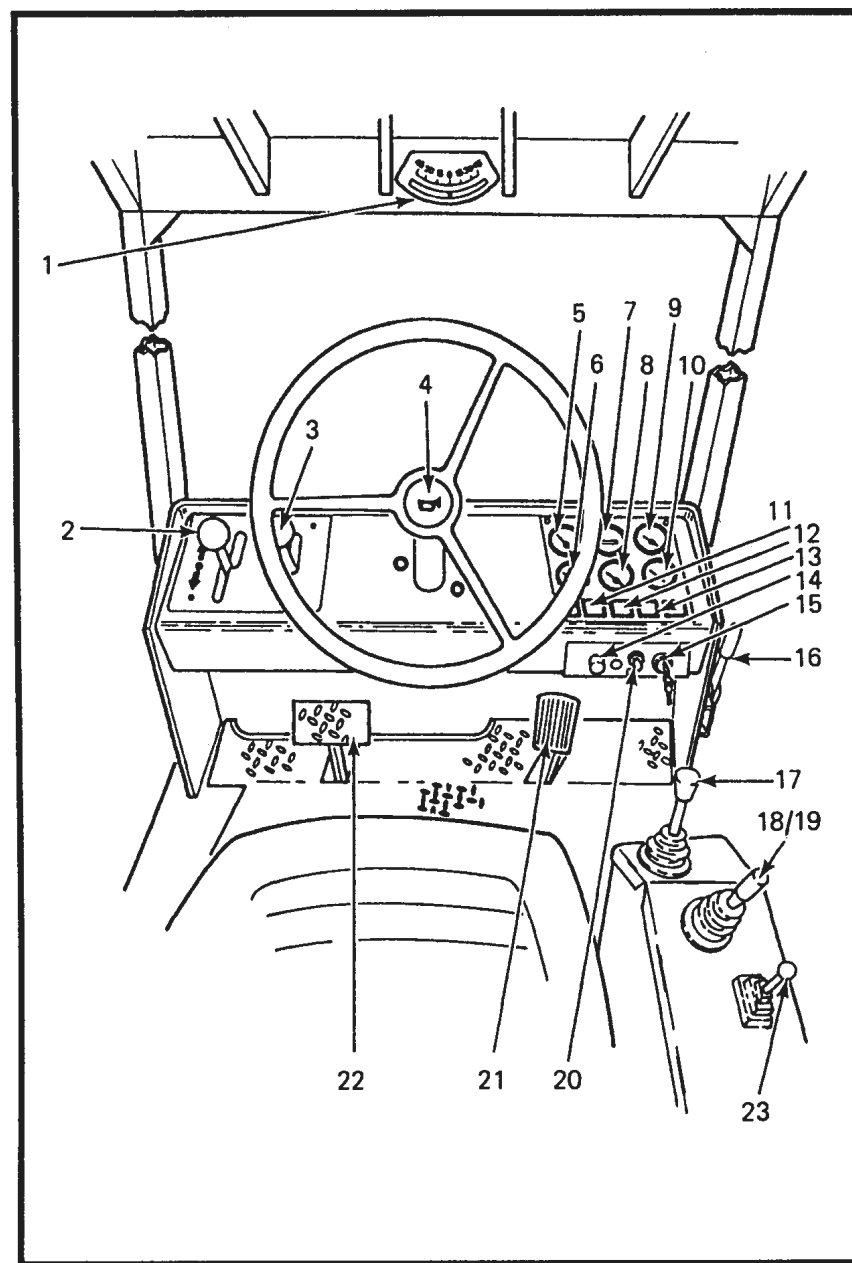
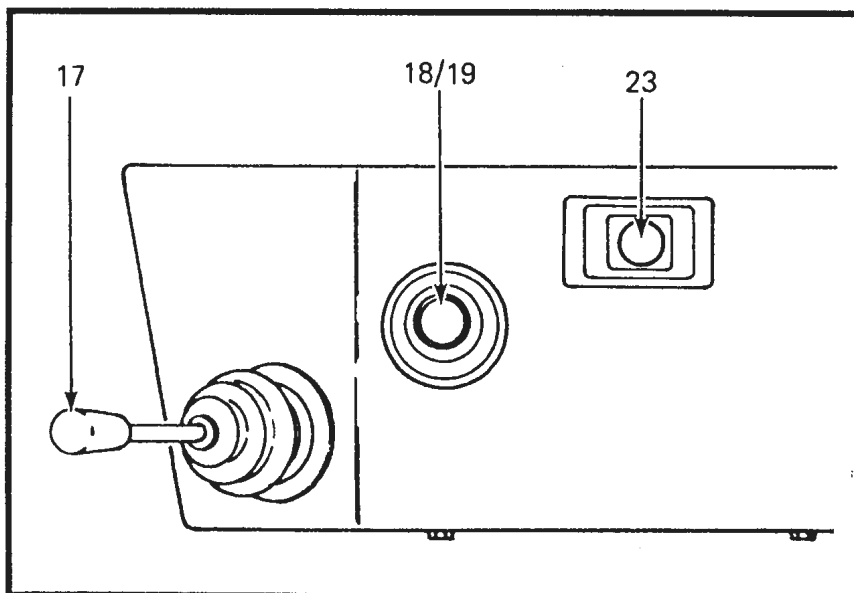


Figure 4-1. Operating Controls and Instruments (Sheet 1 of 2)

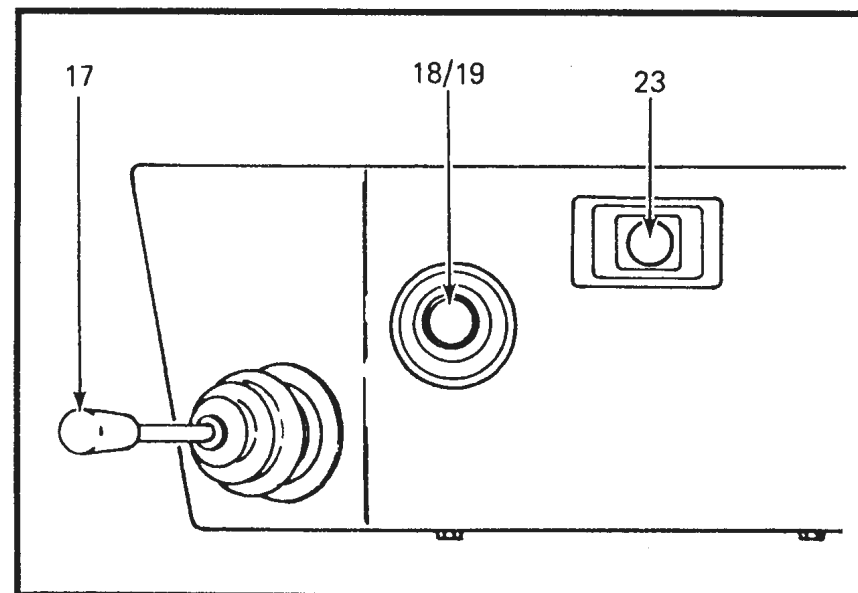
SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS



- | | |
|---|-----------------------------|
| 1. Level Indicator | 13. Hydraulic Filter |
| 2. Direction Control Lever | Restriction Indicator |
| 3. Powershift Transmission Range Selector | 14. Cold Start Button |
| 4. Horn | 15. Key Switch |
| 5. Engine Coolant Temperature Gauge | 16. Parking Brake Lever |
| 6. Engine Oil Pressure Gauge | 17. Boom Control Joystick |
| 7. Hourmeter | 18. Fork Tilt Joystick |
| 8. Voltmeter | 19. Frame Leveling Joystick |
| 9. Transmission Oil Temperature Gauge | 20. Steering Mode Selector |
| 10. Fuel Gauge | Switch |
| 11. Low Brake Pressure Warning Indicator | 21. Accelerator Pedal |
| 12. Parking Brake Indicator | 22. Brake Pedal |
| | 23. Auxiliary Hydraulic |
| | Control (Optional) |

Figure 4-1. Operating Controls and Instruments (Sheet 2 of 2)

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS



- | | |
|---|-----------------------------|
| 1. Level Indicator | 13. Hydraulic Filter |
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| 12. Parking Brake Indicator | 22. Brake Pedal |
| | 23. Auxiliary Hydraulic |
| | Control (Optional) |

Figure 4-1. Operating Controls and Instruments (Sheet 2 of 2)

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

POWERSHIFT TRANSMISSION RANGE SELECTOR

The Range Selector (1 2 3) (3) for the Powershift Transmission is located on the instrument panel to the left of the steering column. The Range Selector lever controls the three speed ranges of the Powershift Transmission. Any of the speed ranges can be selected while the lift truck is moving.

HORN

The Horn button (4) controls the operation of the horn. The horn is used to alert personnel to the approach of the lift truck or a change of direction.

ENGINE COOLANT TEMPERATURE GAUGE

The Engine Coolant Temperature Gauge (WATER TEMP) (5) indicates the engine coolant temperature from 100 to 240 degrees F (38 to 116 degrees C) when the keyswitch is in the ON position. Normal operating range of the engine should be between 170 degrees F (77 degrees C) and 208 degrees F (98 degrees C).

ENGINE OIL PRESSURE GAUGE

The Engine Oil Pressure Gauge (6) indicates engine oil pressure from 0 to 80 psi (0 to 552 kPa) when the engine is running. Minimum operating oil pressure should be 40 psi (280 kPa).

HOURLY METER

The Hourmeter (HOURS) (7) indicates the total operating hours of the engine when the keyswitch is in the ON position. Maintenance recommendations are based on these engine hours.

VOLTMETER

The Voltmeter (8) indicates the output voltage of the alternator to the battery. When the alternator output is less than the battery voltage, the needle indicates less than 12 volts and the alternator is not correctly charging the battery.

TRANSMISSION OIL TEMPERATURE GAUGE

The Transmission Oil Temperature Gauge (OIL TEMP) (9) indicates the oil temperature from 140 to 320 degrees F (60 to 160 degrees C) in the Powershift Transmission. Normal operating range should be 180 to 200 degrees F (82 to 93 degrees C).

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

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SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

FUEL GAUGE

The FUEL Gauge (10) indicates the amount of fuel in the fuel tank.

LOW BRAKE PRESSURE WARNING INDICATOR

The Low Brake Pressure Warning Indicator (11) will light to indicate low pressure in the brake accumulator. The service brake system is fully operational when the Low Brake Warning Indicator is NOT ON.



Do not operate the lift truck when the Low Brake Pressure Warning Indicator is ON.

PARKING BRAKE INDICATOR

The Parking Brake Indicator (P) (12) will be illuminated whenever the Parking Brake is applied.

HYDRAULIC FILTER RESTRICTION INDICATOR

The Hydraulic Filter Restriction Indicator (13) will illuminate to indicate that the hydraulic filter is clogged or dirty.

COLD START BUTTON

The Cold Start Button (HEAT) (14) is used to help start the engine in cold weather. To operate the Cold Start Aid, the key switch must be in the ON position. Push and hold the Cold Start Button to energize the Cold Start Aid.

NOTE:

The use of starting fluids such as ether will result in severe engine damage and void your engine warranty. DO NOT use ether or starting fluids in your lift truck.

KEY SWITCH

The Key Switch (15) is located on the instrument panel. When the Key Switch is turned clockwise to the ON position, the electrical system is energized. When the switch is turned past the ON position against a spring to the START position,

Continued

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

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Continued

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

KEY SWITCH - CONT.

the starter motor is engaged. Once the engine starts, release the switch immediately and the spring will return the switch to the ON position. There is a mechanical lockout that prevents the key switch from being returned to the START position without first being returned to the OFF position.

PARKING BRAKE LEVER

The Parking Brake Lever (16) is located at the right side of the instrument panel. Place the lever in the upright position (BRAKE ON) to apply the parking brake. Turn the knob on the end of the lever to adjust the parking brake

WARNING

Correct adjustment is necessary to provide adequate braking and keep the parking brake lever in the engaged position. Always apply the parking brake when leaving the lift truck.

BOOM CONTROL JOYSTICK

The Boom Control Joystick (17) controls two operations of the boom. Move the joystick forward (BOOM DOWN) to lower the boom; move the joystick back (BOOM UP) to raise the boom. Move the joystick to the right (EXTEND) to extend the boom; move the joystick to the left (RETRACT) to retract the boom.

FORK TILT JOYSTICK

The Fork Tilt/Frame Leveling Joystick (18/19) controls the tilt of the forks at the end of the boom. Move the joystick forward to tilt the tips of the forks downward. Move the joystick back to move the tips of the forks upward.

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

KEY SWITCH - CONT.

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FRAME LEVELING JOYSTICK

WARNING

Do not use the frame leveling function when the load is raised. Level the frame before the load is lifted. If the lift truck is equipped with a tilt carriage, level the frame before using the tilt carriage adjustment.

Move the frame leveling controls slowly and smoothly. Rapid starting and stopping of frame motion can cause the lift truck to tip. The risk of tipping increases as the boom is raised and extended.

The lift truck often operates on ground that is not level. The Fork Tilt/Frame Leveling Joystick (18/19) permits the operator to make the chassis of the lift truck level on slopes up to a 21 percent grade. Move the joystick forward to tilt the chassis of the lift truck to the left. Move the joystick rearward to tilt the chassis of the lift truck to the right. The Level Indicator (1), located on the upper crossmember of the overhead guard, will show you when the frame of the lift truck has reached a level position.

STEERING MODE SELECTOR SWITCH

The Steering Mode Selector (STEERING SELECTOR) (20) is a three-position switch located on the instrument panel between the Cold Start Button and the Key Switch. Using the Steering Mode Selector Switch, the operator can choose from three modes of steering.

Move the Selector Switch to its leftmost position for Coordinated Steering; all four wheels steer the lift truck. This steering mode permits the lift truck to make smaller radius turns. Coordinated Steering is the normal mode for most lift truck operations.

Move the Selector Switch to its center position for Front Wheel Steering; the front wheels steer the lift truck and the rear wheels stay in a fixed position.

Move the Selector Switch to its rightmost position for Crab Steering; all four wheels turn parallel to each other. Crab Steering permits the lift truck to travel

Continued

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Continued

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

STEERING MODE SELECTOR SWITCH - CONT.

along a line that is diagonal to the forward-and-reverse axis of the lift truck. Crab Steering is used to move away from buildings or escape from wheel ruts.

The lift truck must be completely stopped before the steering mode is changed. The wheels must be aligned for straight travel before another mode is selected. Use the Front Wheel Steering mode to align the wheels before another steering mode is selected.

ACCELERATOR PEDAL

The Accelerator Pedal (21) controls the engine speed and is operated by the operator's right foot. Push the pedal to increase engine speed.

BRAKE PEDAL

The Brake Pedal (22), operated by the operator's left foot, applies the service brakes and disengages the transmission at the same time. When the operator varies the position of the pedal, the lift truck can be made to move slowly while a high engine speed is used for lifting loads ("inching"). For further description of the inching function of the service Brake Pedal, see "BASIC OPERATING PROCEDURES" in **SECTION 5 - OPERATING INSTRUCTIONS**. Completely depressing the Brake Pedal disengages the transmission and fully applies the service brakes.

AUXILIARY HYDRAULIC CONTROL (OPTIONAL)

The VR90B can be fitted with one or more optional Auxiliary Hydraulic Controls (23) to control any of a number of optional hydraulic functions. Contact your Ingersoll-Rand Distributor for further information on these options.

SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS

STEERING MODE SELECTOR SWITCH - CONT.

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SECTION 5 - OPERATING INSTRUCTIONS

Contents

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Stability and Center of Gravity	2	Traveling	22
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! WARNING

5



Improper operation of the lift truck can be hazardous.

Before you start, use, or in any other way operate the lift truck, read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES. Make sure that you also read and understand the ROUGH TERRAIN FORKLIFT SAFETY MANUAL FOR OPERATORS AND MECHANICS. Failure to understand and follow the instructions in these two manuals can cause serious injury or death.

GENERAL

The lift truck is designed to pick up and move materials. The lift truck has forks on the front of a boom to engage the load. The boom lifts the load so that it can be moved and stacked.

In order to understand how the lift truck can pick up a load, you must first know some basic things about the lift truck.

The operation of a lift truck is based on the principle of two weights balanced on opposite sides of a pivot (fulcrum). Refer to Figure 5-1.

Continued

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

GENERAL - CONT.

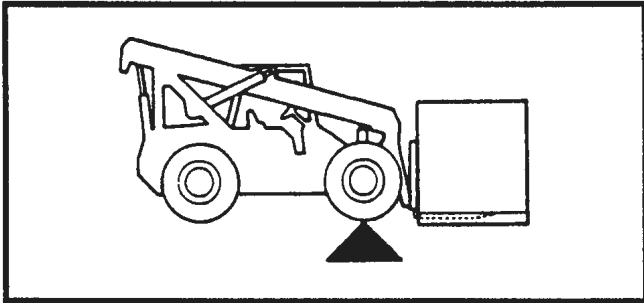


Figure 5-1. Weights Balanced on Fulcrum

In order for this principle to work for a lift truck, the load on the forks must be balanced by the weight of the lift truck. The location of the center of gravity of both the lift truck and the load is also a factor.

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

STABILITY AND CENTER OF GRAVITY

The center of gravity (CG) of any object is the single point about which the object is balanced in all directions. Every object has a CG. Refer to Figure 5-2. When the lift truck picks up a load, the lift truck and the load have a new combined CG. The stability of the lift truck is determined by the location of its CG, or, if the lift truck is loaded, the combined CG. Refer to Figure 5-3.

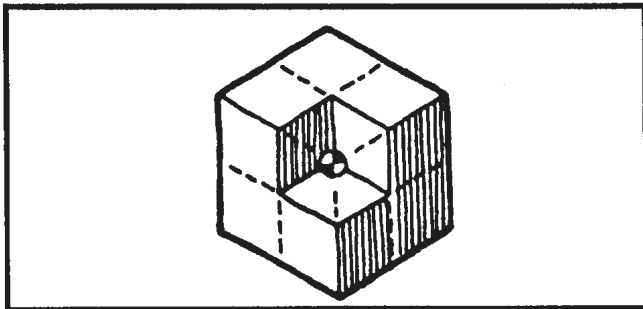


Figure 5-2. Center of Gravity of an Object

Continued

SECTION 5 - OPERATING INSTRUCTIONS

GENERAL - CONT.

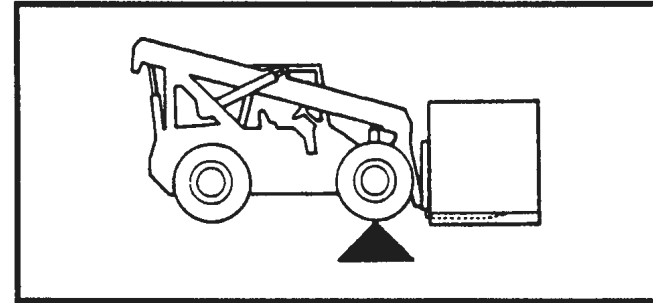


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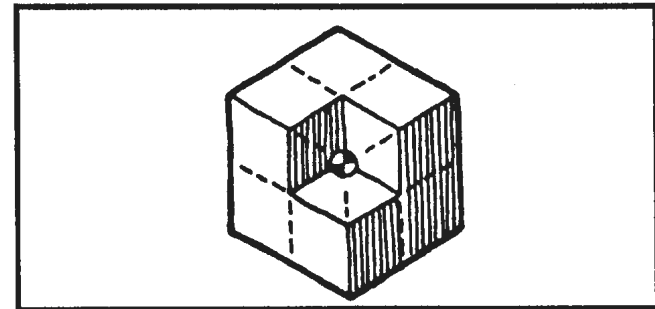


Figure 5-2. Center of Gravity of an Object

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SECTION 5 - OPERATING INSTRUCTIONS

STABILITY AND CENTER OF GRAVITY - CONT.

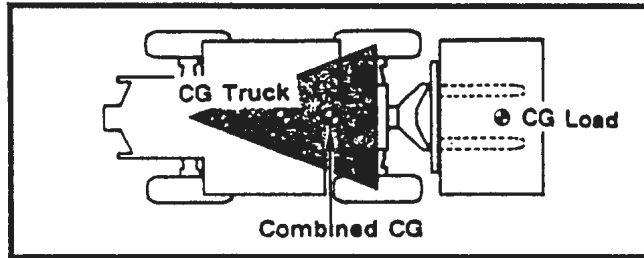


Figure 5-3. Combined CG of Lift Truck and Its Load

The lift truck has moving parts and therefore has a CG that moves. The CG moves forward and backward as the boom is extended and retracted. The CG also moves forward and backward as the forks are tilted forward and backward. The CG moves up and down as the boom moves up and down. Refer to Figure 5-4.

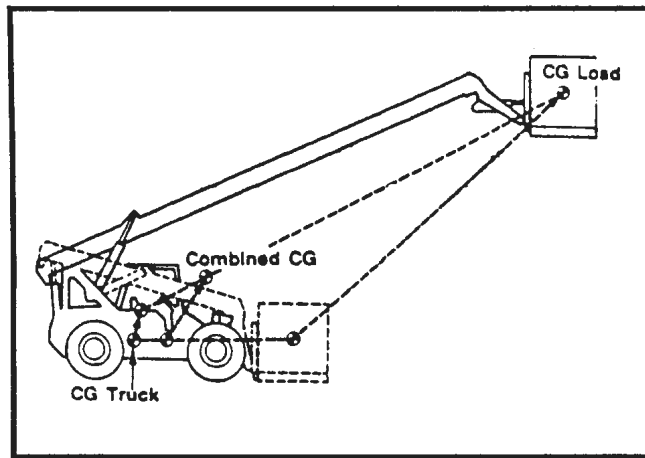


Figure 5-4. A Lift Truck's CG Moves as the Load Moves

The center of gravity, and therefore the stability, of the loaded lift truck is affected by a number of factors:

- Size, weight, shape, and position of the load
- Height to which the load is raised
- Boom extension
- Amount of forward and backward tilt
- Tire pressure
- Surface conditions where the lift truck is operating
- Dynamic forces created when the lift truck is moving

Continued
5-3

SECTION 5 - OPERATING INSTRUCTIONS

STABILITY AND CENTER OF GRAVITY - CONT.

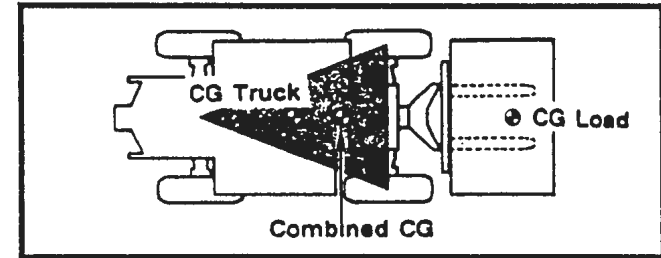


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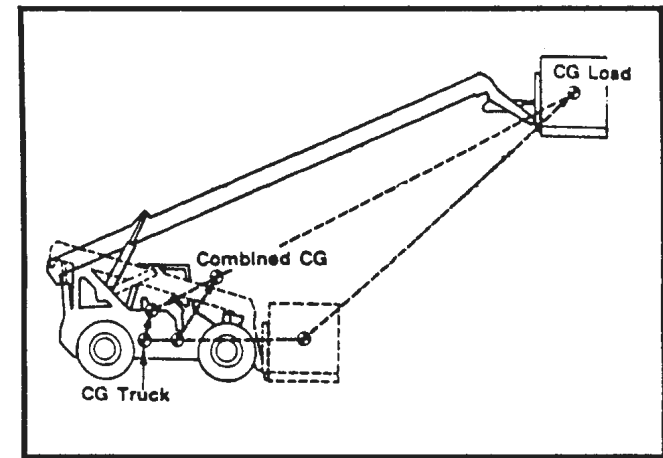


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- Surface conditions where the lift truck is operating
- Dynamic forces created when the lift truck is moving

Continued
5-3

SECTION 5 - OPERATING INSTRUCTIONS

STABILITY AND CENTER OF GRAVITY - CONT.

These dynamic forces are caused by factors such as acceleration, braking, turning, and operating on uneven surfaces or on an incline. These factors must also be considered when traveling with an unloaded lift truck, because **AN UNLOADED LIFT TRUCK WILL TIP OVER TO THE SIDE EASIER** than a loaded lift truck with its load in the lowered position.

In order for the lift truck to be stable (not tip over forward nor to the side), the CG must stay within the area of the lift truck represented by a triangle drawn between the front wheels and the pivot of the rear axle. Refer to Figure 5-5.

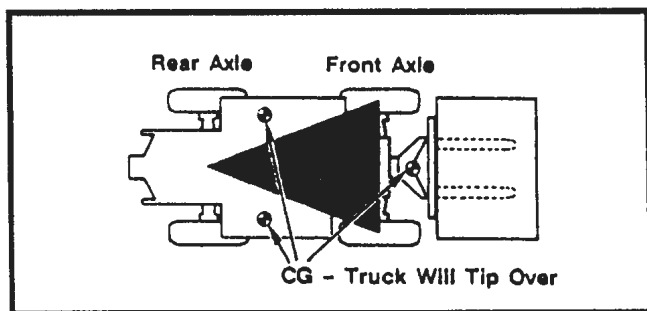


Figure 5-5. The Lift Truck's CG Must Remain within the Shaded Area

If the CG moves forward of the front axle, the lift truck will tip forward. If the CG moves outside of the line on either side of the stability base, the lift truck will tip to the side.

INSPECTION BEFORE OPERATION

Inspect the lift truck for the following items before use and every eight hours or daily. Unless otherwise specified below, detailed procedures for these checks are described in **SECTION 8 - 8 HOUR OR DAILY MAINTENANCE** of this Operation and Maintenance Manual.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

STABILITY AND CENTER OF GRAVITY - CONT.

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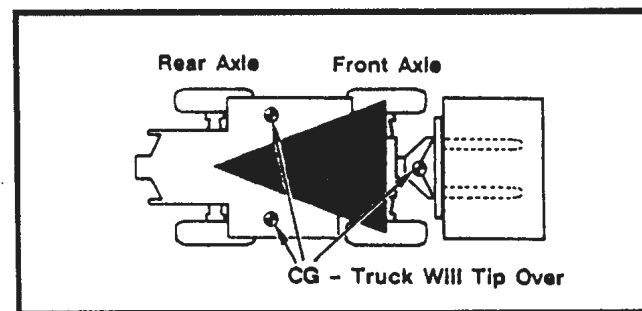


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If the CG moves forward of the front axle, the lift truck will tip forward. If the CG moves outside of the line on either side of the stability base, the lift truck will tip to the side.

INSPECTION BEFORE OPERATION

Inspect the lift truck for the following items before use and every eight hours or daily. Unless otherwise specified below, detailed procedures for these checks are described in **SECTION 8 - 8 HOUR OR DAILY MAINTENANCE** of this Operation and Maintenance Manual.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

INSPECTION BEFORE OPERATION - CONT.

WARNING



Unexpected machine motion or moving parts can cut or crush.

Do not stand between tire and frame unless the engine is STOPPED, the key is REMOVED from the keyswitch, the parking brake is ON, and the tires are BLOCKED.

WARNING



Fuel is flammable. May cause severe injury or death.

Shut down the engine, extinguish all open flames, and do not smoke while filling the tank.

Always wipe up any spilled fuel.

1. Check fuel level at fuel gauge. Fill fuel tank if necessary.
2. Drain water from the fuel/water separator.
3. Oil levels in the engine and hydraulic tank.

Continued
5-5

SECTION 5 - OPERATING INSTRUCTIONS

INSPECTION BEFORE OPERATION - CONT.

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Continued
5-5

SECTION 5 - OPERATING INSTRUCTIONS

INSPECTION BEFORE OPERATION - CONT.

4. Coolant level in the auxiliary coolant reservoir and condition of the radiator; clean the radiator if necessary.

NOTE

The radiator cap is NOT normally removed to check coolant level; coolant level is checked in the auxiliary coolant reservoir. See check procedure under "COOLANT LEVEL" in SECTION 8 - 8 HOUR OR DAILY MAINTENANCE.

5. Condition of the drive belts.
6. Condition of forks, carriage, boom, boom chains, and overhead guard.
7. Leaks from the engine, transmission, hydraulic system, brake system, and fuel system.
8. Condition of wheels and tires.
9. Operator restraint system (seat, seat belt, seat mounts, hip restraints, and floor plates).
10. Condition of overhead guard.

WARNING

Improper operation can be hazardous.

Report damage or faulty operation immediately. Do not operate a damaged or defective lift truck. A lift truck will only do its job when it is in proper working order. If repairs are required, install a tag in the operator's area stating "DO NOT OPERATE" and remove the key from the key switch.

SECTION 5 - OPERATING INSTRUCTIONS

INSPECTION BEFORE OPERATION - CONT.

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STARTING PROCEDURES

⚠ WARNING

Unexpected machine motion or moving parts can cut or crush.

Make sure that all personnel are away from the lift truck before the engine is started. Make sure that no one is standing between the wheels and the frame.

Make sure that the area around the lift truck is clear before starting the engine or making any operational checks. Be careful when making the checks. If the lift truck is stationary during a check, apply the parking brake and put the transmission in "Neutral". Proceed carefully.

⚠ WARNING

Seat belt and other OSHA-required safety equipment **MUST** be worn while operating the lift truck. Failure to use all safety equipment could result in serious injury or death.

If the lift truck tips over:

- Do not jump - Stay on the truck
- Hold the steering wheel firmly
- Brace feet
- Lean forward and away from impact

Continued
5-7

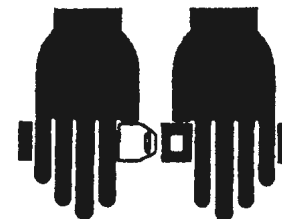
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Continued
5-7

SECTION 5 - OPERATING INSTRUCTIONS

STARTING PROCEDURES - CONT.

Do not start or operate the lift truck, including any of its functions or attachments, from any place other than the operator's seat.

1. Make sure the parking brake is applied.
2. Put the direction control lever for the transmission in the "Neutral" (N) position.

NOTICE

Starter may overheat if operated longer than 30 seconds.

If the engine fails to start, allow the starter to cool two (2) to three (3) minutes before trying again.

NOTICE

Starting fluids can severely damage the engine and void the engine warranty.

Do not use ether or other starting fluids or starting aids that have not been approved.

3. Turn the key to START to engage the starter. The Perkins diesel engine has a cold start aid. If the outside temperature is 45 degrees F (7 degrees C) or below, crank the engine two revolutions to prime the fuel system. Release the key to the ON position. Push the button for the cold start aid and hold it for 20 to 25 seconds, wait 60 seconds, then engage the starter again for approximately 10 to 30 seconds.

NOTE:

Diesel engines can be difficult to start during cold weather because of their design. The battery must be fully charged and in good condition to start a diesel engine in cold weather.

4. If the engine does not start after four attempts, get help from authorized service personnel.

SECTION 5 - OPERATING INSTRUCTIONS

STARTING PROCEDURES - CONT.

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SECTION 5 - OPERATING INSTRUCTIONS

PRE-OPERATION CHECKS

With the engine running, inspect the lift truck for the following items before use and every eight hours or daily. Unless otherwise specified below, detailed procedures for these checks are described in **SECTION 8 - 8 HOUR OR DAILY MAINTENANCE** of this Operation and Maintenance Manual.

1. Check the operation of the horn, gauges, and indicator lights as described in **SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS**.
2. Check the oil level in the powershift transmission with the engine running at idle speed.
3. Slowly raise, lower, extend, and retract the boom several times without a load. Make sure that the boom moves smoothly in accordance with control inputs.
4. Check the operation of the powershift transmission.
5. Check the operation of the service brakes and the parking brake.
6. Check the operation of the steering system.

BASIC OPERATING PROCEDURES

WARNING



Improper operation can be hazardous.

There are a number of operations that, if not performed carefully, can cause the lift truck to tip. If you have not read **SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES** of this manual, do so **NOW**. If you have not read the **ROUGH TERRAIN FORKLIFT SAFETY MANUAL FOR OPERATORS AND MECHANICS**, do so **NOW**. As you study the following information about how to properly operate a lift truck, remember the **WARNINGS**.

Continued
5-9

SECTION 5 - OPERATING INSTRUCTIONS

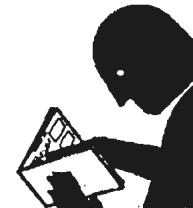
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Continued
5-9

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Many new operators make the mistake of thinking that driving a rough terrain forklift truck is the same as driving an automobile. The procedures are not the same. It is true that some lift truck operating procedures are as simple and obvious as driving the family automobile (e.g., Look where you are going, start and stop smoothly, etc.). But a lift truck is a special machine designed to do a much different job from an automobile. Because of the areas in which a lift truck operates, and its other operating characteristics (for example: coordinated or crab steering, and frame leveling), every operator must receive special training.

THE VR60B AND VR70B LIFT TRUCKS ARE INTENDED FOR USE BY AUTHORIZED AND TRAINED OPERATORS ONLY. This statement means that the operator **MUST** be trained to drive the lift truck and must thoroughly understand the procedures for lift truck operation.

A qualified person, experienced in lift truck operation, must guide the operator through several driving and load-handling operations before the new operator attempts to operate the lift truck alone. A basic education in correct driving and load-handling techniques is absolutely necessary to prepare the new operator for proper defensive driving and to expect the unexpected.

OPERATE THE ROUGH TERRAIN FORKLIFT TRUCK ONLY IN AREAS THAT HAVE BEEN APPROVED FOR ITS OPERATION. Certain areas contain hazardous flammable gases, liquid, dust, fibers, or other materials. Lift trucks that are operated in these areas must have special approval. These areas are designated to show the type of approval required for operation in the area. A rough terrain forklift truck is not normally operated in these restricted areas. If a rough terrain forklift truck must be operated in a restricted area, it must have some modifications and special approval. Contact your Ingersoll-Rand distributor if this requirement is necessary.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Many new operators make the mistake of thinking that driving a rough terrain forklift truck is the same as driving an automobile. The procedures are not the same. It is true that some lift truck operating procedures are as simple and obvious as driving the family automobile (e.g., Look where you are going, start and stop smoothly, etc.). But a lift truck is a special machine designed to do a much different job from an automobile. Because of the areas in which a lift truck operates, and its other operating characteristics (for example: coordinated or crab steering, and frame leveling), every operator must receive special training.

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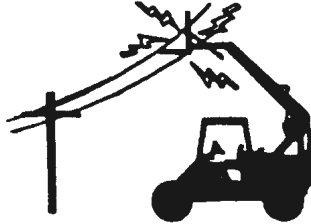
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Continued

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

! DANGER



Electrocution hazard.

Boom contact with power lines will result in serious injury or death.

Do not operate a lift truck over or near electric power lines.

A lift truck is not insulated. Do not operate any part of the lift truck within 12 feet (3.7 metres) of an electric power line.

DO NOT CARRY RIDERS. A lift truck is built for only one person—the operator. It is dangerous for anyone to ride on the forks or anywhere else on the lift truck.

! WARNING



This lift truck is designed and intended for handling materials. A lift truck is not designed to lift people.

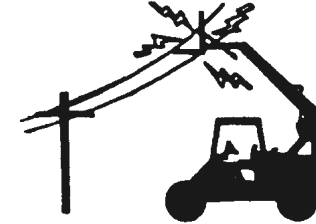
Do not use a lift truck to lift people.

Continued
5-11

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

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Continued
5-11

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

If a lift truck must be moved with an elevator or crane, make sure the lifting device has the capacity to lift the truck. The weight of your lift truck can be found on the machine's nameplate.

Drive carefully, observe traffic rules, and be in full control of the lift truck at all times. Be completely familiar with all the driving and load-handling techniques contained in this Operation and Maintenance Manual and the **Rough Terrain Forklift Safety Manual for Operators and Mechanics**.

The VR60B and VR70B lift trucks have a powershift transmission with a range selector lever for the three speed ranges. The selector lever has three positions for the three speed ranges (HIGH [3], INTERMEDIATE [2], and LOW [1]) The direction control lever has three positions: "Forward" (FWD), "Neutral" (N), and "Reverse" (REV).

The VR60B and VR70B lift trucks do not have transfer cases; they operate in 4-wheel drive continuously.

Move the direction control lever to either the "Forward" (FWD) or "Reverse" (REV) position, as desired.

Check the area around the lift truck. Apply the service brakes and release the parking brake. To move the lift truck, release the brake and push down on the accelerator pedal. A loaded or unloaded lift truck can usually begin to move with the range selector lever in the "2" position. Start in the "1" position when the lift truck is on a grade or in mud. After the lift truck is moving, move the range lever to increase speed or select a lower range as necessary.

NOTICE

Equipment damage.

DO NOT move the direction control lever to the opposite position (FWD to REV or REV to FWD) when the lift truck is moving.

To change directions, first stop the movement of the lift truck with the brake pedal. Select the speed range, then move the direction control lever to the opposite direction. Look in the direction of travel. Release the brake and accelerate by pushing on the accelerator pedal.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

If a lift truck must be moved with an elevator or crane, make sure the lifting device has the capacity to lift the truck. The weight of your lift truck can be found on the machine's nameplate.

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Inching

The VR60B and VR70B service brake pedal incorporates an “inching” function. Inching is the movement of a lift truck that permits a slow travel speed while the engine is operated at a higher speed for faster operation of the hydraulic system. When the service brake pedal is partially depressed, the clutches in the powershift transmission are partially disengaged and the movement of the lift truck is slow. When the service brake pedal is fully depressed, the powershift transmission is completely disengaged and the service brakes are applied. Use the accelerator pedal to keep the engine speed high for the hydraulic function. Refer to Figure 5-6.

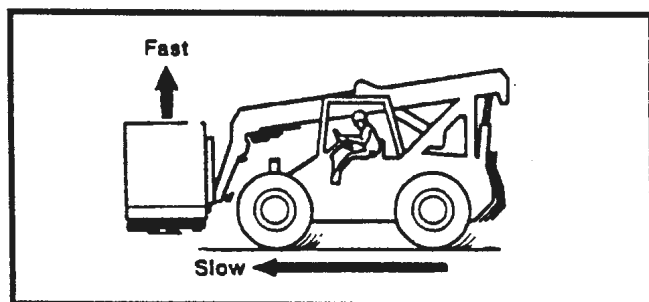


Figure 5-6. Inching

Inching requires coordinated movement of the service brake pedal and the accelerator pedal. New operators must practice this procedure before attempting to handle loads.

Steering and Turning

⚠ WARNING

TRAVEL SLOWLY WHEN TURNING. Lift trucks can tip over even at very slow speeds. The combination of speed and the sharpness of a turn can cause a tipover. A lift truck is less stable when the forks are elevated, with or without a load. Most operators can understand the need to be careful when handling loads, but some operators do not realize that a tipover can occur with an empty lift truck because similar dynamic forces are present. In fact, the lift truck will actually tip over more easily when empty than when loaded with the load lowered. Rearward tilt of the carriage and load, off-center loads, and uneven or soft ground will aggravate these conditions.

Continued
5-13

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

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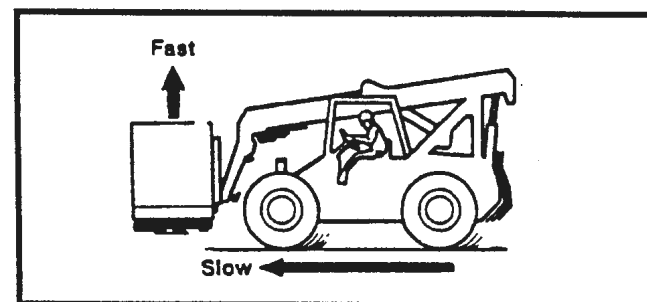


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Continued
5-13

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Steering and Turning - Cont.

Lift trucks are designed to work in a relatively small space. Because of their design, they can turn more sharply than some other vehicles. An operator must be aware of tail swing and always check to make sure the tail swing area is clear before turning. Refer to Figure 5-7. Failure to observe the tail swing area when making a turn can cause serious injury or death.

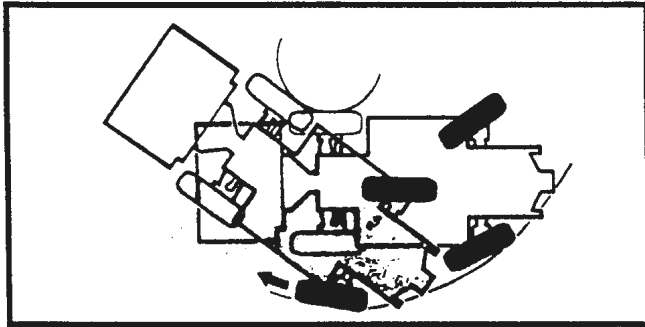


Figure 5-7. Lift Truck Tail Swing

WARNING

Keep a safe distance from the edge of docks, ramps, platforms, and other similar working surfaces. Watch the tail swing. Remember when traveling in the forward direction that when the steering wheel is turned to move the lift truck away from the edge of the dock, the rear can swing TOWARD the edge. This action can cause the lift truck to fall off the dock.

Keep a safe distance from the edges of excavations so that the ground does not suddenly collapse and tip over the lift truck. Be careful when operating on slopes when the ground is soft or muddy so that the lift truck does not suddenly slide and tip over.

If the lift truck tips over:

- Do not jump - Stay on the truck
- Hold the steering wheel firmly
- Brace feet
- Lean forward and away from impact

Continued

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Steering and Turning - Cont.

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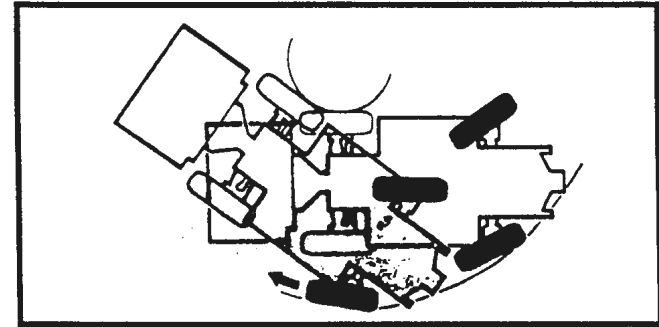


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Continued

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Steering and Turning - Cont.

When possible, keep both hands on the steering wheel. During most loading or unloading operations, the operator steers with the left hand. The right hand is used to operate the boom controls.

The VR60B and VR70B have three modes of steering:

1. **Front wheel only** (steering mode selector in center position): Front wheel steering is normally used only when traveling on roads. Refer to Figure 5-8.

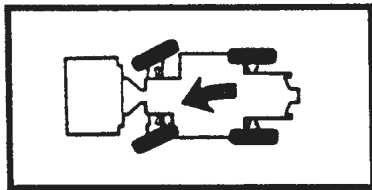


Figure 5-8. Front Wheel Only Steering

2. **Crab** (all wheels track in the same direction; steering mode selector in rearward position): Crab steering is used to move away from buildings or escape from wheel ruts. Refer to Figure 5-9.

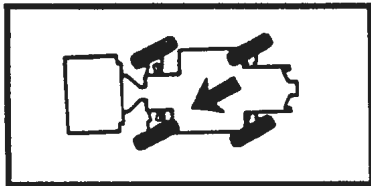


Figure 5-9. Crab Steering

3. **Coordinated** (rear wheels turn the opposite of the front wheels; steering mode selector in forward position): Coordinated steering provides the greatest maneuverability and is the mode of steering most often used. Refer to Figure 5-10.

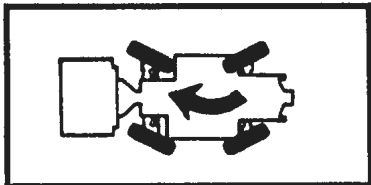


Figure 5-10. Coordinated Steering

Continued
5-15

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Steering and Turning - Cont.

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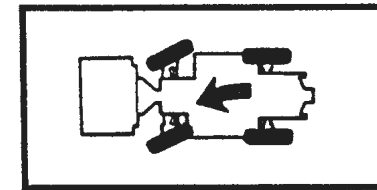


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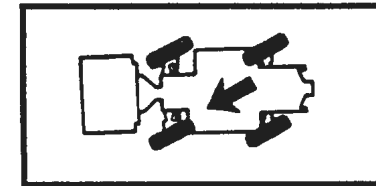


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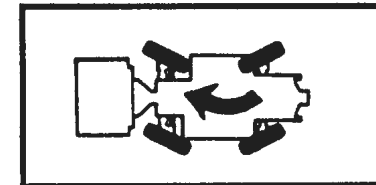


Figure 5-10. Coordinated Steering

Continued
5-15

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Steering and Turning - Cont.

NOTICE

Equipment damage.

The lift truck must be completely stopped before the steering mode is changed. The wheels must be aligned for straight travel before another mode is selected. Use the front wheel (2-wheel) steering mode to align the wheels before another steering mode is selected.

HANDLING AND MOVING LOADS

! WARNING



Improper operation can be hazardous.

If you have not read SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES of this manual, do so NOW. If you have not read the ROUGH TERRAIN FORKLIFT SAFETY MANUAL FOR OPERATORS AND MECHANICS, do so NOW. As you study the following information about how to properly handle and move loads, remember the WARNINGS.

1. Handle only loads within the rated capacity as shown on the Rated Capacity Chart(s) mounted on the lift truck. MAKE SURE THAT THE RATED CAPACITY CHART YOU ARE USING CORRESPONDS TO THE BOOM ATTACHMENT FITTED TO THE LIFT TRUCK AT THE MOMENT. This rated capacity represents the maximum load that can be lifted for the boom extensions when the

Continued

SECTION 5 - OPERATING INSTRUCTIONS

BASIC OPERATING PROCEDURES - CONT.

Steering and Turning - Cont.

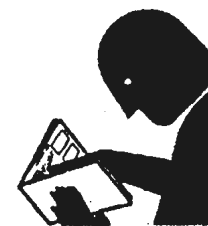
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HANDLING AND MOVING LOADS

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

lift truck is on a hard, level surface. However, such factors as weak floors, uneven terrain, soft ground, special load-handling attachments, or loads having a high center of gravity can mean that the safe working load is less than the rated capacity. When such conditions exist, the operator must reduce the load so that the lift truck will remain stable.

WARNING

Do not use the frame leveling function when the load is raised. Level the frame before the load is lifted. If the lift truck is equipped with a tilt carriage, level the frame before using the tilt carriage adjustment.

Move the frame leveling controls slowly and smoothly. Rapid starting and stopping of frame motion can cause the lift truck to tip. The risk of tipping increases as the boom is raised and extended.

2. When operating on a side slope, use the frame leveling function to compensate for uneven terrain. Use the level indicator to make sure the lift truck is level before raising the boom.
3. Inspect the load to be lifted. DO NOT raise the boom unless the frame is level. Lift the load and lower the load only on stable level ground. If a load must be handled several times, put stacking blocks under the loads.
4. Handle only stable loads. A load can have unstable items that can easily shift and fall on someone. DO NOT handle a load if ANY part of it is likely to fall.
5. If a suspended load must be lifted, DO NOT permit it to swing freely. Use a tether to control its movement. Start and stop the lift truck slowly and make turns carefully.
6. Position each load the same distance from the center of the carriage. This action will help center the load on the carriage. Set the forks as far apart as possible for maximum support of the load. Center the weight of the load between the forks. Otherwise the load can fall from the forks when you turn a corner or hit a bump. An off-center load will increase the possibility of the lift truck tipping over to the side.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

7. Make sure that the floor or surface can hold the weight of the lift truck and the load. The weight of your lift truck can be found on the machine's nameplate.

Lifting, Lowering, and Tilting

The boom extension, lift, and tilt functions are controlled by the operator's control levers.

The speed of the hydraulic functions is controlled by the position of the control levers and the speed of the engine. The farther the hand lever is moved from the "Neutral" (N) position, the faster the speed of the hydraulic function.

DO NOT lift or hit anything that can fall on the operator or another person. A lift truck is equipped with an overhead guard and load backrest extension to give reasonable protection to the operator from falling objects, but cannot protect against every possible impact. Other persons do not have overhead protection. Do not hit objects such as stacked material so that it can become dislodged and fall. The operator must be careful when working near stacks or objects that can fall.

WARNING



Keep yourself and others away from the lift mechanism. Never permit anyone under or on the forks.

Never put head, arms, hands, or legs through the boom mechanism nor near the forks or carriage. This rule applies not only to the operator, but also a helper. A helper must not be near the load or lift mechanism when the operator is attempting to handle a load. The lift mechanism has moving parts with close clearances that can cause serious injury or death.

Make sure the operation of the boom and the Rated Capacity Chart is understood before a load is lifted.

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

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SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

1. Avoid fast starts. Sudden movement can cause the lift truck to tip or cause the loss of the load from the forks. People can be hurt or killed and material can be damaged. Approach the load carefully. Make sure the lift truck is perpendicular to the load. Raise the forks to the height to engage the load.
2. Move forward slowly until the forks are in position under the load. When lifting a load, the forks must support at least two-thirds (2/3) of the length of the load. Refer to Figure 5-11. Make sure that the load is centered between the forks, and that the forks are centered on the carriage. The center of gravity must be as close to the load backrest and the center of the carriage as possible. Make sure that the forks do not extend past the load so that loads or equipment that are behind the load being lifted are not damaged. Refer to Figure 5-12.

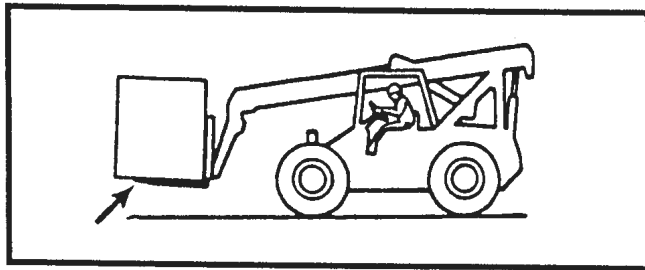


Figure 5-11. Ensure that at least two-thirds (2/3) of the load is supported by the forks.

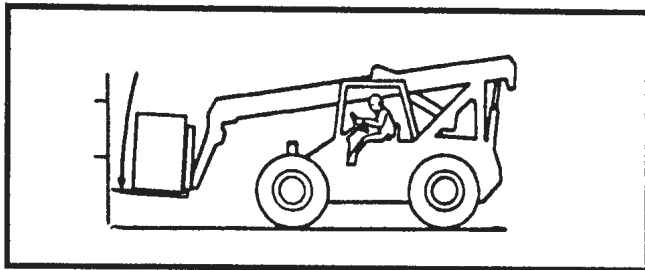


Figure 5-12. Be careful of forks beyond load.

If the forks are longer than the load, move the forks under the load so that the tips of the forks do not extend beyond the load. Lift the load from the surface. Move backward a few inches, then lower the load onto the surface and inch forward to engage the load against the carriage. Tilt the forks backward just far enough to

Continued
5-19

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

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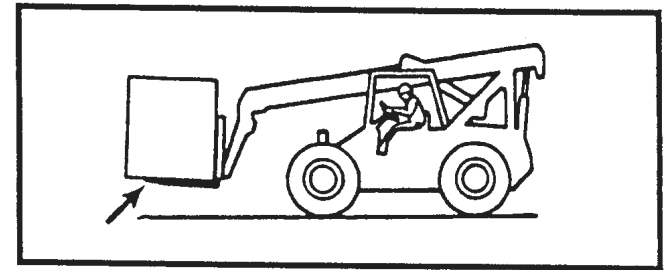


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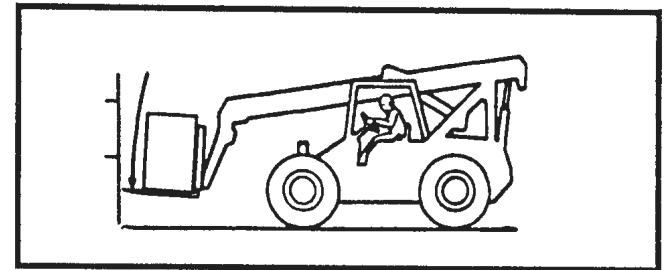


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Continued
5-19

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

lift the load from the surface. When the boom is raised from the surface level, the tips of the forks move forward in an arc. Make sure there is enough clearance so that the forks or the load do not hit loads or equipment that are behind the load being lifted.

WARNING

The forks on this lift truck have a large range of tilt. Do not tilt the forks to cause a loss of the load.

3. Always use a helper if you can not clearly see the point where the load will be stacked. Move the lift truck into position and make sure that the area is clear. Lower the load onto the stack or the surface. Tilt the forks to the horizontal position to disengage the load. Move the lift truck carefully away from the load to disengage the forks.

WARNING

Be careful when putting a load at a high elevation. When the lift height increases, your depth perception decreases and the area you can see clearly decreases. Putting a load at a high elevation can require a helper to guide you.

4. When stacking a load at a high elevation, make sure that everyone is away from the area where the load can tip or fall. Move the lift truck as close to the load point as possible with the load lowered. Use the frame leveling function as necessary before the load is raised.

Slowly and carefully raise the load. Keep the forks tilted backward a small amount so that load cannot slide from the forks. Never tilt the forks forward unless the load is over the stack point and ready to be disengaged.

If there is any indication, during the lift movement, that the load or the lift truck is not stable, STOP immediately. Retract the boom and lower the load and decrease the size of the load. Move the lift truck to a more stable and level position. Make sure the lift truck has the capacity to lift the load.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

WARNING

The lift truck becomes less stable as the load is lifted higher.

5. When the load being lifted approaches the stack height, slow to a minimum lift speed. Lift the load a small amount above the stack height.

WARNING

Do not extend the lift cylinder to the end of its stroke at a high lift speed. The sudden stop can cause the load to fall or the lift truck to tip.

Make sure the stack point can safely hold the load.

6. When the load is above the stack point, carefully move the load over the stack point. Gently lower the load until the weight is removed from the forks. Do not make a downward force on the stack with the forks or boom when lowering the load. Do not drag the forks on the surface under the load. Tilt the forks so that they are approximately level and parallel to the load surface so that they can be easily disengaged from the load.

Check that floor, support beams, scaffolding, and load surface can support the load before you completely disengage from the load. If there is a problem with the stack point, lift the load, tilt the load backward a small amount, retract the boom, and lower the load to the ground.

After the load is correctly stacked, move the lift truck slowly backward to disengage the forks. Retract the boom and lower the forks to a traveling height before moving the lift truck away from the area.

When lifting round objects, use a block behind the object. Tilt the carriage forward so that the forks can slide along the floor under the object to be lifted. Refer to Figure 5-13.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

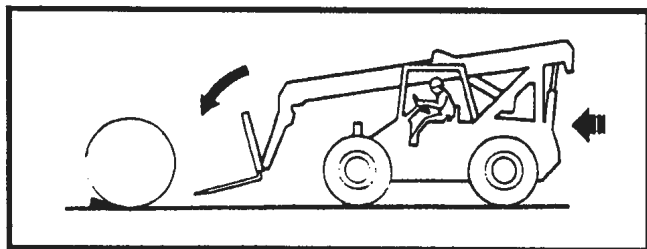


Figure 5-13. Lifting a Round Object; Note Blocked Object

Tilt the carriage fully backward to help keep the load on the forks. Refer to Figure 5-14. Use additional caution when carrying drums, reels, cylinders, and other round objects. Use a tether if necessary to control the load. Watch the clearances when the loads are very long, high or wide.

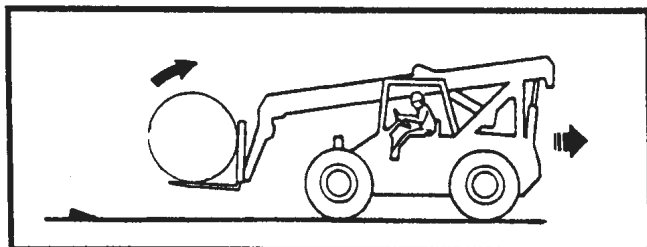


Figure 5-14. Tilting Carriage Backward

NOTE:

Not every load can be lifted using only the forks of a lift truck. Some loads will require a special attachment.

TRAVELING

When traveling with the load lowered, keep the load against the carriage and the forks tilted backward. This position will help keep the load on the forks and give better forward and side stability.

Travel with the lift mechanism raised only enough to clear the ground or obstacles. When the carriage or load is in an elevated position, the stability of the lift truck is reduced. A lift truck without a load can be more likely to tip sideways, especially in a turn, than a lift truck with a load carried in the lowered position.

SECTION 5 - OPERATING INSTRUCTIONS

HANDLING AND MOVING LOADS - CONT.

Lifting, Lowering, and Tilting - Cont.

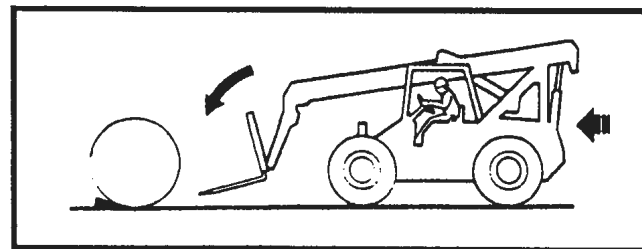


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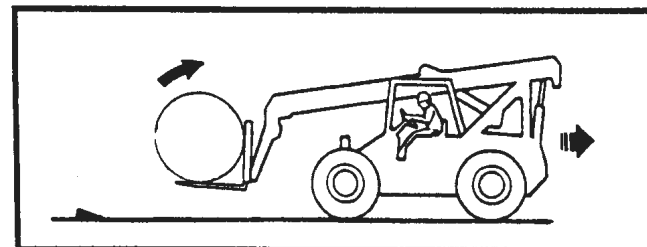


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SECTION 5 - OPERATING INSTRUCTIONS

TRAVELING - CONT.

For better visibility with large loads, travel with the load trailing, but always keep a proper lookout in the direction of travel. If the lift truck must travel in a direction where there is an obstruction to visibility, another person can be required for a lookout.

WARNING

When the boom is in the lowered position, the area on the right side of the lift truck can be difficult to observe. The lift truck has a mirror for viewing the area where the boom can cause interference with the operator's view. This mirror is an aid to the operator, but is **NOT** a driving mirror and must **NOT** be used as a driving mirror when operating in Reverse. **ALWAYS** look in the direction of travel to avoid personal injury or property damage.

When traveling up or down a grade with a loaded lift truck, the load should be kept up-grade to maintain control. When operating an unloaded lift truck on a steep grade, the counterweight must be kept up-grade.

Watch for pedestrians at all times. Do not drive up to anyone standing in front of an object. Use extra care at crossroads, doorways, and other locations where pedestrians can step into the path of travel of the lift truck. Slow down when approaching blind intersections or turns and sound the horn. The horn can alert pedestrians that there is a vehicle in the area and to be alert to possible danger.

Whenever the lift truck is moving, keep arms, legs, etc. inside the operator's compartment. Arms and legs outside the machine can be injured when passing obstructions.

Do not pass another vehicle traveling in the same direction at intersections, blind spots, or at other dangerous locations.

Avoid bumps, holes, soft ground, slick spots, and loose materials that can cause the lift truck to swerve or tip. If such areas cannot be avoided, go slowly. Always make sure you pick the smoothest route for your lift truck.

Do not indulge in stunt driving or horseplay.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

TRAVELING - CONT.

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

TRAVELING - CONT.

Stay away from the edge of the road. Keep the wheels of the lift truck—particularly the steering wheels—on the roadway. If the wheels are allowed to run off the edge of the travel surface onto soft ground, the lift truck can tip over.

Under all travel conditions, operate the lift truck at a speed that will permit it to be brought to a stop in a safe manner.

Check the condition of the driving surface of all docks. Make sure the dock floor will hold the weight of the lift truck and the load.

Make sure the dock ramp is secured, in good condition, and of the correct capacity.

ATTACHMENTS

If an attachment or special equipment is installed on the lift truck, make sure that the operating instructions are available and understood before operating the attachment.

WARNING

Make sure the nameplate is correct if an attachment has been installed.

Make sure you are using the correct Rated Capacity Chart for the attachment fitted to your lift truck at the moment.

PARKING

Never leave a lift truck in a condition from which it can cause damage or injury. When parking the lift truck, perform the following procedures:

1. Stop the lift truck and apply the parking brake.
2. Fully lower the boom and forks. Tilt the carriage forward until the tips of the forks touch the ground.
3. If the engine has been working hard, let the engine idle for a few minutes before it is stopped. This procedure is very important when operating a turbocharged engine. Turn the key switch to OFF to stop the engine.

Continued

SECTION 5 - OPERATING INSTRUCTIONS

TRAVELING - CONT.

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Continued

SECTION 5 - OPERATING INSTRUCTIONS

PARKING - CONT.

4. Remove the ignition key. Lock all anti-vandalism covers. Refer to Figure 5-15.

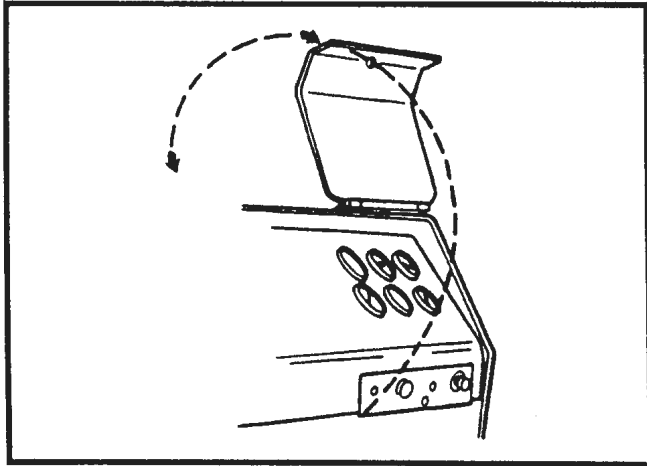


Figure 5-15. Anti-Vandalism Cover, Instrument Panel

TOWING

The lift truck cannot be towed from one job site to another. The following procedure is only for use when the lift truck must be removed from mud or other places and it cannot move under its own power.

1. The engine of the lift truck must operate. The steering and brakes cannot be operated if the engine is not running.
2. Use extra care if the traction conditions are bad or the lift truck is on a grade. Bad traction conditions can cause the lift truck or the towing vehicle to slide. Grades can require additional distance to stop the lift truck.
3. Make sure that the tow chain has the capacity to do the job; the weight of your lift truck can be found on the machine's nameplate. Carefully fasten the tow chain around the axle of the lift truck. Make sure that the tow chain is fastened so that the chain will not cause damage to the lift truck or the towing vehicle.
4. An operator must be on the lift truck when it is towed to operate the steering and brakes.

SECTION 5 - OPERATING INSTRUCTIONS

PARKING - CONT.

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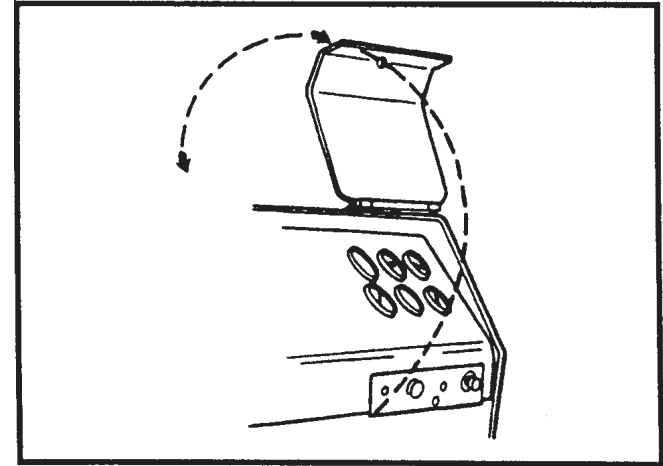


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The lift truck cannot be towed from one job site to another. The following procedure is only for use when the lift truck must be removed from mud or other places and it cannot move under its own power.

1. The engine of the lift truck must operate. The steering and brakes cannot be operated if the engine is not running.
2. Use extra care if the traction conditions are bad or the lift truck is on a grade. Bad traction conditions can cause the lift truck or the towing vehicle to slide. Grades can require additional distance to stop the lift truck.
3. Make sure that the tow chain has the capacity to do the job; the weight of your lift truck can be found on the machine's nameplate. Carefully fasten the tow chain around the axle of the lift truck. Make sure that the tow chain is fastened so that the chain will not cause damage to the lift truck or the towing vehicle.
4. An operator must be on the lift truck when it is towed to operate the steering and brakes.

SECTION 5 - OPERATING INSTRUCTIONS

TRANSPORTATION

WARNING

A loose lift truck can shift or fall while being transported.

Tie down the lift truck securely before moving the hauling vehicle or transporter.

Lift trucks are not designed for use on public roads and must be transported to job sites on a trailer or flatbed truck. Make sure that the trailer or flatbed truck has enough capacity to carry the lift truck; the weight of your lift truck can be found on the machine's nameplate. Make sure the ramps can hold the lift truck. Make sure the ramps and trailer surfaces are clean so that the lift truck cannot slide. Use blocks and tiedowns to make sure the lift truck cannot fall from the trailer. For further details, see "TRANSPORTING AND HAULING" in SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES.

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SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

Contents

General Information —————	1	Lubricating Oil/Grease
Fluid Capacities —————	3	Specifications (except Engine) —7
Lubrication Chart —————	4	Engine Lubricating Oil
Hydraulic Oil Requirements		Specifications ————— 7
and Specifications —————	6	Perkins Fuel Oil Specifications — 8
		Hazardous Substance Precaution — 9

GENERAL INFORMATION

Lubrication is an essential part of preventive maintenance, affecting to a great extent the useful life of the unit. Different lubricants are required and some components require more frequent lubrication than others. Therefore, it is important that the instructions regarding types of lubricants and the frequency of the application be explicitly followed. Periodic lubrication of the moving parts reduces to a minimum the possibility of mechanical failures.

6

The Lubrication Chart shows those items requiring regular service and the intervals at which service should be performed. Details concerning fuel, oil, and other lubricants follow the Lubrication Chart. A regular service program should be geared to the items listed under each interval. On the following pages each item is listed in the sequence in which lubrication and maintenance is to be performed. These intervals are based on average operating conditions. In the event of extremely severe, dusty, or wet operating conditions, more frequent lubrication than specified may be necessary.

Specific recommendations of brand and grade of lubricants are not made here due to regional availability, operating conditions, and the continual development of improved products. Where questions arise, refer to the requirements and specifications in this manual or in the component manufacturer's manual.

All oil levels are to be checked with the machine parked on a level surface, and while the oil is cold, unless otherwise specified.

On plug type check points, the oil levels are to be at the bottom edge of the check port.

All grease fittings are SAE STANDARD unless otherwise indicated. Grease non-sealed fittings until grease is seen extruding from the fitting. One ounce (28 grams) of EP-MPG equals one pump on a standard one pound (0.45 kg) grease gun.

Continued
6-1

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

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Continued
6-1

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

GENERAL INFORMATION - CON'T.

Overlubrication on non-sealed fittings will not harm the fittings or components, but underlubrication will definitely lead to a shorter lifetime.

Unless otherwise indicated, items not equipped with grease fittings—linkages, pins, levers, etc.—should be lubricated with oil once a week. Motor oil, applied sparingly, will provide the necessary lubrication and help prevent the formation of rust. An Anti-Seeze compound may be used if rust has not formed; otherwise, the component must be cleaned first.

Grease fittings that are worn or those that have a stuck check ball must be replaced.

All filters and filter elements for air, fuel, engine oil, and hydraulic fluid must be obtained through Ingersoll-Rand. Ordering the recommended filters and elements as listed in the Parts Catalog will ensure the proper size and filtration for the machine. Use only genuine Ingersoll-Rand replacement parts.

To prevent minor irregularities from developing into serious conditions that might involve shutdown and major repairs, several other services or checks are recommended for the same intervals as the periodic lubrication. The purpose of these services or checks, which require only a few minutes, is to ensure the uninterrupted and safe operation of the unit by revealing the need for adjustment caused by normal wear.

Thoroughly wash all fittings, caps, plugs, etc. with non-flammable, nontoxic cleaning solution before servicing to prevent dirt from entering while performing the service.

Lubricants must be at operating temperature when draining.

Visually check the entire unit in regard to capscrews, nuts, and pins being properly secured. Spot-check several capscrews and nuts for proper torque. If any are found loose, a more thorough investigation must be made.

This symbol represents an area where lubrication is required:



SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

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SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

FLUID CAPACITIES

NOTE

The following fluid capacities are provided for servicing personnel who must service the machine in remote locations where complete shop facilities and resources are not available. These capacities will give the servicing personnel an approximation of the fluid capacities of the components to be serviced. Always ensure that the specified method of checking for accurate fluid levels is used.

FLUID/OIL	APPROXIMATE CAPACITY
Diesel Fuel #2 ASTD-975-60T (Gallons/Liters)	36/136
Engine Oil (Quarts/Liters)	9.0/8.5
Transmission Oil TDH (Quarts/Liters)	18.4/17.7
Engine Coolant--50% Water/50% Glycol (Quarts/Liters)	21.4/20.2
Hydraulic Oil (Gallons/Liters)	27.5/104.5

Table 6-1. Fluid Capacities

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

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Engine Coolant--50% Water/50% Glycol (Quarts/Liters)	21.4/20.2
Hydraulic Oil (Gallons/Liters)	27.5/104.5

Table 6-1. Fluid Capacities

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

Interval (Hours)	Item No.	Description	Service Points	Operation	Lubrication or Service
8 or Daily	1	Engine Oil Level	Dipstick	Check	API SE*
	2	Transmission Oil Level	Dipstick	Check	TDH
	3	Coolant Level (In Bottle)	1	Check	
	4	Air Filter (Restriction Indicator)		Check	Clean or Replace
	5	Hydraulic Oil Level		Check	TDH
1150	20	Diesel Water Separator	Sight Ga. 1	Drain	
	6	Boom Pivots	13 Figs.	Lubricate	***
	7	Bronze Wear Shoes	5	Lubricate	***
	8	Chain Sheave Bearings	3 Figs.	Lubricate	***
	9	Axle Pivot	4 Figs.	Lubricate	***
150	19	Boom Rollers	2	Lubricate	***
	1	Engine Oil	1	Change	API SE*
	7	Oil Filter	1	Replace	**
	10	Plastic Wear Shoes	16	Lubricate	***
	11	Battery Water Level	1	Check	
500	13	Tire Pressure—12 Ply	4	Check	65 psi
	13	Axle Differential Oil Level	2 Plugs	Check	SAE 90 EP
		Final Drive Oil Level	4 Plugs	Check	SAE 90 EP ‡ & Friction Mod
	14	Tie Rods	4 Figs.	Lubricate	***
	15	Steering Cylinders	8 Figs.	Lubricate	***
1000	16	Drive Shafts	4 Figs.	Lubricate	***
	17	Boom Chains	3	Lubricate and Adjust	SAE 30
	18	Fork Pins	2	Lubricate	***
	19	Brake Accumulator	1	Check	!!!
	20	Diesel Water Separator	1	Change	**

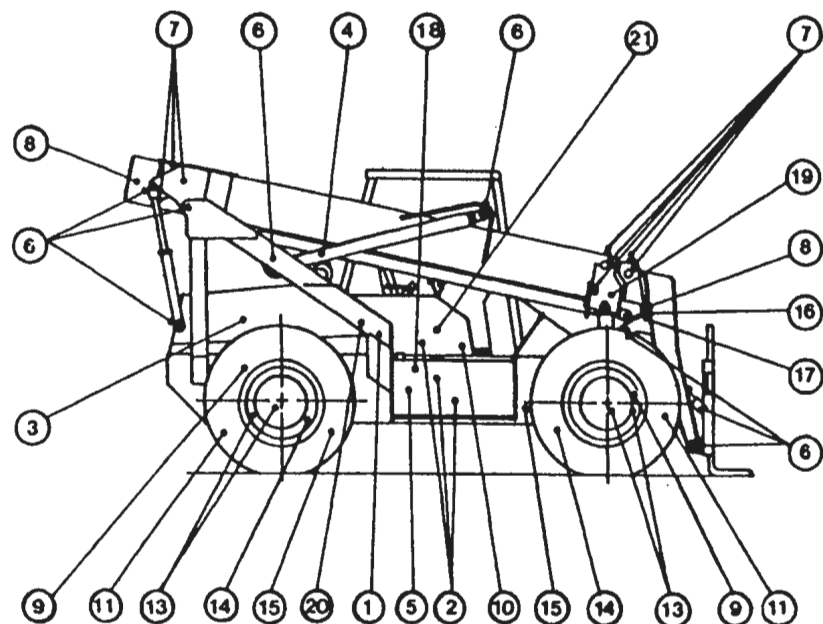
Figure 6-1. VR-60B/70B Lubrication Chart (Sheet 1 of 2)

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

Interval (Hours)	Item No.	Description	Service Points	Operation	Lubrication or Service
8 or Daily	1	Engine Oil Level	Dipstick	Check	API SE*
	2	Transmission Oil Level	Dipstick	Check	TDH
	3	Coolant Level (In Bottle)	1	Check	
	4	Air Filter (Restriction Indicator)		Check	Clean or Replace
	5	Hydraulic Oil Level		Check	TDH
1150	20	Diesel Water Separator	Sight Ga. 1	Drain	
	6	Boom Pivots	13 Figs.	Lubricate	***
	7	Bronze Wear Shoes	5	Lubricate	***
	8	Chain Sheave Bearings	3 Figs.	Lubricate	***
	9	Axle Pivot	4 Figs.	Lubricate	***
150	19	Boom Rollers	2	Lubricate	***
	1	Engine Oil	1	Change	API SE*
	7	Oil Filter	1	Replace	**
	10	Plastic Wear Shoes	16	Lubricate	***
	11	Battery Water Level	1	Check	
500	13	Tire Pressure—12 Ply	4	Check	65 psi
	13	Axle Differential Oil Level	2 Plugs	Check	SAE 90 EP
		Final Drive Oil Level	4 Plugs	Check	SAE 90 EP ‡ & Friction Mod
	14	Tie Rods	4 Figs.	Lubricate	***
	15	Steering Cylinders	8 Figs.	Lubricate	***
1000	16	Drive Shafts	4 Figs.	Lubricate	***
	17	Boom Chains	3	Lubricate and Adjust	SAE 30
	18	Fork Pins	2	Lubricate	***
	19	Brake Accumulator	1	Check	!!!
	20	Diesel Water Separator	1	Change	**

Figure 6-1. VR-60B/70B Lubrication Chart (Sheet 1 of 2)

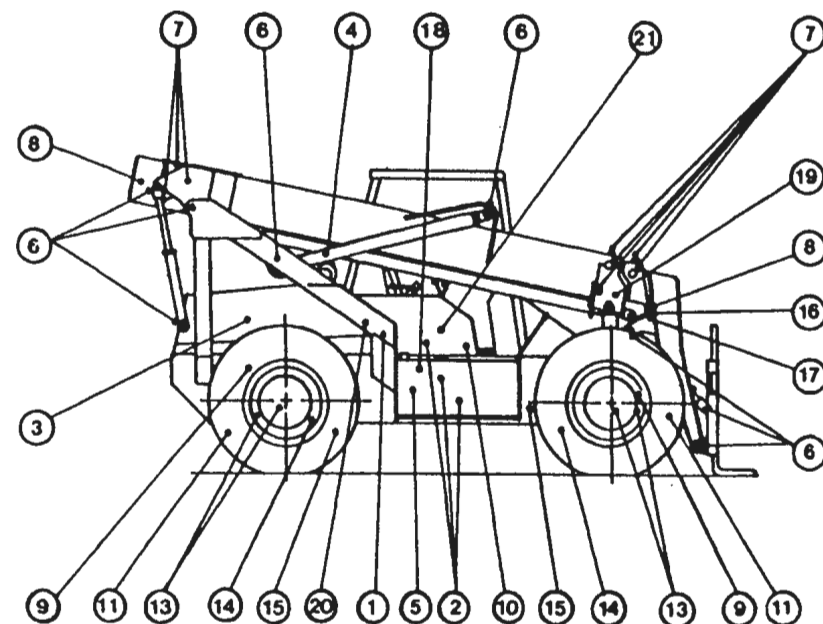
SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS



- * 10W-30 for 0°F and above; 5W-20 below 0°F.
- ** See Parts Manual.
- *** Multipurpose Grease with 2-4% molybdenum disulfide.
- !! Monthly minimum.
- !!! Check daily for first week of operation.
- ‡ Add Friction Modifier Additive CPN 58791478

Figure 6-1. VR-60B/70B Lubrication Chart (Sheet 2 of 2)

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS



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Figure 6-1. VR-60B/70B Lubrication Chart (Sheet 2 of 2)

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

HYDRAULIC OIL REQUIREMENTS AND SPECIFICATIONS

The quality of the hydraulic oil is important to the satisfactory performance of any hydraulic system. The oil serves as the power transmission medium, system coolant, and lubricant. Selection of the proper oil is essential to ensure proper system performance and life. For the specifications and requirements that hydraulic oil used in this unit should meet, refer to Table 6-2, Requirements for Hydraulic Oil.

Viscosity:	60 SUS Minimum at operating temperature 7500 SUS Maximum at operating temperature 150 to 225 SUS at 100° Fahrenheit (generally) 44 to 48 SUS at 210° Fahrenheit (generally)
Viscosity Index:	90 Minimum
Aniline Point:	-175 Minimum
API Gravity	28 Minimum
	Parafinic oils: 28 or more; Mixed base: 24 to 28; Napthanic or asphaltic base: 24 or less
Recommended Additives:	Rust and oxidation inhibitors Foam depressant
Desirable Characteristics:	Stability of physical and chemical characteristics High demulsibility (low emulsibility) for separation of water, air, and contaminants Resistance to the formation of gums, sludges, acids, tars, and varnishes High lubricity and film strength

Table 6-2. Requirements for Hydraulic Oil

The following are only a few examples of the commercial brand oils meeting specifications for use at temperatures above 10°F (-12°C):

International Harvester	Hy Tran
Auto. Trans. Fluid	Type F
Mobil Oil Company	Mobil Fluid DTE 25
Sun Oil Company	Sun Oil 2105

For temperatures below 10°F (-12°C), the following examples meet specifications:

Auto Transmission Fluid	Type F
Mobil Oil Company	Mobil DTE 13
Shell Oil Company	Tellus T-27

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

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SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

LUBRICATING OIL/GREASE SPECIFICATIONS (EXCEPT ENGINE)

EXTREME PRESSURE MULTIPURPOSE LUBRICANT

This gear lubricant is compounded to achieve high load-carrying capacity and meet the requirements of either API-GL-5 or MIL-L-2105C. Unless otherwise specified, SAE 90 viscosity may be used for year-round service. Low temperature usage is restricted as follows:

SAE Viscosity Number	Minimum Ambient Temperature °F (°C)
75W	-40 (-40)
80W	-15 (-26)
85W	+10 (-12)
90	+20 (-7)
140	+40 (+5)
250	+50 (+10)

EXTREME PRESSURE MULTIPURPOSE GREASE

This is a lithium soap-base grease with a high load-carrying capacity. The following properties are recommended:

Timkin OK Load	40 Lb. Minimum
Dropping Point	350°F (177°C) Minimum
Oil Viscosity	75 SUS Minimum at 210°F (99°C)
Water Resistance	Excellent

Under normal operating conditions, the following consistency grades are recommended:

NLGI No. 0 for subzero Fahrenheit temperatures.
NLGI No. 1 or No. 2 for normal ambient temperatures.
NLGI No. 2 or No. 3 for temperatures over 100°F (38°C).

ENGINE LUBRICATING OIL SPECIFICATIONS

NOTE

For latest applicable engine lubricating oil specifications, contact engine manufacturer/distributor or your Ingersoll-Rand Distributor

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

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SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

PERKINS FUEL OIL SPECIFICATIONS

To get the correct power and performance from your engine, use good quality fuel. The recommended fuel specification for Perkins engines is indicated below:

Cetane number:	45 Minimum
Viscosity:	2.5/4.5 centistrokes at 40°C
Density:	0,835/0,855 kg/liter
Sulphur:	0.5% of mass maximum
Distillation:	85% at 350°C

Cetane Number indicates ignition performance. A fuel with a low cetane number can cause cold start problems and affect combustion.

Viscosity is the resistance to flow and engine performance can be affected if it is outside the limits.

Density: A lower density reduces engine power; a higher density increases engine power and exhaust stroke.

Sulphur: A high sulphur content (not normally found in Europe, North America, or Australasia) can cause engine wear. Where only high-sulphur fuels are available, it is necessary to use a highly alkaline lubricating oil in the engine or to renew the lubricating oil more frequently.

Distillation: This is an indication of the mixture of different hydrocarbons in the fuel. A high ratio of lightweight hydrocarbons can affect the combustion characteristics.

Low-Temperature Fuels: Special winter fuels may be available for engine operation at temperatures below 32°F (0°C). These fuels have a lower viscosity and also limit the wax formation in the fuel at low temperatures. If wax formation occurs, this could stop the fuel flow through the filter.

Aviation Kerosene Fuels: These fuels can be used but they can affect engine performance. It is recommended that you consult the Perkins Technical Service Department, especially if JP4 fuel is to be used. These fuels are more flammable than diesel fuel and need careful storage and careful management.

If you need advice on adjustments to an engine setting or to the lubricating oil change periods that may be necessary because of the standard of available fuel, consult your Perkins distributor or the Perkins Technical Service Department.

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SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

HAZARDOUS SUBSTANCE PRECAUTION

The following information is provided to assist the owners and operators of Ingersoll-Rand Road Machinery Equipment. Further information may be obtained by contacting your Ingersoll-Rand Road Machinery Equipment Distributor.

The following substances are used in the manufacture of this machine and may be hazardous to health if used incorrectly.

SUBSTANCE	PRECAUTION
Antifreeze (Water-cooled engine)	Avoid ingestion, skin contact, and breathing fumes.
Hydraulic Oil	Avoid ingestion, skin contact, and breathing fumes.
Engine Lubricating Oil	Avoid ingestion, skin contact, and breathing fumes.
Preservative Grease	Avoid ingestion, skin contact, and breathing fumes.
Rust Preventative	Avoid ingestion, skin contact, and breathing fumes.
Engine Fuel	Avoid ingestion, skin contact, and breathing fumes.
Battery Fluid	Avoid ingestion, skin contact, and breathing fumes.
SAE Gear Oil	Avoid ingestion, skin contact, and breathing fumes.

The following substances may be produced during the operation of this machine and may be hazardous to health.

SUBSTANCE	PRECAUTION
Engine Exhaust Fumes	Avoid breathing.
Engine Exhaust Fumes	Avoid buildup of fumes in confined spaces.
Electric Motor Dust (Brushes/Insulation)	Avoid breathing during maintenance.
Brake Lining Dust *	Avoid breathing during maintenance.

*Only on machines with dry axle brakes.

SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS

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SECTION 7 - INITIAL BREAK-IN MAINTENANCE

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General	1	Brake Accumulator	3
New or Rebuilt Engine Break-In	2	Hydraulic Oil Filter	3
Powershift Transmission Oil Filter	2		

! WARNING

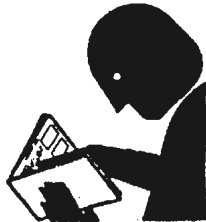


Unexpected machine motion or moving parts can cut or crush.

7

Apply the parking brake and shut down the engine before working on the machine.

! WARNING



Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

GENERAL

Any new equipment requires an initial modification of the maintenance schedule to properly break in the various systems and component units. Perform the one-time initial break-in maintenance tasks below IN ADDITION TO the periodic

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SECTION 7 - INITIAL BREAK-IN MAINTENANCE

Contents

General	1	Brake Accumulator	3
New or Rebuilt Engine Break-In	2	Hydraulic Oil Filter	3
Powershift Transmission Oil Filter	2		

! WARNING

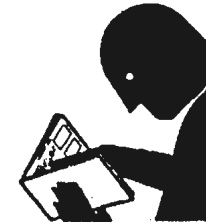


Unexpected machine motion or moving parts can cut or crush.

7

Apply the parking brake and shut down the engine before working on the machine.

! WARNING



Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

GENERAL

Any new equipment requires an initial modification of the maintenance schedule to properly break in the various systems and component units. Perform the one-time initial break-in maintenance tasks below IN ADDITION TO the periodic

Continued
7-1

SECTION 7 - INITIAL BREAK-IN MAINTENANCE

GENERAL - CONT.

maintenance tasks described in the following sections. After each initial break-in maintenance task has been performed, the regular service intervals should be followed.

NEW OR REBUILT ENGINE BREAK-IN

A new or rebuilt engine must be operated under special conditions during the first 50 hours. These special conditions prevent damage to the engine until the new parts can make adjustments to the operating conditions.

1. Make sure the fluid levels of engine oil and coolant are correct as described in **SECTION 8 - 8 HOUR OR DAILY MAINTENANCE**.
2. Start and run the engine at approximately one-half throttle for 30 minutes for the first operation. During this first operating period, check the gauges and indicators frequently for correct operation and indications as described in **SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS**. Check for leaks.
3. If the work conditions are slow and the loads are less than 50 percent of the truck capacity, a simulated work condition must be used during the first four hours of operation. Operate the lift truck with a minimum load of 75 percent capacity. Operate the engine through cycles from idle to full throttle and back to idle. Avoid long periods of high engine speeds with a light load during the first 50 hours of operation. High engine speeds with a light load can cause damage to the cylinders in the engine.
4. After 50 hours of operation, adjust the valve clearance and tighten the cylinder head bolts to the correct torque. Valve clearance and cylinder head bolt torque values can be found in your Perkins Engine Manual.

POWERSHIFT TRANSMISSION OIL FILTER

Change the powershift transmission oil filter after the first 20 hours of operation and again after the first 250 hours on a new or rebuilt transmission. For the procedure, refer to **SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE**.

SECTION 7 - INITIAL BREAK-IN MAINTENANCE

GENERAL - CONT.

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NEW OR REBUILT ENGINE BREAK-IN

A new or rebuilt engine must be operated under special conditions during the first 50 hours. These special conditions prevent damage to the engine until the new parts can make adjustments to the operating conditions.

1. Make sure the fluid levels of engine oil and coolant are correct as described in **SECTION 8 - 8 HOUR OR DAILY MAINTENANCE**.
2. Start and run the engine at approximately one-half throttle for 30 minutes for the first operation. During this first operating period, check the gauges and indicators frequently for correct operation and indications as described in **SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS**. Check for leaks.
3. If the work conditions are slow and the loads are less than 50 percent of the truck capacity, a simulated work condition must be used during the first four hours of operation. Operate the lift truck with a minimum load of 75 percent capacity. Operate the engine through cycles from idle to full throttle and back to idle. Avoid long periods of high engine speeds with a light load during the first 50 hours of operation. High engine speeds with a light load can cause damage to the cylinders in the engine.
4. After 50 hours of operation, adjust the valve clearance and tighten the cylinder head bolts to the correct torque. Valve clearance and cylinder head bolt torque values can be found in your Perkins Engine Manual.

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SECTION 7 - INITIAL BREAK-IN MAINTENANCE

BRAKE ACCUMULATOR

The operation of the brake accumulator must be checked regularly. When an accumulator is first put into service (a new lift truck or a rebuilt accumulator), the operation of the accumulator must be checked within 72 hours during the first week of operation. For the procedure, refer to **SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE**.

HYDRAULIC OIL FILTER

Change the oil filter for the hydraulic system after the first 100 hours of operation. For the procedure, refer to **SECTION 13 - 2000 HOUR OR BIENNIAL MAINTENANCE**.

SECTION 7 - INITIAL BREAK-IN MAINTENANCE

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SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

Contents

General Maintenance Precautions—	2	Boom and Forks —————	13
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Coolant Level —————	4	Boom System —————	18
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Hydraulic Oil Level —————	8	Parking Brake —————	19
Fuel/Water Separator ———	9	Steering System —————	20
Drive Belt —————	9	Powershift Transmission ———	20
Fuel System —————	11		
Tires and Wheels —————	12		

! WARNING



8

Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine.

! WARNING



Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

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GENERAL MAINTENANCE PRECAUTIONS

The lift truck must be put on blocks for some kinds of maintenance and repair. For complete blocking procedure and Warning, see "JACKING AND BLOCKING THE LIFT TRUCK" in SECTION 14 - ROUTINE ADJUSTMENTS.

CHECKS WITH THE ENGINE SHUT DOWN

! WARNING



Unexpected machine motion or moving parts can cut or crush.

Do not stand between tire and frame unless:

- Engine is stopped
- Key is removed from key switch
- Parking brake is applied
- Tires are blocked

OPENING THE HOOD

The front and rear engine compartments are covered by hoods. Release the two latches to open the front hood. Lift the side of the front hood nearest the operator's seat a small amount and slide the hood forward on the support rail. It can then be tipped to the right side of the lift truck for access to the engine and transmission compartment.

Two latches hold the hood at the rear engine compartment. Release the latch on each side of the hood and slide the rear hood backward along the rails for access to the rear engine compartment. Refer to Figure 8-1.

Continued

GENERAL MAINTENANCE PRECAUTIONS

The lift truck must be put on blocks for some kinds of maintenance and repair. For complete blocking procedure and Warning, see "JACKING AND BLOCKING THE LIFT TRUCK" in SECTION 14 - ROUTINE ADJUSTMENTS.

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Continued

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

OPENING THE HOOD - CONT.

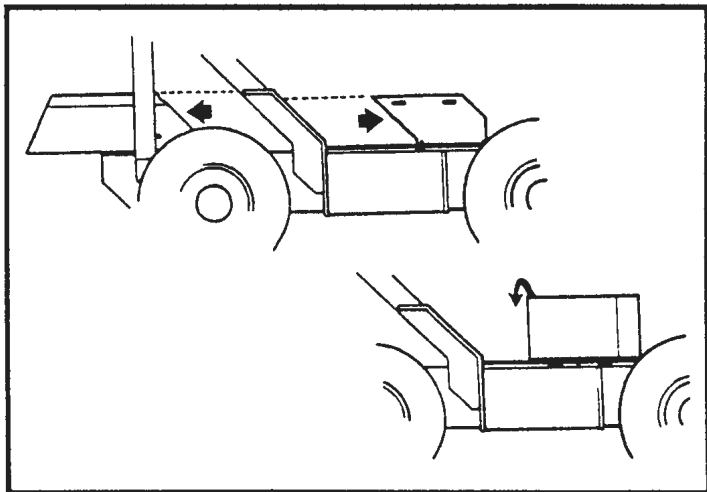


Figure 8-1. Opening Front and Rear Hoods

ENGINE OIL LEVEL

Keep the engine oil at the correct level between the ADD and FULL marks on the dipstick. Use the correct oil shown in the Lubrication Chart, Figure 6-1. After the engine has been shut down, wait one minute before checking the oil level. Refer to Figures 8-2 and 8-3.

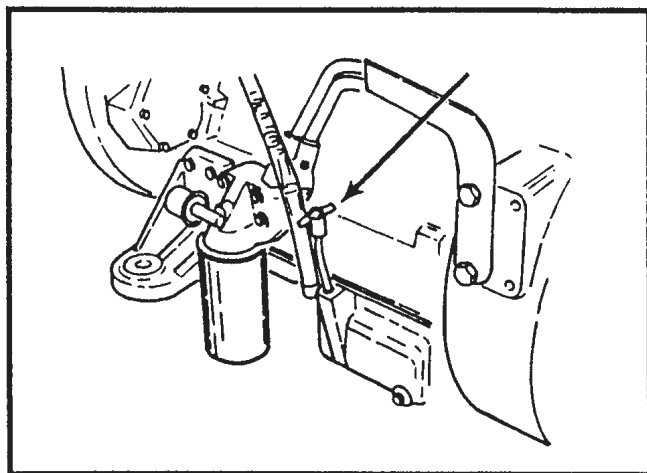


Figure 8-2. Engine Oil Dipstick

Continued
8-3

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

OPENING THE HOOD - CONT.

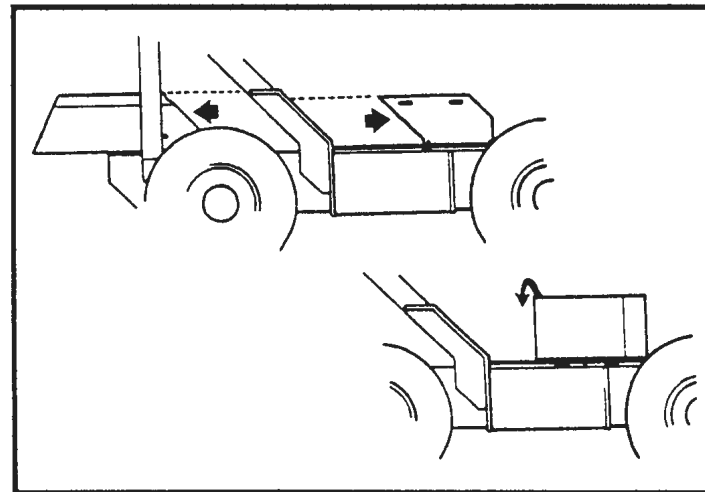


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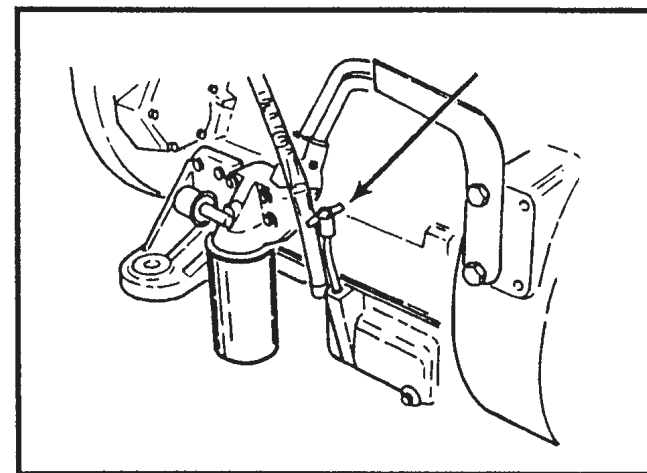


Figure 8-2. Engine Oil Dipstick

Continued
8-3

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

ENGINE OIL LEVEL - CONT.

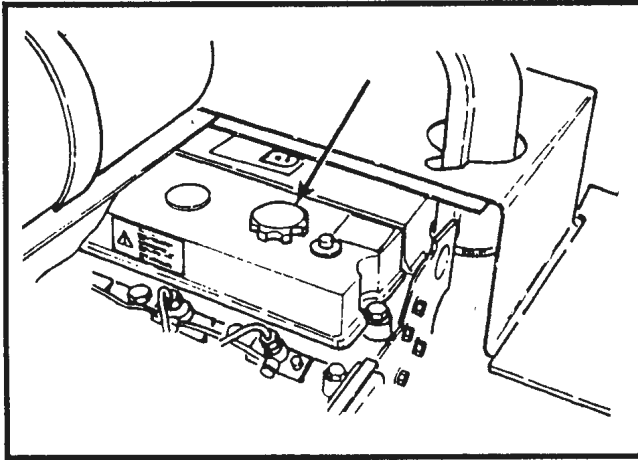
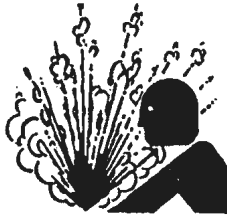


Figure 8-3. Engine Oil Fill Point

COOLANT LEVEL

! WARNING



Steam or fluid escaping from the radiator can burn. Inhibitor contains alkali; avoid contact with skin and eyes.

Always shut down the engine and allow to cool down before removing the radiator cap. Remove cap slowly to relieve pressure. Avoid contact with steam or escaping fluid.

The radiator cap is not normally removed unless the coolant system must be drained and filled. Make sure the coolant level is between the "FULL" and the "ADD" marks on the auxiliary coolant reservoir. The coolant will expand as it is heated and the level in the auxiliary coolant reservoir will increase. When additional coolant is needed, fill the auxiliary coolant reservoir to the FULL mark. Refer to Figure 8-4.

Continued

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

ENGINE OIL LEVEL - CONT.

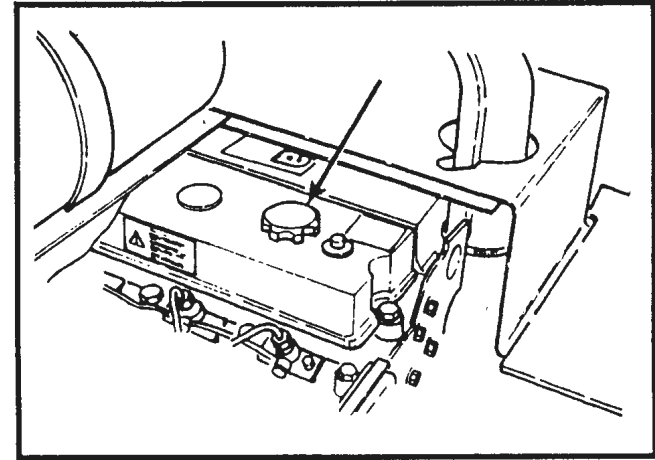
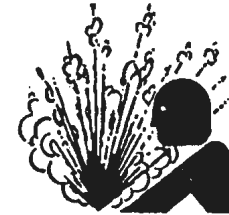


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COOLANT LEVEL - CONT.

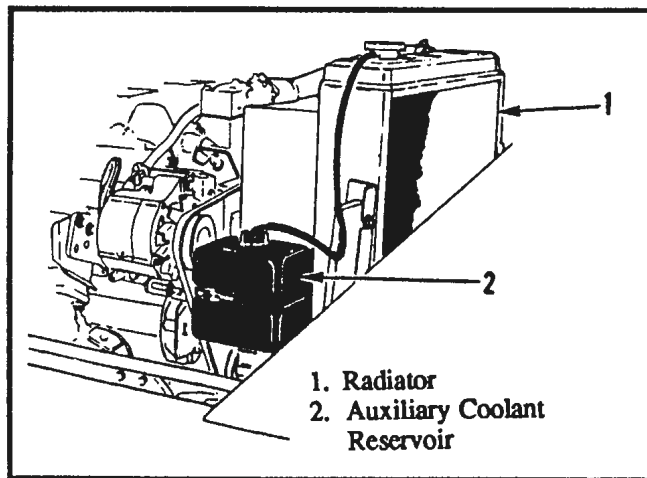


Figure 8-4. Auxiliary Coolant Reservoir

Check the coolant hose for leaks and damage. Check the radiator fins. Clean the radiator with compressed air or water as needed.

AIR FILTER

NOTICE

Engine damage.

Raw, unfiltered air can cause engine damage.

Never service the air cleaner while the engine is running.

Clean the pre-cleaner daily. The air filter is under the pre-cleaner behind the overhead guard. Refer to Figure 8-5. Check the air restriction indicator. If the air restriction indicator shows the red band, clean or replace the air filter. Refer to Figure 8-6.

Continued

COOLANT LEVEL - CONT.

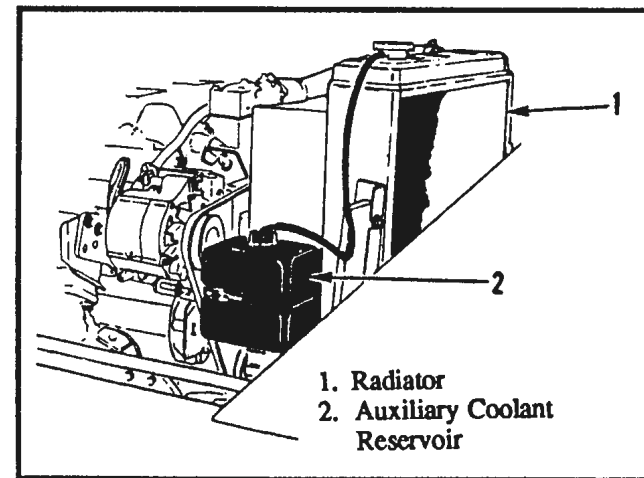


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Continued

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

AIR FILTER - CONT.

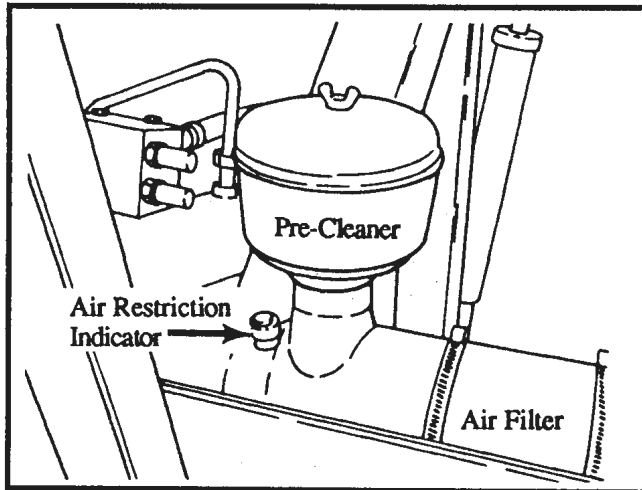


Figure 8-5. Air Filter and Pre-Cleaner

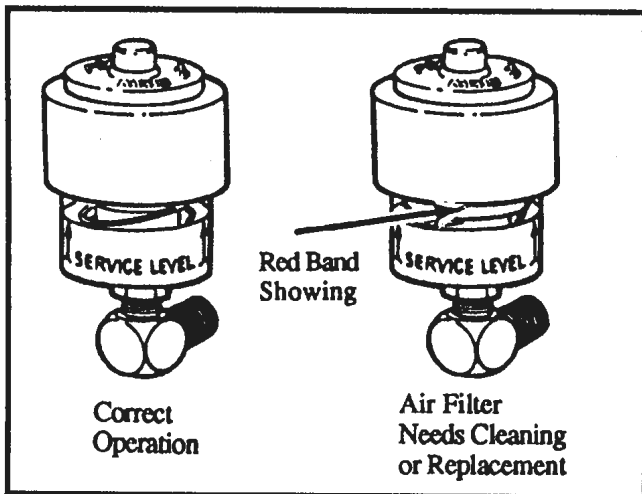


Figure 8-6. Air Restriction Indicator

Clean or replace the air filter as necessary. Use compressed air to clean the filter element. The air pressure must be less than 30 psi (205 kPa). Apply the air from the inside to the outside of the element. Refer to Figure 8-7.

Continued

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

AIR FILTER - CONT.

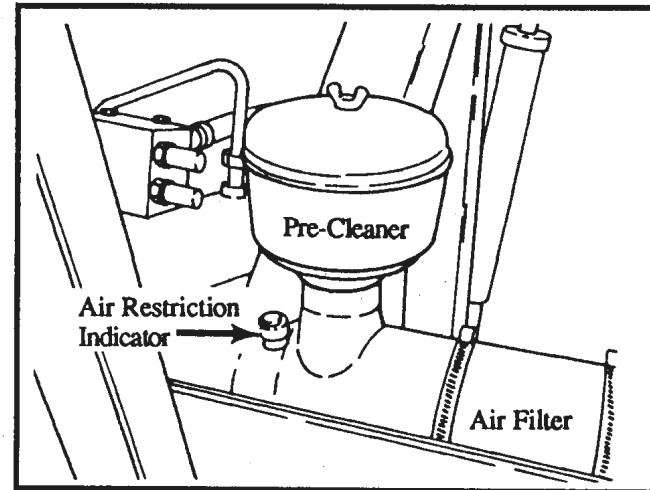


Figure 8-5. Air Filter and Pre-Cleaner

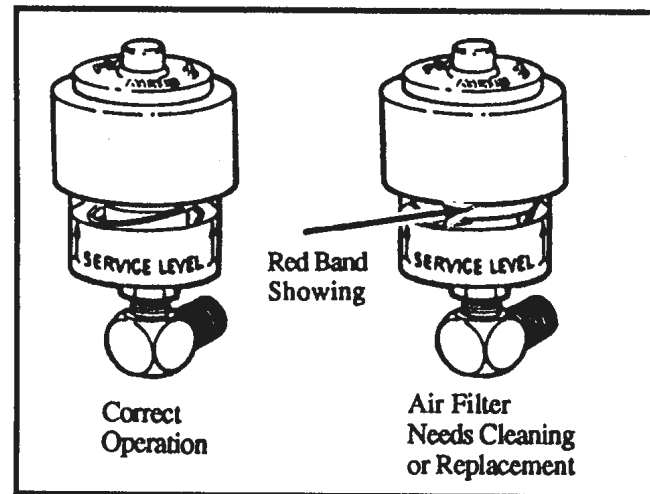


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Continued

AIR FILTER - CONT.

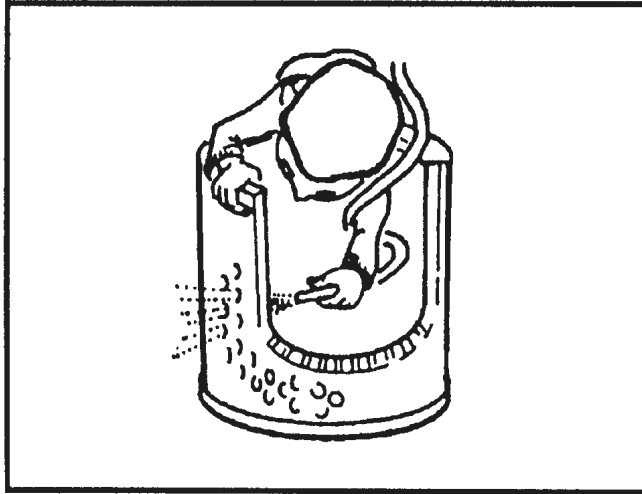


Figure 8-7. Cleaning Filter with Compressed Air

To inspect the filter element, put a bright light inside and look for holes or other damage. Refer to Figure 8-8. If it is damaged, replace it with a new element. Clean the inside of the canister when the filter is changed.

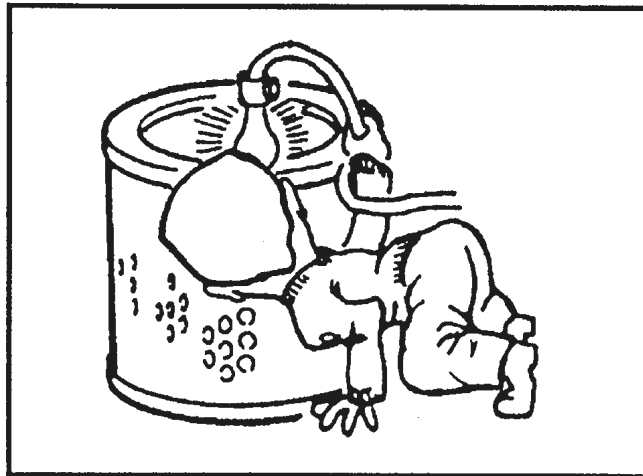


Figure 8-8. Filter Inspection

AIR FILTER - CONT.

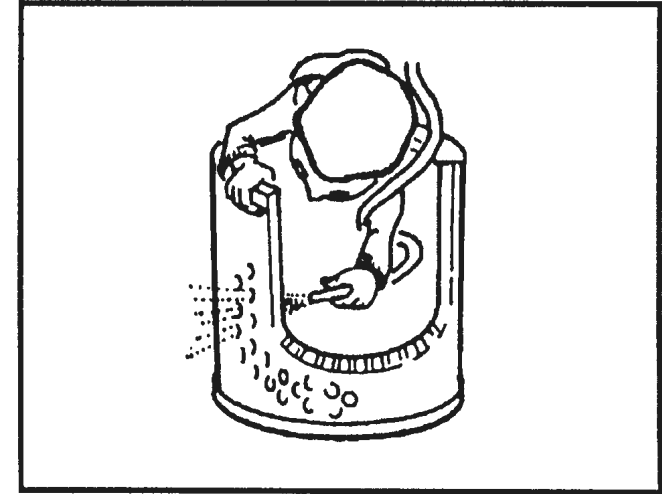


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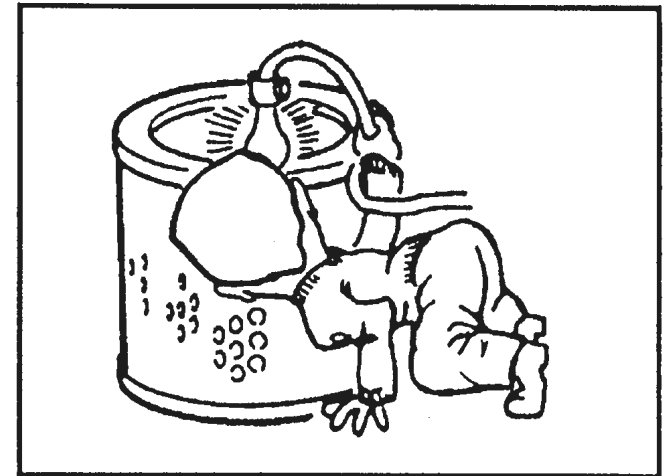


Figure 8-8. Filter Inspection

HYDRAULIC OIL LEVEL

NOTICE

Never operate the engine without oil in the hydraulic system. A few revolutions without oil can damage the hydraulic pumps.

Do not permit dirt to enter the hydraulic system when the oil level is checked or the filter is changed.

Check the hydraulic oil level when the oil is at operating temperature, the boom is fully retracted, the carriage is lowered, and the engine is shut down. Add hydraulic oil only as needed. If hydraulic oil is added past the "FULL" level, the hydraulic oil will leak from the breather during operation. All models have a sight glass on the side of the hydraulic tank for checking the oil level in the hydraulic tank. Refer to Figure 8-9.

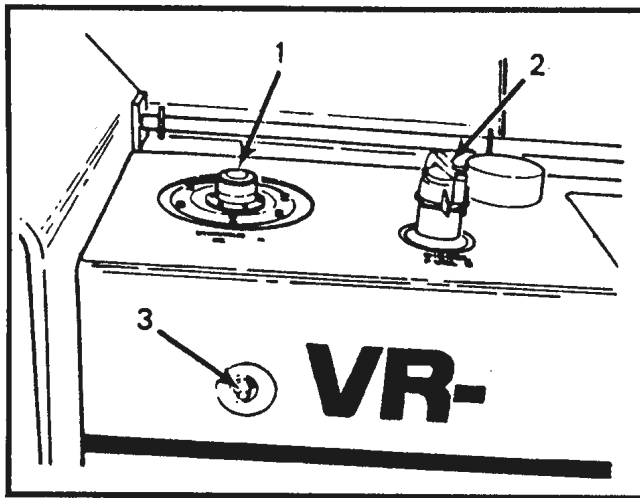


Figure 8-9. (1) Hydraulic Oil Tank Fill; (2) Fuel Tank Fill; (3) Hydraulic Oil Sight Gauge

HYDRAULIC OIL LEVEL

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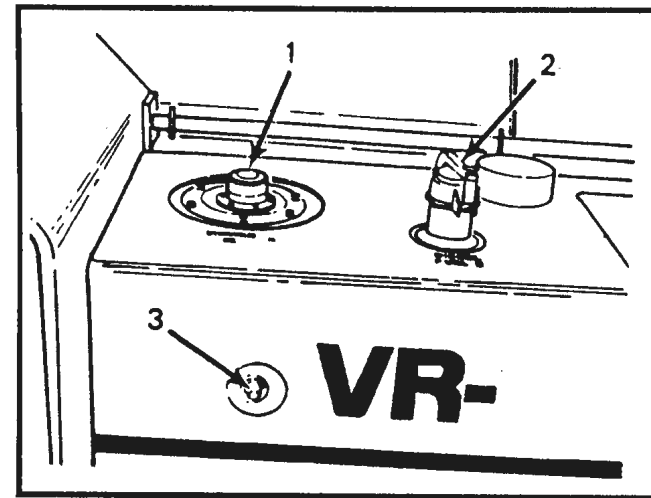


Figure 8-9. (1) Hydraulic Oil Tank Fill; (2) Fuel Tank Fill; (3) Hydraulic Oil Sight Gauge

FUEL/WATER SEPARATOR

Drain the water from the fuel/water separator (diesel/water separator), which is located at the forward end of the engine (over the flywheel housing). Refer to Figure 8-10 .

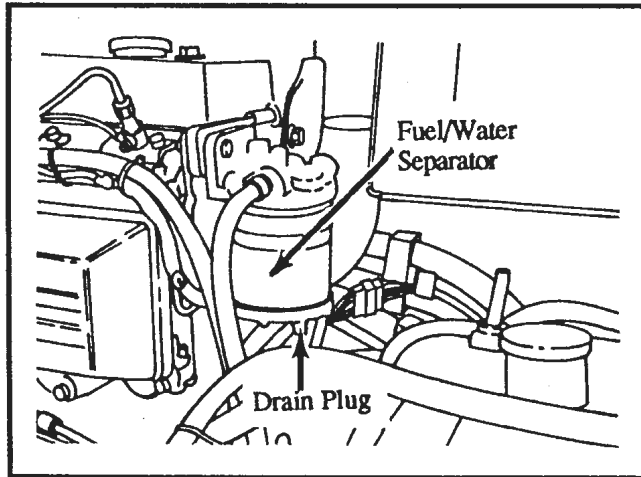


Figure 8-10. Fuel/Water Separator

1. Open the drain plug on the bottom of the canister. Drain some fuel (and any water) into a cup until clean fuel flows from the canister.
2. Close the drain plug.

DRIVE BELT

Check the drive belt for wear and damage. [NOTE: When a pair of drive belts are used, they must be replaced as a pair. When a pair of drive belts are used, adjust the tension for the tightest belt.]

A gauge is available that will indicate the tension in the drive belt. Fit the gauge at the center of the longest length of the drive belt and measure the tension. Refer to Figure 8-11. The correct tension is approximately 80 lbf (355 N).

A common way to check belt tension is to press with the thumb at the center of the longest length and check the deflection. Refer to Figure 8-12. When the thumb pressure is 20 lbf (100 N), the correct deflection is 1/2 inch (13 mm).

Continued

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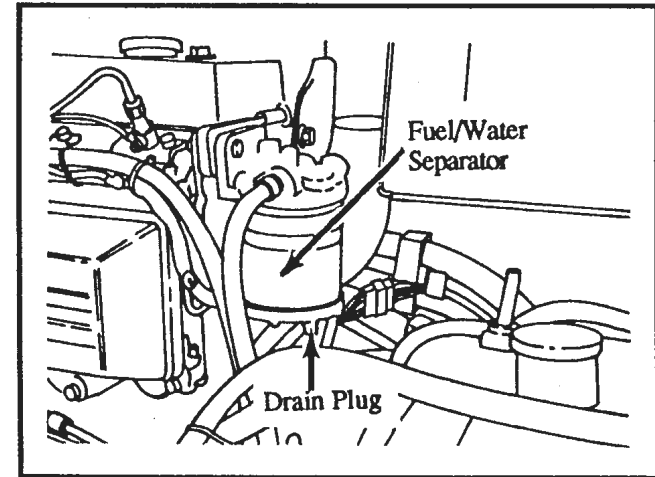


Figure 8-10. Fuel/Water Separator

1. Open the drain plug on the bottom of the canister. Drain some fuel (and any water) into a cup until clean fuel flows from the canister.
2. Close the drain plug.

DRIVE BELT

Check the drive belt for wear and damage. [NOTE: When a pair of drive belts are used, they must be replaced as a pair. When a pair of drive belts are used, adjust the tension for the tightest belt.]

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DRIVE BELT - CONT.

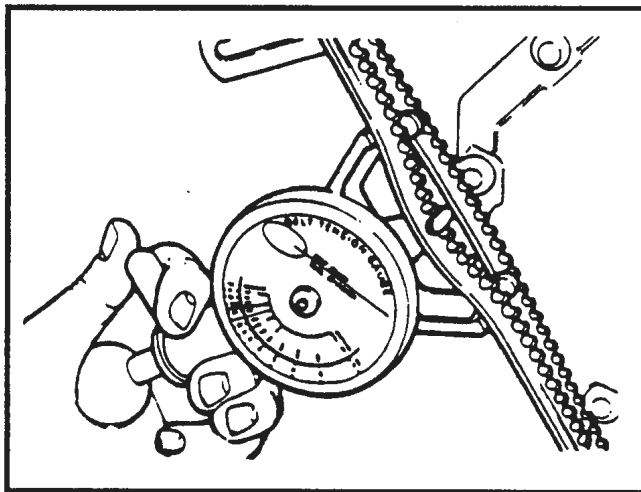
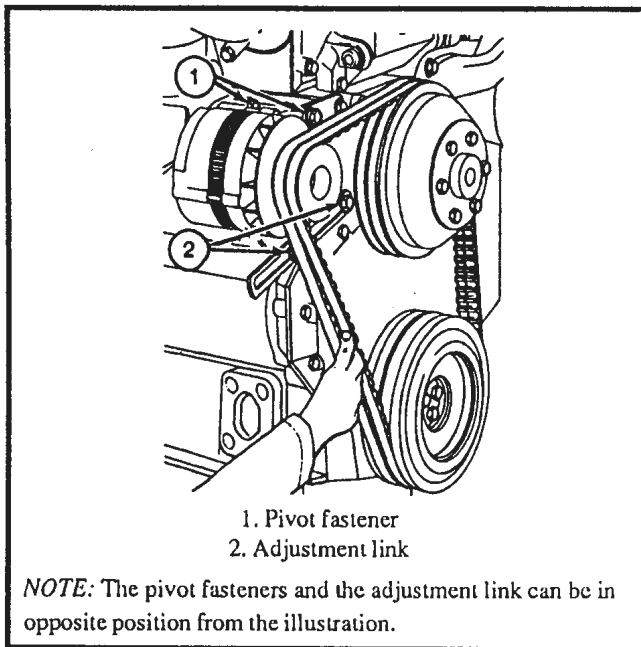


Figure 8-11. Using Gauge to Check Drive Belt Tension



NOTE: The pivot fasteners and the adjustment link can be in opposite position from the illustration.

Figure 8-12. Checking and Adjusting Drive Belt Tension

Continued

DRIVE BELT - CONT.

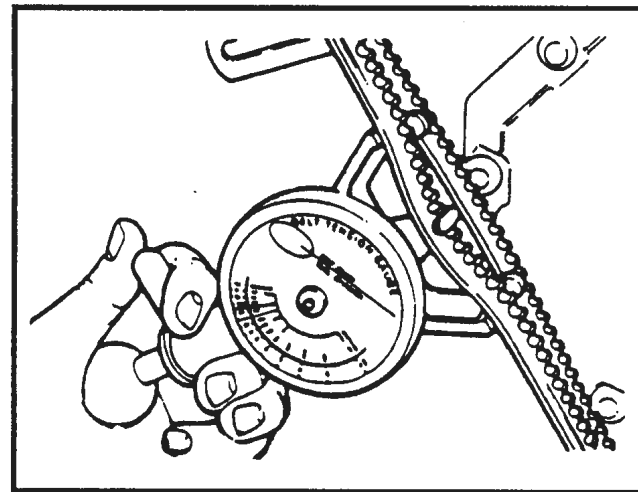
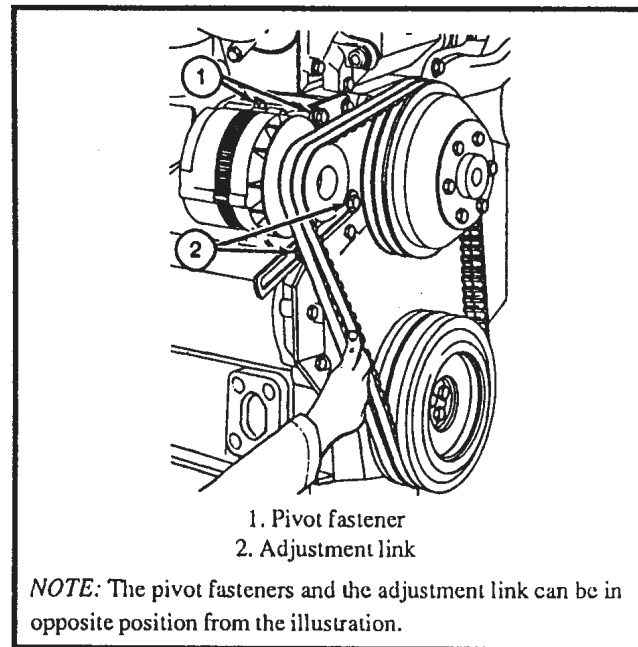


Figure 8-11. Using Gauge to Check Drive Belt Tension



NOTE: The pivot fasteners and the adjustment link can be in opposite position from the illustration.

Figure 8-12. Checking and Adjusting Drive Belt Tension

Continued

DRIVE BELT - CONT.

Loosen the bolt on the adjustment link (2) and the pivot fasteners (1) to adjust the tension of the drive belts. Move the alternator pulley against the drive belts to adjust the tension. Tighten the adjustment link and pivot fasteners.

The drive belts are removed from the engine by loosening the tension and then removing them from the pulleys.

FUEL SYSTEM

 **WARNING**



Fuel is flammable.

Shut down the engine, extinguish all open flames, and do not smoke while filling the fuel tank.

Always wipe up any spilled fuel.

Check the fuel system for leaks and the condition of parts. If there is a leak in the fuel system, extra care must be used during the repair. All fuels are very flammable and can burn or cause an explosion. Do not operate the lift truck until the leak is corrected. To add fuel to the lift truck:

1. Make sure the fuel tank is filled with fuel of the correct type. For complete Perkins engine fuel specifications, see **SECTION 6 - FUEL AND LUBRICATION SPECIFICATIONS**. Clean the fuel cap. The fuel fill point is located on the right side of the lift truck. Refer to Figure 8-9.
2. Replace the fuel cap after fuel has been added.

DRIVE BELT - CONT.

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2. Replace the fuel cap after fuel has been added.

TIRES AND WHEELS

WARNING



Air pressure in tires can cause tire and wheel parts to explode and cause serious injury or death. Tires must be removed and air pressure added in a safety cage if the air pressure is less than 80 percent of the correct air pressure. Follow the procedures under "WHEELS AND TIRES" in SECTION 14 - ROUTINE ADJUSTMENTS.

If a tire must be removed for repair, remove the air pressure from the tire before the wheel is removed from the lift truck.

When air pressure is added to tires, use equipment with a gauge or pressure regulator and a clip-on chuck. Make sure the hose is long enough so that the person adding air pressure can stand to the side and not in the path of the wheel parts in case of an explosion.

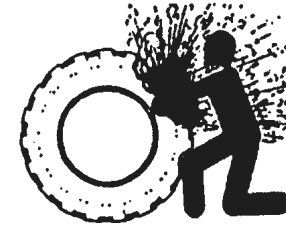
Keep the tires at the correct air pressure as shown on the nameplate mounted on the machine. Check the air pressure with a gauge when the tires are cold. If it is necessary to add air pressure to a tire that is warm, check one of the other tires and add air to the tire that has low air pressure so that the air pressures are equal. The air pressure of a warm tire must always be equal to or greater than the air pressure specified for cold tires.

Check the tires for damage. Check the tread and remove any objects that will cause damage. Check for bent or damaged rims. Check for loose or missing hardware. Remove any wire, strapping, or other material that is wrapped around the axle.

Make sure the wheel nuts are tight. Tighten the wheel nuts as described under "WHEELS AND TIRES" in SECTION 14 - ROUTINE ADJUSTMENTS. When the wheels are removed and installed again, check the nuts after eight hours of operation. When the nuts stay tight after an eight-hour check, the interval for checking with a torque wrench can be extended to 350 hours.

TIRES AND WHEELS

WARNING



Air pressure in tires can cause tire and wheel parts to explode and cause serious injury or death. Tires must be removed and air pressure added in a safety cage if the air pressure is less than 80 percent of the correct air pressure. Follow the procedures under "WHEELS AND TIRES" in SECTION 14 - ROUTINE ADJUSTMENTS.

If a tire must be removed for repair, remove the air pressure from the tire before the wheel is removed from the lift truck.

When air pressure is added to tires, use equipment with a gauge or pressure regulator and a clip-on chuck. Make sure the hose is long enough so that the person adding air pressure can stand to the side and not in the path of the wheel parts in case of an explosion.

Keep the tires at the correct air pressure as shown on the nameplate mounted on the machine. Check the air pressure with a gauge when the tires are cold. If it is necessary to add air pressure to a tire that is warm, check one of the other tires and add air to the tire that has low air pressure so that the air pressures are equal. The air pressure of a warm tire must always be equal to or greater than the air pressure specified for cold tires.

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BOOM AND FORKS

 WARNING


Never work under a raised boom or forks. Lower the forks to the surface before inspecting the parts.

Do not try to correct fork tip alignment by bending the forks or adding shims. Replace damaged forks.

Never repair damaged forks by heating or welding. Forks are made of special steel using special procedures. Replace damaged forks.

1. Check for leaks in the hydraulic system. Check the condition of the hydraulic hoses and tubes.
2. Check the welds on the boom and forks for cracks. Check for loose and damaged parts. Make sure the capscrews and nuts are tight.
3. Check the wear shoes for wear. Check the rollers for wear or damage. Make sure the surfaces on the boom where the wear shoes and rollers travel are not rough or damaged.
4. Check the load backrest extension for cracks and damage.
5. Check that the fork tips are aligned within 13 mm (0.5 in) of each other. Refer to Figure 8-13. Also check the forks for latch defects, fork pin damage, and maximum angle as shown in Figure 8-13.

Continued

BOOM AND FORKS

 WARNING


Never work under a raised boom or forks. Lower the forks to the surface before inspecting the parts.

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Continued

BOOM AND FORKS - CONT.

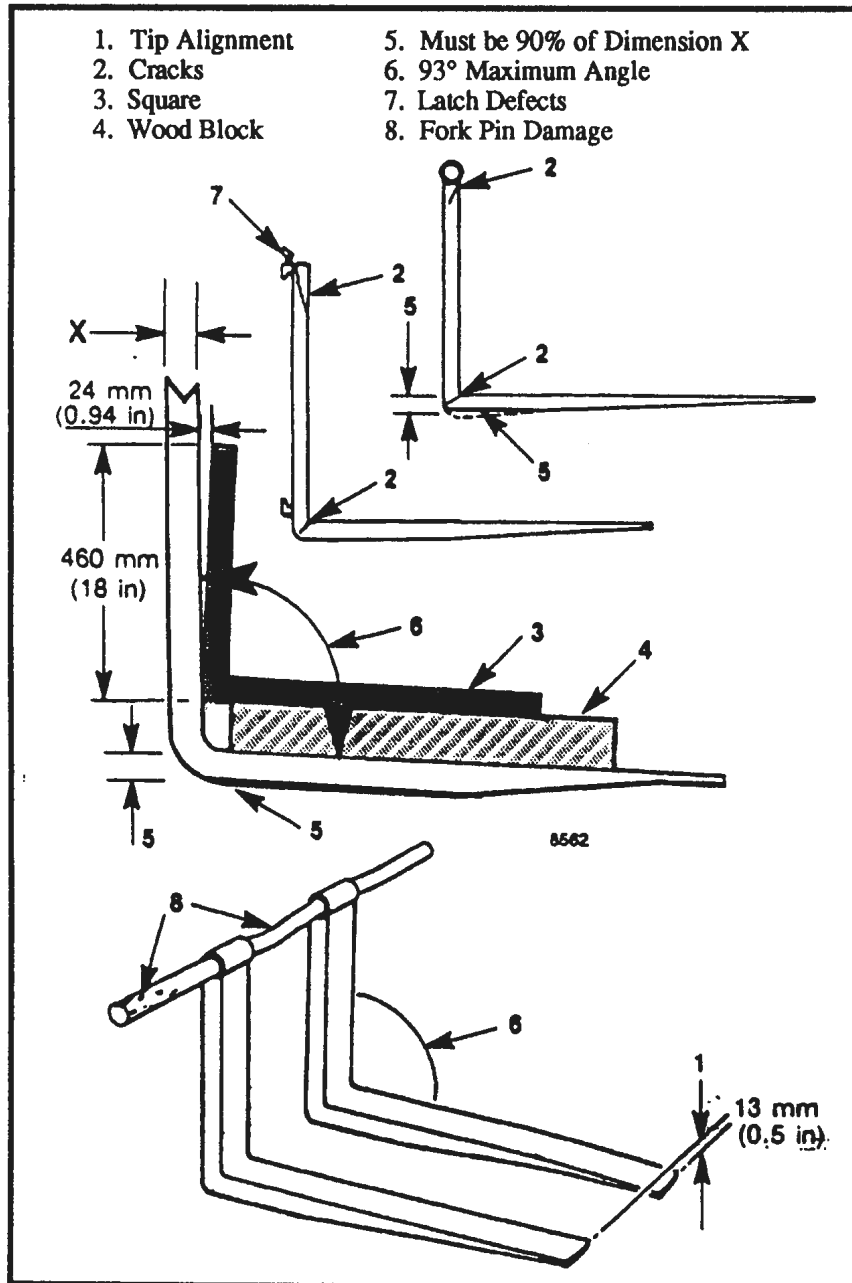


Figure 8-13. Checking the Forks

BOOM AND FORKS - CONT.

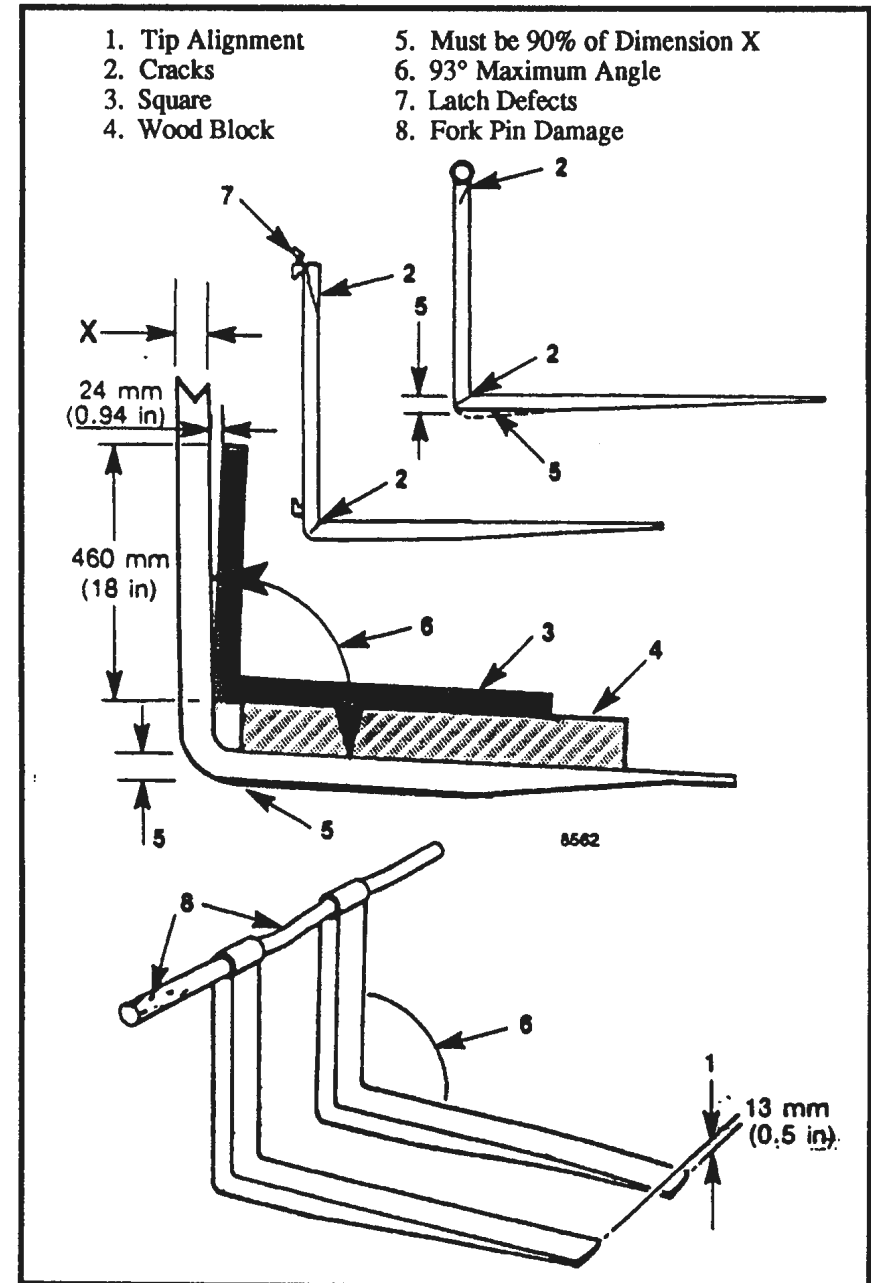


Figure 8-13. Checking the Forks

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

OPERATOR RESTRAINT SYSTEM

The seat belt, hip restraint brackets, seat and seat mounts, and floor plates are all part of the operator restraint system. Each item must be checked to make sure it is attached securely, functions correctly, and is in good condition. Refer to Figure 8-14.

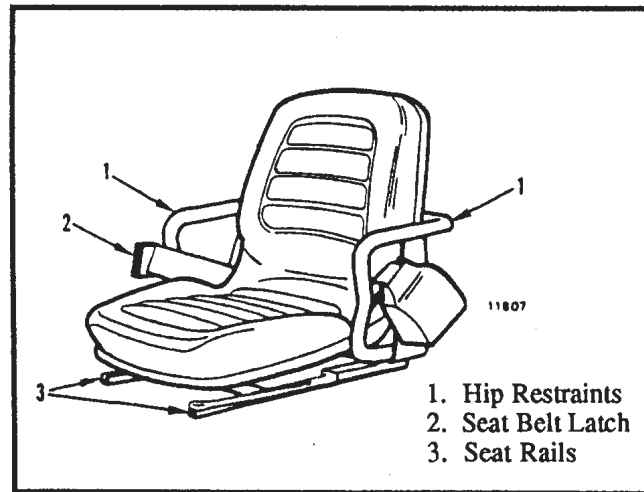


Figure 8-14. Operator Restraint System

The seat belt must latch securely. Make sure the seat belt extends and retracts smoothly and is not frayed or torn. If the seat belt cannot be pulled from the retractor assembly, remove the screw that keeps the cover on the retractor. Push the bar to release the spool. Straighten the belt so that it pulls out and retracts smoothly. When the belt is again operating smoothly, reinstall the retractor cover and screw. The seat belt must latch securely. Refer to Figure 8-15.

Make sure the seat rails are not loose. The seat rails must lock securely in position, but move freely when unlocked. The seat rails must be securely fastened to the mounting surface. The floor plate must be fastened to the lift truck frame.

Continued

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

OPERATOR RESTRAINT SYSTEM

The seat belt, hip restraint brackets, seat and seat mounts, and floor plates are all part of the operator restraint system. Each item must be checked to make sure it is attached securely, functions correctly, and is in good condition. Refer to Figure 8-14.

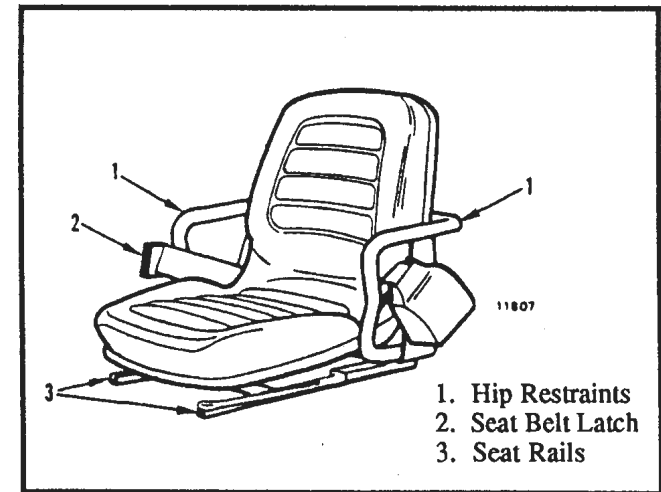


Figure 8-14. Operator Restraint System

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Make sure the seat rails are not loose. The seat rails must lock securely in position, but move freely when unlocked. The seat rails must be securely fastened to the mounting surface. The floor plate must be fastened to the lift truck frame.

Continued

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

OPERATOR RESTRAINT SYSTEM - CONT.

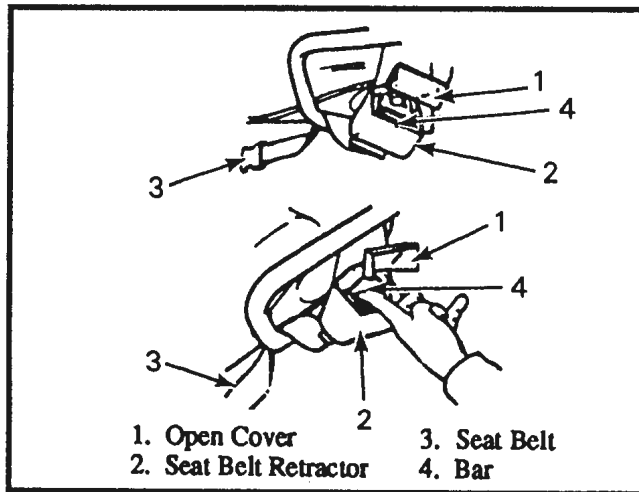


Figure 8-15. Releasing a Jammed Seat Belt

CHECKS WITH THE ENGINE RUNNING

⚠ WARNING



Unexpected machine motion or moving parts can cut or crush.

Make sure that all personnel are away from the lift truck before the engine is started. Make sure that no one is standing between the wheels and the frame.

Continued

SECTION 8 - 8 HOUR OR DAILY MAINTENANCE

OPERATOR RESTRAINT SYSTEM - CONT.

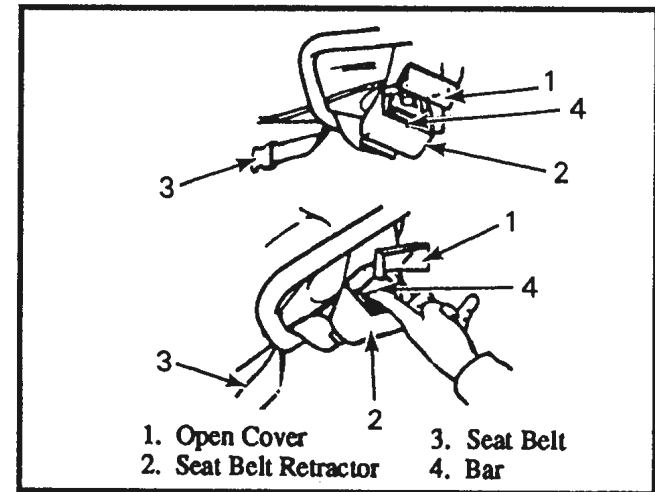


Figure 8-15. Releasing a Jammed Seat Belt

CHECKS WITH THE ENGINE RUNNING

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Unexpected machine motion or moving parts can cut or crush.

Make sure that all personnel are away from the lift truck before the engine is started. Make sure that no one is standing between the wheels and the frame.

Continued

CHECKS WITH THE ENGINE RUNNING - CONT.

 WARNING


FASTEN YOUR SEAT BELT! The seat belt is installed to help the operator stay on the truck if the lift truck tips over. **IT CAN ONLY HELP IF IT IS FASTENED.**

Make sure that the area around the lift truck is clear before starting the engine or making any operational checks. Be careful when making the checks. If the lift truck is stationary during a check, apply the parking brake and put the transmission in "Neutral" (N). Proceed carefully.

GAUGES, WARNING LIGHTS, AND HORN

Start the engine. Check the gauges and lights for correct operation as described in **SECTION 4 - OPERATING CONTROLS AND INSTRUMENTS**. Check the operation of the horn. Check the fuses if any of the gauges, horn, or lights do not operate. The fuses are under the instrument panel. Refer to Figure 8-16.

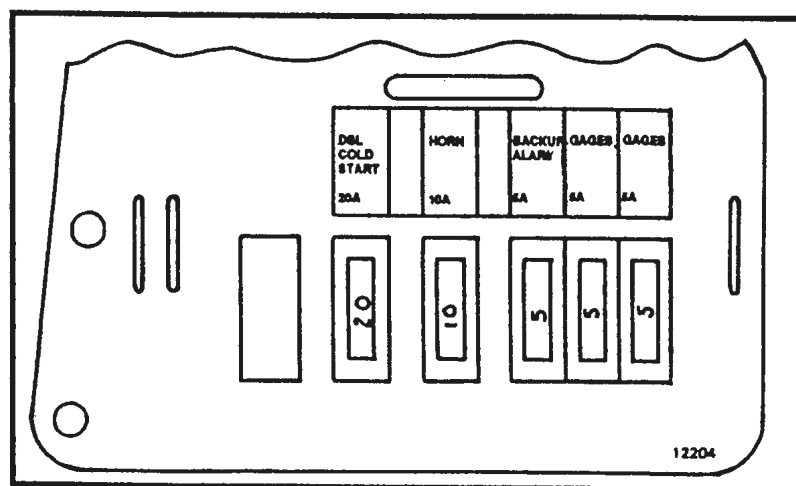


Figure 8-16. Fuse Panel

Continued
8-17

CHECKS WITH THE ENGINE RUNNING - CONT.

 WARNING


FASTEN YOUR SEAT BELT! The seat belt is installed to help the operator stay on the truck if the lift truck tips over. **IT CAN ONLY HELP IF IT IS FASTENED.**

Make sure that the area around the lift truck is clear before starting the engine or making any operational checks. Be careful when making the checks. If the lift truck is stationary during a check, apply the parking brake and put the transmission in "Neutral" (N). Proceed carefully.

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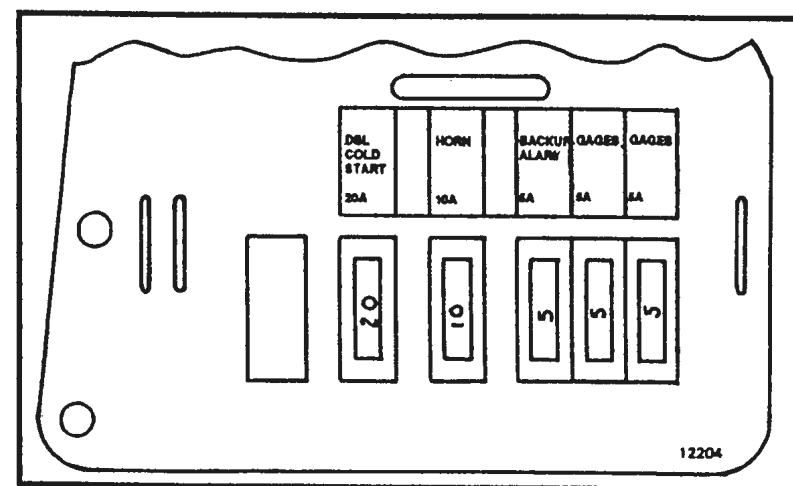


Figure 8-16. Fuse Panel

Continued
8-17

BOOM SYSTEM

! WARNING



Lower the boom completely. Never allow anyone under raised forks. Do not put any part of your body in or through the lift or extend mechanism unless all parts of the boom are completely lowered and the engine is **SHUT DOWN**.

1. Slowly raise, lower, extend, and retract the boom several times without a load. Make sure that the boom moves smoothly in accordance with control inputs.
2. Put a capacity load on the forks and raise the load approximately 7 feet (2 meters) above the surface. The boom must operate smoothly.
3. Lower the load to just above the surface. Tilt the forks backward and forward. Do not tilt the forks so that the load will slide from the forks. The forks must tilt smoothly. Remove the load when the checks are complete.
4. Check the operation of the frame leveling control. The frame leveling control must operate smoothly.

! WARNING

Do not try to locate hydraulic leaks by putting hands on pressurized hydraulic hose or components. Hydraulic oil can be injected into the body by pressure.

5. Check for leaks in the hydraulic system.

BOOM SYSTEM

! WARNING



Lower the boom completely. Never allow anyone under raised forks. Do not put any part of your body in or through the lift or extend mechanism unless all parts of the boom are completely lowered and the engine is **SHUT DOWN**.

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4. Check the operation of the frame leveling control. The frame leveling control must operate smoothly.

! WARNING

Do not try to locate hydraulic leaks by putting hands on pressurized hydraulic hose or components. Hydraulic oil can be injected into the body by pressure.

5. Check for leaks in the hydraulic system.

SERVICE BRAKES

Check the operation of the service brakes. Push on the brake pedal. The brakes must be applied before the pedal reaches the floor plate. The brake pedal must stop firmly and must not move slowly down after the brakes are applied. The brakes must apply equally to all drive wheels with no noticeable pull to either side. The service brakes must be adjusted as required by a qualified service person.

The service brakes are a wet disk brake system inside the planetary hub of each wheel. Hydraulic pressure from the hydraulic system is used to actuate the service brakes when the brake pedal is pushed by the operator. The hydraulic pressure also charges an accumulator in the brake system. When the accumulator is fully charged, it has enough energy in storage to apply the service brakes a minimum of ten (10) times if the hydraulic system is not operating. If the hydraulic system is not operating and the accumulator is not charged, the service brakes will not operate. The Low Brake Pressure Warning light will also illuminate. These service brakes do not have an adjustment for wear.

Operate the engine so that the hydraulic pump will charge the accumulator. When the accumulator is charged and the engine is shut down, the accumulator must apply the brakes a minimum of ten (10) times in sequence when the brake pedal is pushed. If the Low Brake Pressure Warning Light illuminates, the accumulator is not charged or has a defect.

The operation of the accumulator must be checked regularly. When an accumulator is first put into service (a new lift truck or a rebuilt accumulator), the operation of the accumulator must be checked within 72 hours during the first week of operation. The operation of the accumulator must then be checked after every 150 hours of operation.

PARKING BRAKE

Check the operation of the parking brake. The parking brake, when in good condition and correctly adjusted, will hold a lift truck with a capacity load on a 15 percent grade (1.5 foot rise in 10 feet [1.5 meter rise in 10 meters]). Turn the knob on the end of the hand lever to adjust the parking brake. Do not tighten the adjustment so that the brake is still applied when the hand lever is released.

NOTICE

Make sure the parking brake is released when the lift truck is traveling. If the lift truck is moved when the parking brake is applied, the parking brake will be damaged or destroyed.

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Check the operation of the service brakes. Push on the brake pedal. The brakes must be applied before the pedal reaches the floor plate. The brake pedal must stop firmly and must not move slowly down after the brakes are applied. The brakes must apply equally to all drive wheels with no noticeable pull to either side. The service brakes must be adjusted as required by a qualified service person.

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NOTICE

Make sure the parking brake is released when the lift truck is traveling. If the lift truck is moved when the parking brake is applied, the parking brake will be damaged or destroyed.

STEERING SYSTEM

 CAUTION

The lift truck is equipped with power steering. Should the engine quit while the lift truck is in motion, the steering will be difficult.

Make sure the steering system operates smoothly and gives good steering control.

There are three steering modes controlled by a selector valve. All four wheels are articulated and can be steered:

1. **Front wheel steering:** The front wheels steer the lift truck and the rear wheels stay in a fixed position.
2. **Crab steering:** All four wheels turn parallel to each other. This mode of operation permits the lift truck to travel along a line that is diagonal to the forward and reverse axis of the lift truck.
3. **Coordinated steering:** All four wheels steer the lift truck. This mode of steering permits the lift truck to make small radius turns.

POWERSHIFT TRANSMISSION

Check the oil level in the powershift transmission with the engine running and the oil at normal operating temperature. Apply the parking brake and put the direction control lever in the "Neutral" (N) position.

The dipstick is a T-handle on the side of the transmission near the operator's seat. A pipe extension raises the dipstick to the floor plate level for easier access when the front hood is open. The dipstick tube is also the fill point for transmission oil. Refer to Figure 8-17.

Continued

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Check the oil level in the powershift transmission with the engine running and the oil at normal operating temperature. Apply the parking brake and put the direction control lever in the "Neutral" (N) position.

The dipstick is a T-handle on the side of the transmission near the operator's seat. A pipe extension raises the dipstick to the floor plate level for easier access when the front hood is open. The dipstick tube is also the fill point for transmission oil. Refer to Figure 8-17.

Continued

POWERSHIFT TRANSMISSION - CONT.

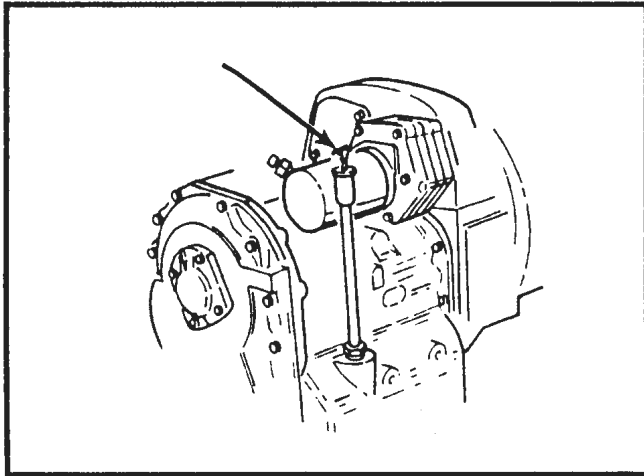


Figure 8-17. Transmssion Oil Dipstck/Fill Tube

Check the operation of the powershift transmission.

1. With the direction control lever in "Neutral" (N), the lift truck should not move or creep forward or backward. The engine of the lift truck should not start unless the direction control lever is in "Neutral" (N).
2. With the direction control lever in "Forward" (FWD) or "Reverse" (REV), the lift truck should move in the corresponding direction. The backup alarm should also sound when the lift truck is in "Reverse" (REV).
3. With the brake pedal fully depressed, the clutches in the powershift transmission should be fully disengaged and the lift truck should not move or creep.

POWERSHIFT TRANSMISSION - CONT.

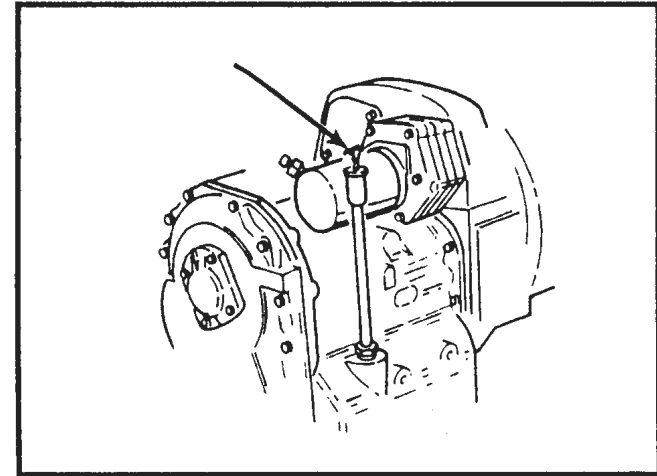


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SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

Contents

Boom Pivots	1	Axle Pivot	5
Bronze Wear Shoes	3	Boom Rollers	7
Chain Sheave Bearings	5		

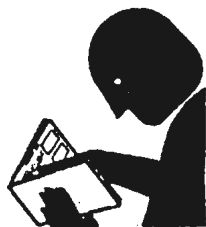
! WARNING



Unexpected machine motion can cut or crush.

Apply the parking brake and shut down the engine before working on the machine.

! WARNING



Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

BOOM PIVOTS

Lubricate the boom pivots (13 fittings) with MPG-EP grease. Refer to the Lubrication Chart, Figure 6-1, item 6, and Figures 9-1 through 9-3.

Continued
9-1

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

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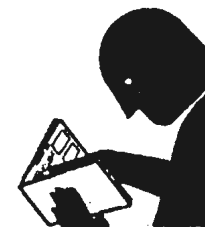
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Continued
9-1

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BOOM PIVOTS - CONT.

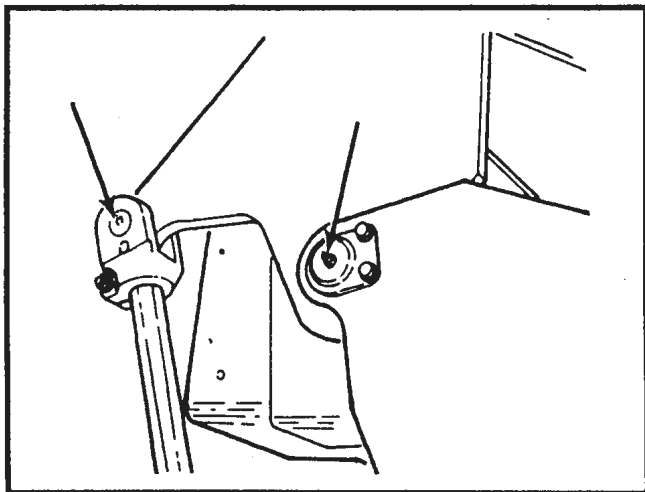


Figure 9-1. Boom Pivot Lube Points

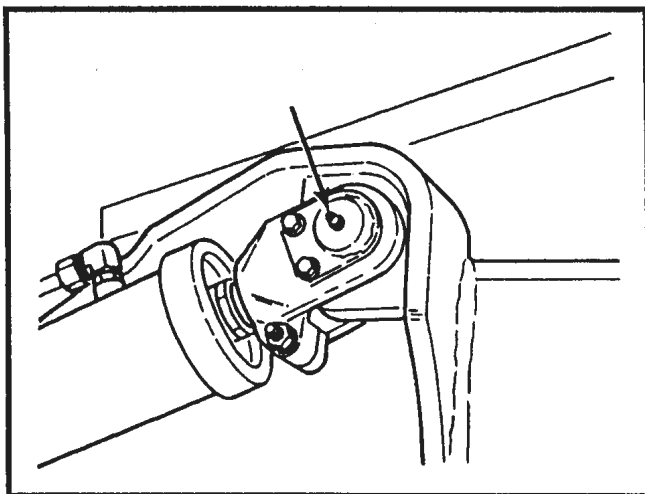


Figure 9-2. Boom Pivot Lube Point

Continued

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BOOM PIVOTS - CONT.

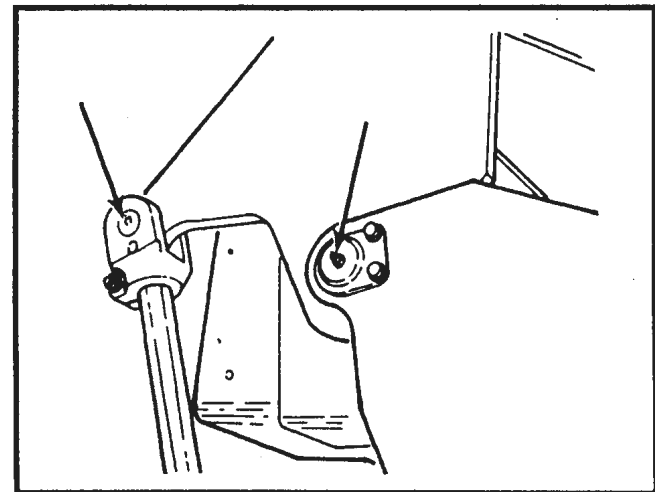


Figure 9-1. Boom Pivot Lube Points

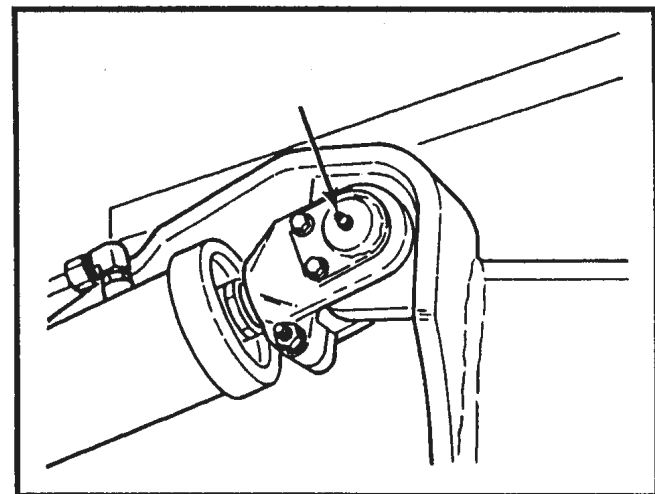


Figure 9-2. Boom Pivot Lube Point

Continued

BOOM PIVOTS - CONT.

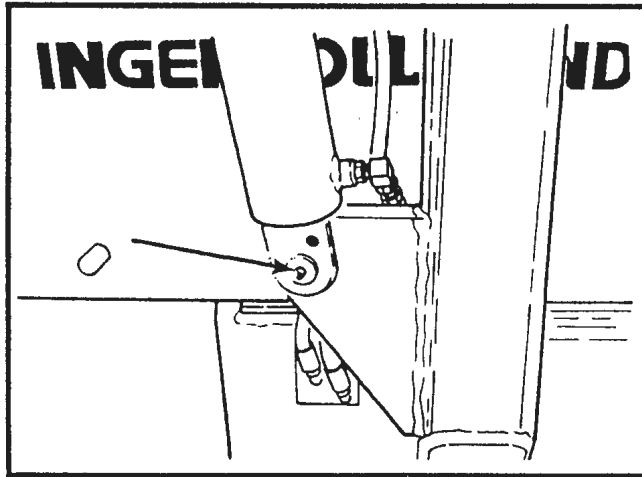


Figure 9-3. Boom Pivot Lube Point

BRONZE WEAR SHOES

The two rectangular bronze wear shoes on the bottom front of the intermediate boom section must be lubricated with multipurpose grease every 50 hours for maximum service life. Refer to Figure 9-4, items 3 and 4. The service interval for the round plastic wear shoes can be extended to 150 hours.

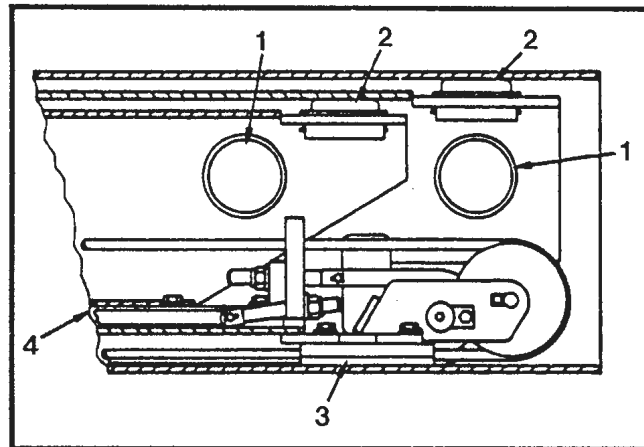


Figure 9-4. Wear Shoes. (1) Side wear shoes (plastic); (2) Top wear shoes (plastic); (3) Bottom wear shoes (bronze), intermediate section; (4) Bottom wear shoes (bronze), inner boom section.

Continued
9-3

BOOM PIVOTS - CONT.

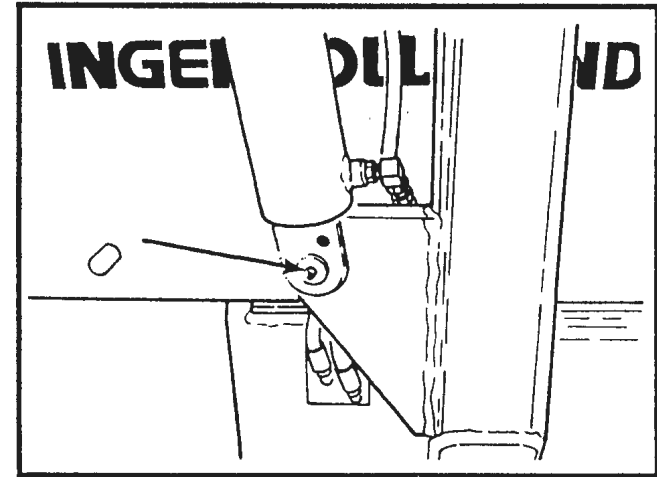


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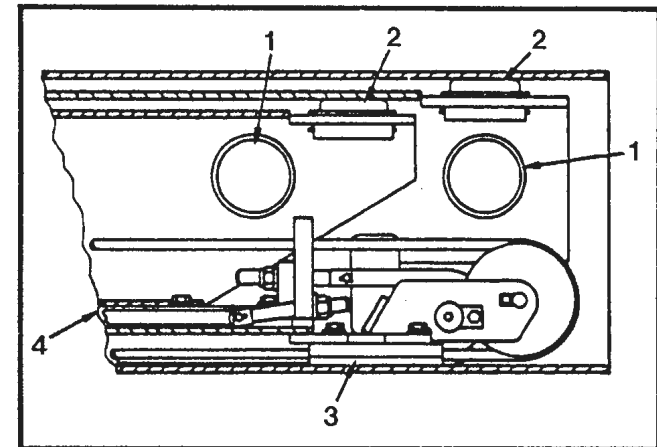


Figure 9-4. Wear Shoes. (1) Side wear shoes (plastic); (2) Top wear shoes (plastic); (3) Bottom wear shoes (bronze), intermediate section; (4) Bottom wear shoes (bronze), inner boom section.

Continued
9-3

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BRONZE WEAR SHOES - CONT.

The rectangular bronze wear shoes must be replaced before the threads of the mounting capscrews become even with the wear surface. The round plastic wear shoes normally have approximately 0.375 inch (10mm) of adjustment. They must be replaced when the wear surface approaches the slot for locking the wear shoe in position.

NOTE

In sandy or arid conditions, a spray-on dry lubricant should be considered for wear shoe lubrication instead of grease.

Use the following procedure to lubricate the wear shoes:

1. Apply grease to the wear shoe paths along the boom sections. The wear shoes that are on the top rear and the bottom front of the boom sections will wear faster than the other wear shoes because more of the load is applied to them.

The round plastic wear shoes on the top front of the boom and the rectangular bronze wear shoes on the bottom rear of the boom will normally wear slowly because the load of the boom is not applied to them. Refer to Figure 9-5.

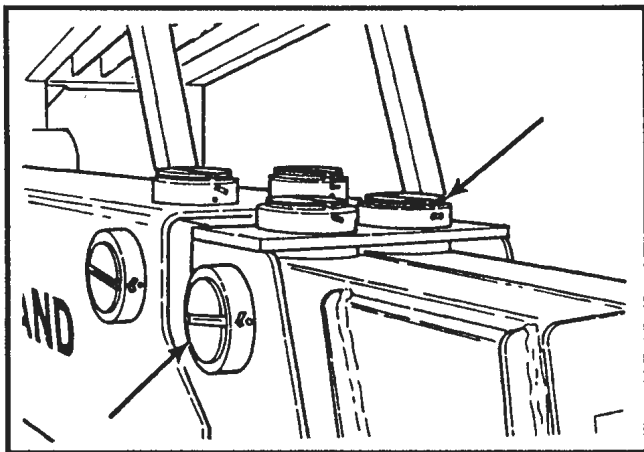


Figure 9-5. Plastic Wear Shoes.

2. Put a "reverse loading" on the boom sections to apply multipurpose grease to the top rear wear shoes. The boom must be fully retracted and the carriage pushed against the ground. This "reverse loading" creates a space

Continued

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BRONZE WEAR SHOES - CONT.

The rectangular bronze wear shoes must be replaced before the threads of the mounting capscrews become even with the wear surface. The round plastic wear shoes normally have approximately 0.375 inch (10mm) of adjustment. They must be replaced when the wear surface approaches the slot for locking the wear shoe in position.

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In sandy or arid conditions, a spray-on dry lubricant should be considered for wear shoe lubrication instead of grease.

Use the following procedure to lubricate the wear shoes:

1. Apply grease to the wear shoe paths along the boom sections. The wear shoes that are on the top rear and the bottom front of the boom sections will wear faster than the other wear shoes because more of the load is applied to them.

The round plastic wear shoes on the top front of the boom and the rectangular bronze wear shoes on the bottom rear of the boom will normally wear slowly because the load of the boom is not applied to them. Refer to Figure 9-5.

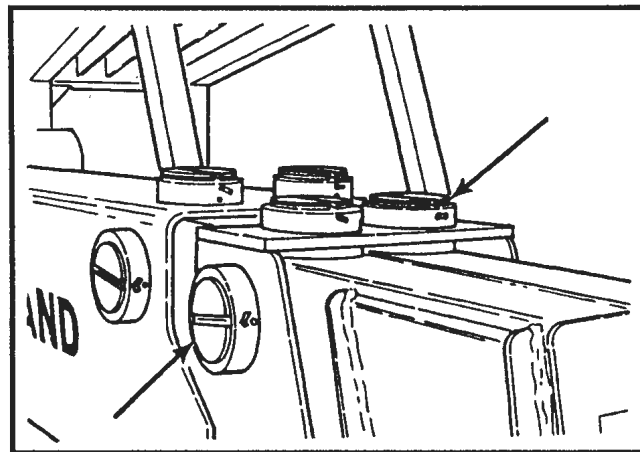


Figure 9-5. Plastic Wear Shoes.

2. Put a "reverse loading" on the boom sections to apply multipurpose grease to the top rear wear shoes. The boom must be fully retracted and the carriage pushed against the ground. This "reverse loading" creates a space

Continued

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BRONZE WEAR SHOES - CONT.

between the top rear wear shoes and the boom section so that grease can be applied to the wear shoe surface. Loosen the top plastic wear shoes if necessary to make additional space. Repeat this procedure twice. Each time, extend and retract the boom.

An alternate method of applying grease to the round plastic wear shoes is to remove them, one at a time. Lubricate the plastic shoes and their paths along the boom section, then reinstall the plastic shoes.

CHAIN SHEAVE BEARINGS

Lubricate the chain sheave bearings (3 fittings) with MPG-EP grease. Refer to the Lubrication Chart, Figure 6-1, item 8, and to Figure 9-6.

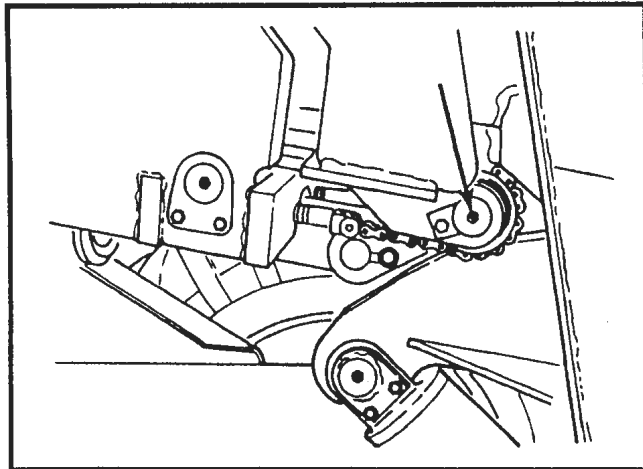


Figure 9-6. Chain Sheave Bearings Lube Point

AXLE PIVOT

Lubricate each axle pivot (frame leveling pin) (2 fittings each) with MPG-EP grease. Refer to Figures 9-7 and 9-8.

Continued

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BRONZE WEAR SHOES - CONT.

between the top rear wear shoes and the boom section so that grease can be applied to the wear shoe surface. Loosen the top plastic wear shoes if necessary to make additional space. Repeat this procedure twice. Each time, extend and retract the boom.

An alternate method of applying grease to the round plastic wear shoes is to remove them, one at a time. Lubricate the plastic shoes and their paths along the boom section, then reinstall the plastic shoes.

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Lubricate the chain sheave bearings (3 fittings) with MPG-EP grease. Refer to the Lubrication Chart, Figure 6-1, item 8, and to Figure 9-6.

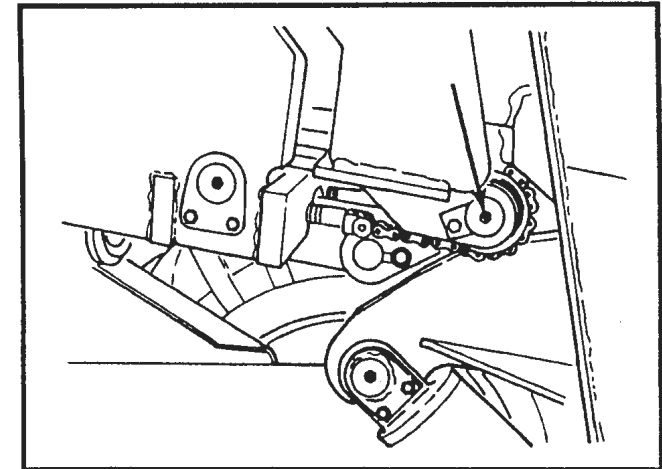


Figure 9-6. Chain Sheave Bearings Lube Point

AXLE PIVOT

Lubricate each axle pivot (frame leveling pin) (2 fittings each) with MPG-EP grease. Refer to Figures 9-7 and 9-8.

Continued

AXLE PIVOT - CONT.

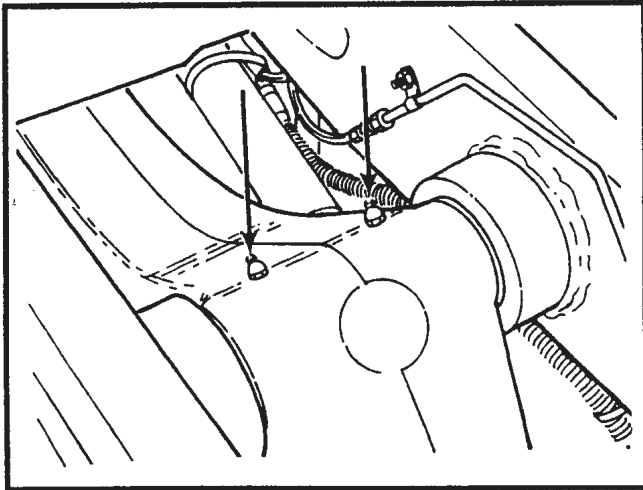


Figure 9-7. Front Axle Pivot Lube Points

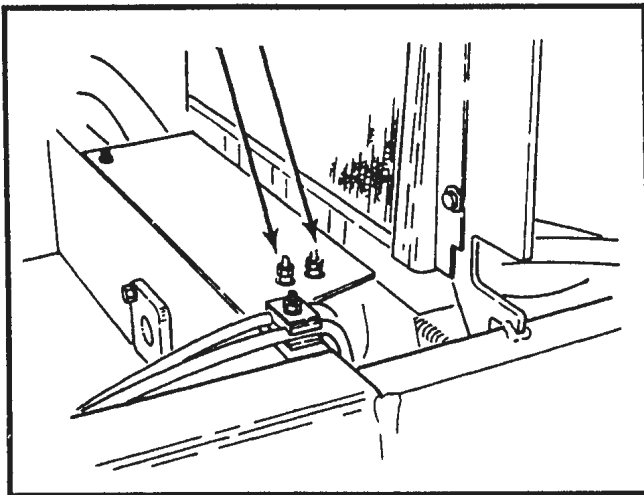


Figure 9-8. Rear Axle Pivot Lube Points

AXLE PIVOT - CONT.

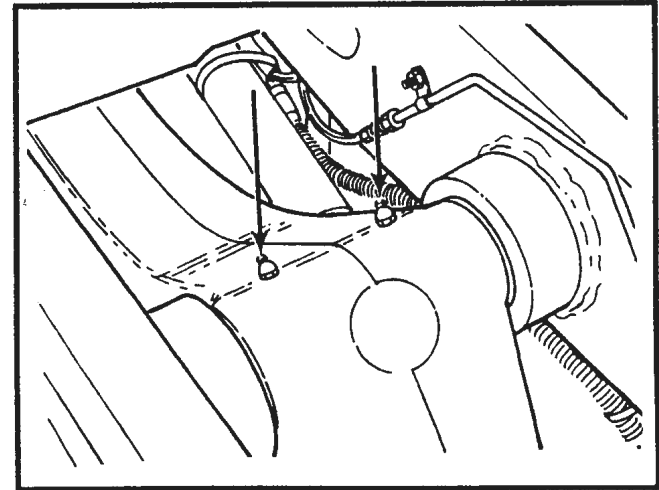


Figure 9-7. Front Axle Pivot Lube Points

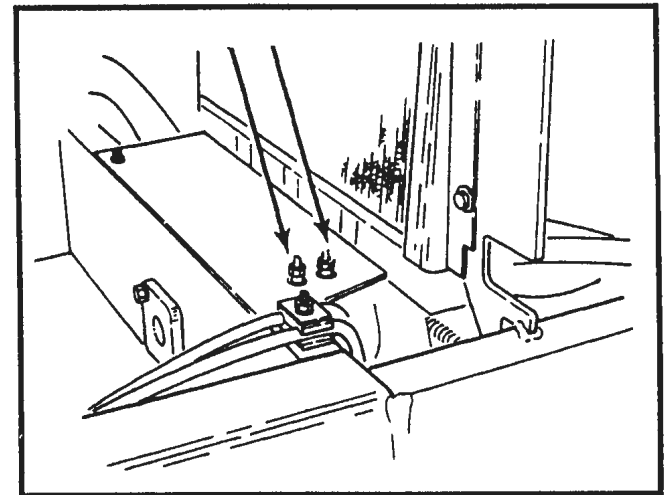


Figure 9-8. Rear Axle Pivot Lube Points

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BOOM ROLLERS

Lubricate the boom rollers (boom load rollers) (2 fittings) with MPG-EP grease. Refer to the Lubrication Chart, Figure 6-1, item 19, and Figure 9-9.

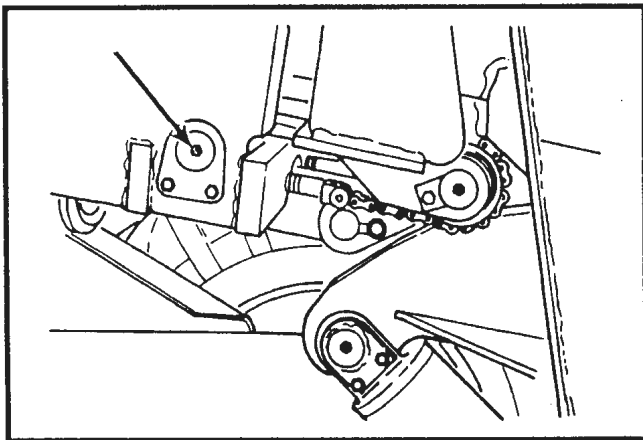


Figure 9-9. Boom Roller Lube Point

SECTION 9 - 50 HOUR OR MONTHLY MAINTENANCE

BOOM ROLLERS

Lubricate the boom rollers (boom load rollers) (2 fittings) with MPG-EP grease. Refer to the Lubrication Chart, Figure 6-1, item 19, and Figure 9-9.

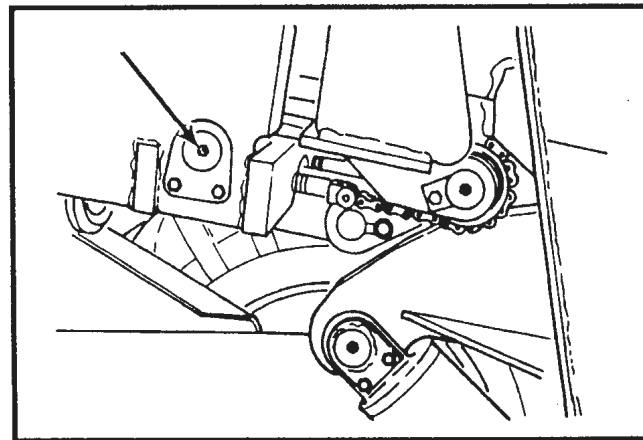


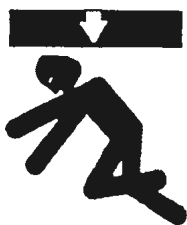
Figure 9-9. Boom Roller Lube Point

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

Contents

Engine Oil and Filter —————	2	Steering Cylinders —————	8
Plastic Wear Shoes —————	3	Drive Shafts —————	8
Battery Water Level —————	3	Boom Chains —————	9
Tire Pressure —————	6	Fork Pins —————	11
Axle Differential Oil Level —————	6	Brake Accumulator —————	12
Final Drive Oil Level (Planetary Hubs) —————	6	Fuel/Water Separator —————	12
Steering Knuckles (Drive Axles) —	7	Parking Brake Adjustment ———	13
Tie Rods —————	8	Latches, Hinges, and Linkages —	13
		Warning Decals —————	13

⚠ WARNING

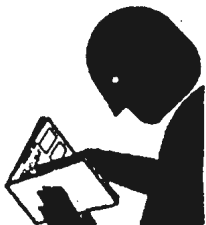


Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine.

10

⚠ WARNING



Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

Contents

Engine Oil and Filter —————	2	Steering Cylinders —————	8
Plastic Wear Shoes —————	3	Drive Shafts —————	8
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		Warning Decals —————	13

⚠ WARNING

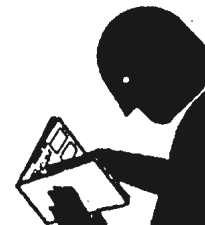


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Apply the parking brake and shut down the engine before working on the machine.

10

⚠ WARNING



Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

WARNING



Hot oil and/or components can burn.

Oil must be at operating temperature when draining.

Avoid contact with hot oil or components.

ENGINE OIL AND FILTER

The engine oil and filter are to be changed at this interval. Use the correct oil according to the specifications shown in the Lubrication Chart, Figure 6-1. Install a new oil filter. Apply clean oil to the surface of the gasket of the new oil filter. Turn the filter until the gasket touches the base and then tighten 1/2 to 3/4 of a turn with your hand. Refer to Figure 10-1.

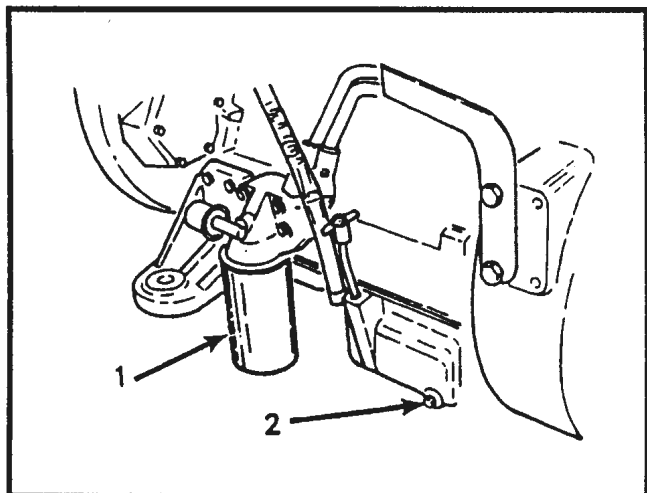


Figure 10-1. (1) Engine Oil Filter; (2) Engine Oil Drain Plug

When new oil has been added and the engine can be operated, start the engine. Check the area around the filter for leaks.

WARNING



Hot oil and/or components can burn.

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Avoid contact with hot oil or components.

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The engine oil and filter are to be changed at this interval. Use the correct oil according to the specifications shown in the Lubrication Chart, Figure 6-1. Install a new oil filter. Apply clean oil to the surface of the gasket of the new oil filter. Turn the filter until the gasket touches the base and then tighten 1/2 to 3/4 of a turn with your hand. Refer to Figure 10-1.

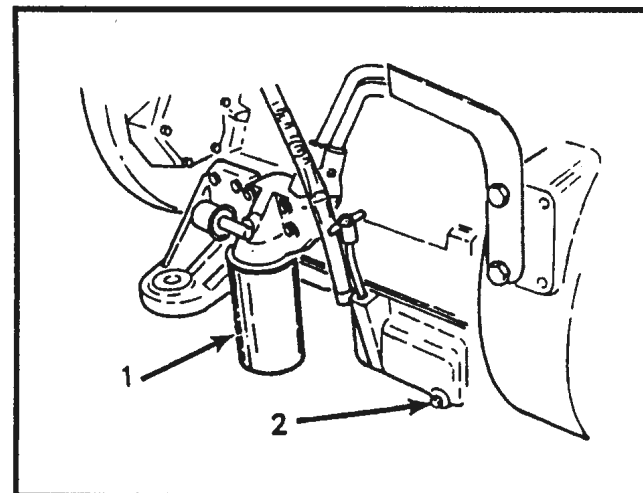


Figure 10-1. (1) Engine Oil Filter; (2) Engine Oil Drain Plug

When new oil has been added and the engine can be operated, start the engine. Check the area around the filter for leaks.

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

PLASTIC WEAR SHOES

The plastic wear shoes should be lubricated at this interval. The procedure for lubricating both the plastic and the bronze wear shoes is described under "Bronze Wear Shoes" in **SECTION 9 - 50 HOUR OR WEEKLY MAINTENANCE** in this Operation and Maintenance Manual.

BATTERY WATER LEVEL

! WARNING

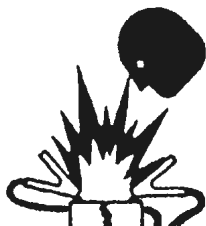


Batteries contain an acid and can cause injury.

Battery fumes can ignite and explode. Skin and eye contact with battery fluid can cause injury.

Do not smoke when observing battery fluid level. Avoid skin and eye contact with the battery fluid. If contact occurs, flush area immediately with water.

! WARNING



Batteries give off fumes that can explode.

Be sure the battery area is well-ventilated (clear of fumes) should it become necessary to connect a jump battery or battery charger.

Do not smoke or use an open flame near a battery.

Continued
10-3

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

PLASTIC WEAR SHOES

The plastic wear shoes should be lubricated at this interval. The procedure for lubricating both the plastic and the bronze wear shoes is described under "Bronze Wear Shoes" in **SECTION 9 - 50 HOUR OR WEEKLY MAINTENANCE** in this Operation and Maintenance Manual.

BATTERY WATER LEVEL

! WARNING

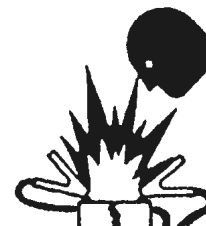


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Do not smoke or use an open flame near a battery.

Continued
10-3

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

BATTERY WATER LEVEL - CONT.

NOTE

The following information on non-maintenance-free type batteries is provided in the event that a non-maintenance-free type of battery is used.

Check all battery connections, making sure they are tight and free of corrosion. Keep the battery clean at all times. Use a small amount of grease on the terminals to help keep them free of corrosion. Refer to Figure 10-2.

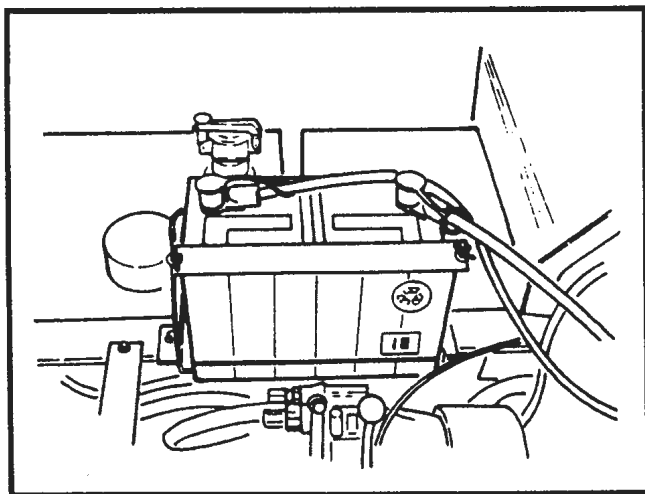


Figure 10-2. Battery Location

Check that electrolyte level is to the full indicator and add clean, distilled water, if required. Use a battery hydrometer to measure the specific gravity in each cell. A fully charged battery will read 1.265 specific gravity at 80 degrees F (27 degrees C).

The hydrometer reading will not be absolutely correct until a temperature correction has been applied. At ordinary temperatures, the error will be very small, and no correction will be needed. However, at extreme temperatures, the correction is important, so the method of correction is explained in the following paragraph.

The temperature correction depends on the temperature of the electrolyte in the battery, NOT on the temperature of the air. To make the correction, the temperature of the electrolyte must be measured. The hydrometer is calibrated to read correctly at only one temperature (80 degrees F [27 degrees C]). The difference between this temperature and the electrolyte temperature is used to

Continued

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

BATTERY WATER LEVEL - CONT.

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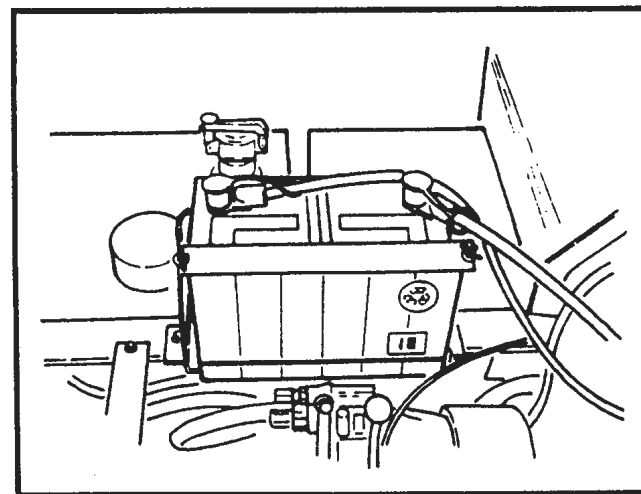


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Continued

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

BATTERY WATER LEVEL - CONT.

make the correction, at the rate of four (4) "points of gravity" (0.004) for every 10 degrees F (5.5 degrees C) difference. An example of this calculation:

TEMPERATURE BELOW 80°F (27 degrees C)

Hydrometer Reading	1.250
Acid Temperature (20°F [-6.6°C])	
Subtract 0.024 Spec. Gravity	
Corrected Spec. Gravity	1.226

TEMPERATURE ABOVE 80°F (27 degrees C)

Hydrometer Reading	1.235
Acid Temperature (100°F [37.7°C])	
Add 0.008 Spec. Gravity	
Corrected Spec. Gravity	1.243

The following chart illustrates the typical ranges of specific gravity for a cell in various stages of charge. The values of specific gravity are given with respect to full charge reference values of 1.26 to 1.28 at 80 degrees F (27 degrees C):

TYPICAL RANGES OF SPECIFIC GRAVITY

1.280 Sp. Gr. to 1.260 Sp. Gr.	100% Charged
1.250 Sp. Gr. to 1.230 Sp. Gr.	75% Charged
1.220 Sp. Gr. to 1.200 Sp. Gr.	50% Charged
1.190 Sp. Gr. to 1.170 Sp. Gr.	25% Charged
1.160 Sp. Gr. to 1.140 Sp. Gr.	Very little useful capacity
1.130 Sp. Gr. to 1.110 Sp. Gr.	Discharge

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

BATTERY WATER LEVEL - CONT.

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1.160 Sp. Gr. to 1.140 Sp. Gr.	Very little useful capacity
1.130 Sp. Gr. to 1.110 Sp. Gr.	Discharge

TIRE PRESSURE

Check the air pressure in the tires. If the indicated pressure is less than 80 percent of the pressure recommended in the Lubrication Chart, Figure 6-1, the tire must be removed and air pressure added in a safety cage. See **SECTION 14 - ROUTINE ADJUSTMENTS** for a complete description of the procedure.

AXLE DIFFERENTIAL OIL LEVEL

Check the oil level in the differentials in each drive axle. Remove the plug in the bowl of the axle housing to check the oil level. Refer to Figure 10-3. Add oil as necessary to keep the oil level at the bottom of the hole for the plug. See the Lubrication Chart, Figure 6-1, for oil specifications.

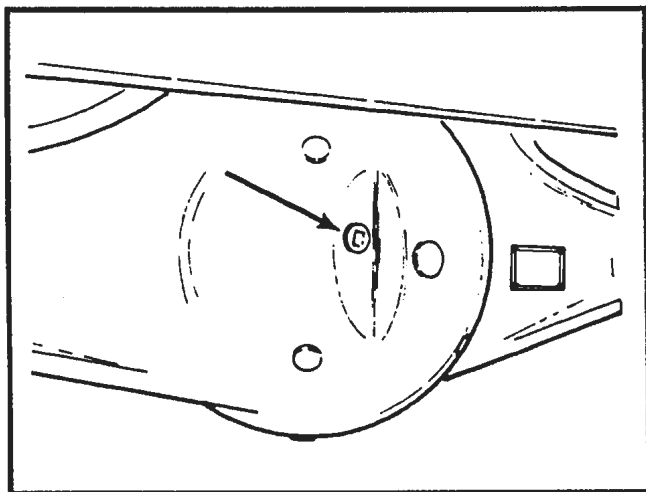


Figure 10-3. Axle Differential Fill/Check Plug.

FINAL DRIVE OIL LEVEL (PLANETARY HUBS)

Check the oil level in all four planetary hubs. Move the wheel so that the arrow on the hub is pointing down. The fill plug will be at the 3 o'clock position on the hub. Remove the fill plug. Add GL-5 gear oil (EP 80W 90) as necessary so that the oil level is even with the bottom of the fill hole. Refer to Figure 10-4.

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Check the air pressure in the tires. If the indicated pressure is less than 80 percent of the pressure recommended in the Lubrication Chart, Figure 6-1, the tire must be removed and air pressure added in a safety cage. See **SECTION 14 - ROUTINE ADJUSTMENTS** for a complete description of the procedure.

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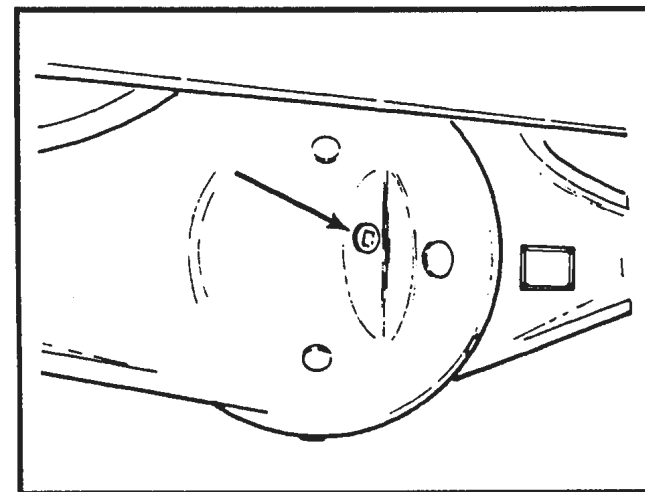


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FINAL DRIVE OIL LEVEL (PLANETARY HUBS) - CONT.

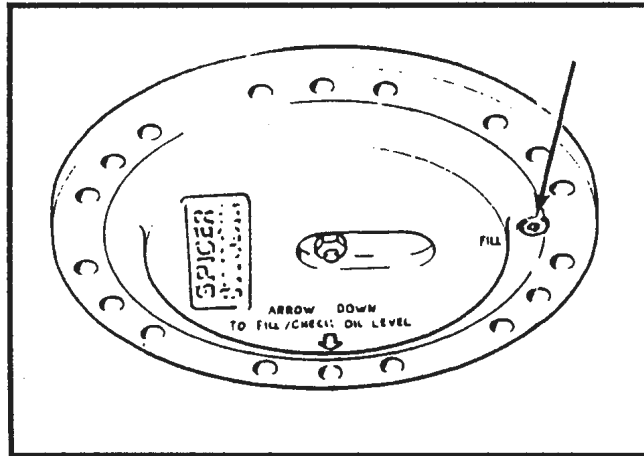


Figure 10-4. Planetary Hub Fill/Check Plug.

STEERING KNUCKLES (DRIVE AXLES)

Each steering knuckle has an upper and lower bearing. A grease fitting is installed for each upper and lower bearing. Apply multipurpose grease to each grease fitting. Refer to Figure 10-5.

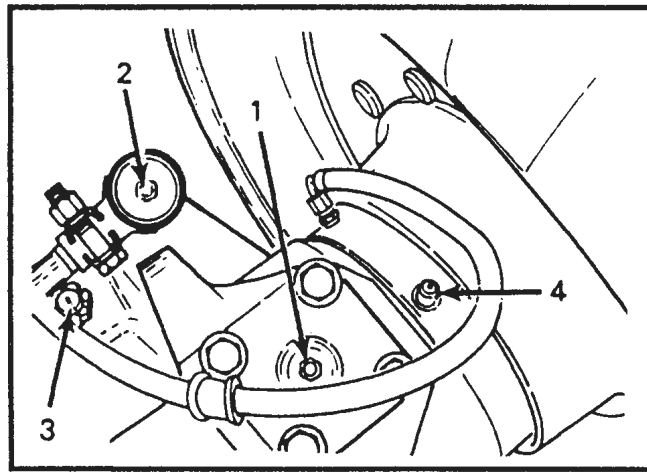


Figure 10-5. Lube Points for (1) Steering Knuckle; (2) Steering Cylinder;
(3) Tie Rod; (4) is Brake Bleeder.

FINAL DRIVE OIL LEVEL (PLANETARY HUBS) - CONT.

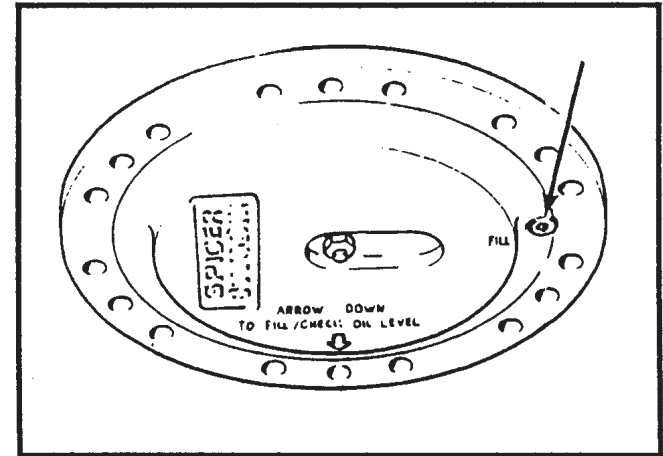


Figure 10-4. Planetary Hub Fill/Check Plug.

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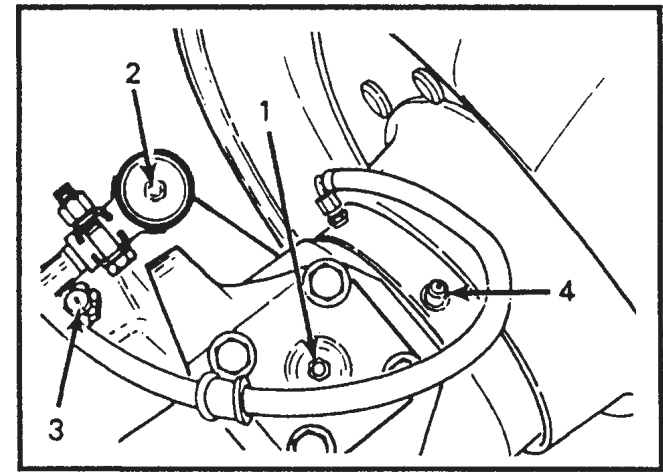


Figure 10-5. Lube Points for (1) Steering Knuckle; (2) Steering Cylinder;
(3) Tie Rod; (4) is Brake Bleeder.

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

TIE RODS

Lubricate the tie rods using multipurpose grease with 2–4 percent molybdenum disulphide. Refer to Figure 10-5.

STEERING CYLINDERS

Lubricate the steering cylinders using multipurpose grease with 2–4 percent molybdenum disulphide. Refer to Figure 10-5.

DRIVE SHAFTS

Lubricate the slip joint on each drive shaft and each universal joint (4 fittings) using multipurpose grease with 2–4 percent molybdenum disulphide. Refer to Figure 10-6.

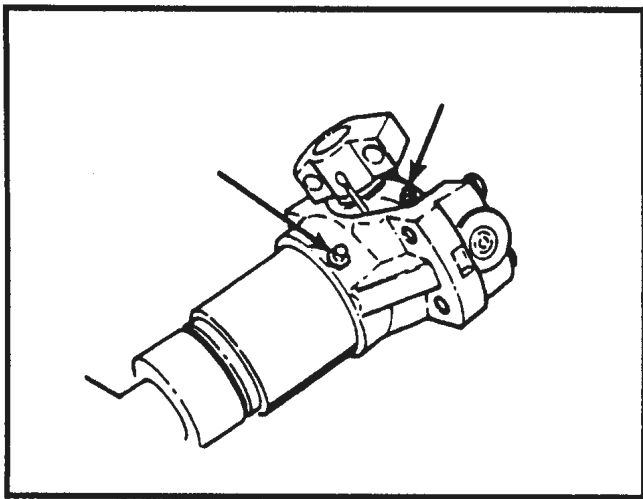


Figure 10-6. Drive Shaft Lube Points

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

TIE RODS

Lubricate the tie rods using multipurpose grease with 2–4 percent molybdenum disulphide. Refer to Figure 10-5.

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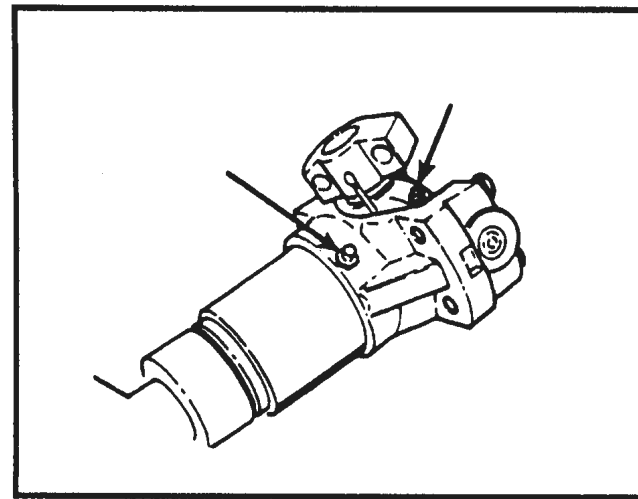


Figure 10-6. Drive Shaft Lube Points

BOOM CHAINS

! WARNING



Lower the boom completely. Never allow anyone under the raised forks. Do not put any part of your body in or through the lift or extend mechanism unless all parts of the boom are completely lowered and the engine is **SHUT DOWN**.

Before making repairs, use blocks and chains on the boom sections and forks so that they cannot move. Make sure the moving parts are attached to the non-moving parts.

Move the boom to the horizontal position. Fully extend the boom and then retract the boom approximately 12 to 18 inches (30 to 45 cm). Stop the engine and apply the parking brake.

NOTE: The retract chains are inside of the boom sections and cannot be easily checked. The extend chains carry most of the load and will wear more rapidly during normal operating conditions. The retract chains must be checked for wear when the extend chains are replaced. Check the retract chains for damage and correct lubrication where they travel over the chain sheaves.

1. Check the extend chains for cracks, broken links, and pins. Refer to Figure 10-7.
2. Raise the boom to horizontal.
3. Fully extend the boom
4. Slowly retract the boom 12 to 18 inches.

BOOM CHAINS

! WARNING



Lower the boom completely. Never allow anyone under the raised forks. Do not put any part of your body in or through the lift or extend mechanism unless all parts of the boom are completely lowered and the engine is **SHUT DOWN**.

Before making repairs, use blocks and chains on the boom sections and forks so that they cannot move. Make sure the moving parts are attached to the non-moving parts.

Move the boom to the horizontal position. Fully extend the boom and then retract the boom approximately 12 to 18 inches (30 to 45 cm). Stop the engine and apply the parking brake.

NOTE: The retract chains are inside of the boom sections and cannot be easily checked. The extend chains carry most of the load and will wear more rapidly during normal operating conditions. The retract chains must be checked for wear when the extend chains are replaced. Check the retract chains for damage and correct lubrication where they travel over the chain sheaves.

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BOOM CHAINS - CONT.

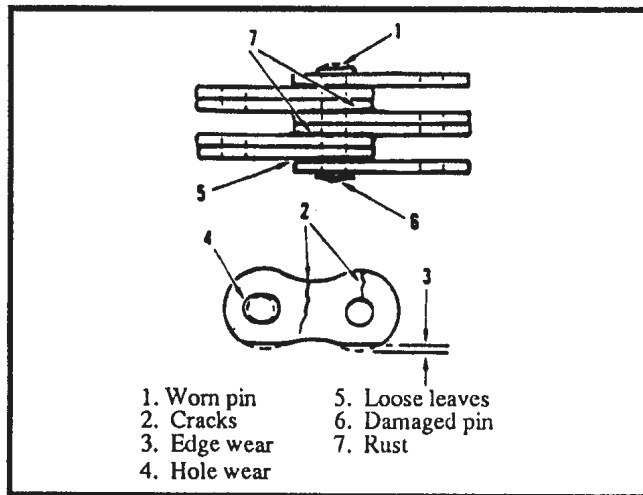


Figure 10-7. Checking Extend Chains

5. Measure down from the midpoint of the intermediate boom section to the centerline of the extend chains. This dimension must be 3.75 to 4.00 inches (9.5 to 10.1 cm). Refer to Figure 10-8.

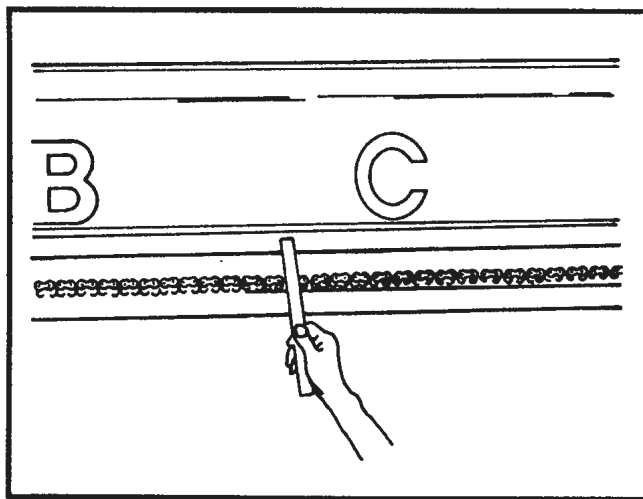


Figure 10-8. Boom Chain Adjustment

Continued

BOOM CHAINS - CONT.

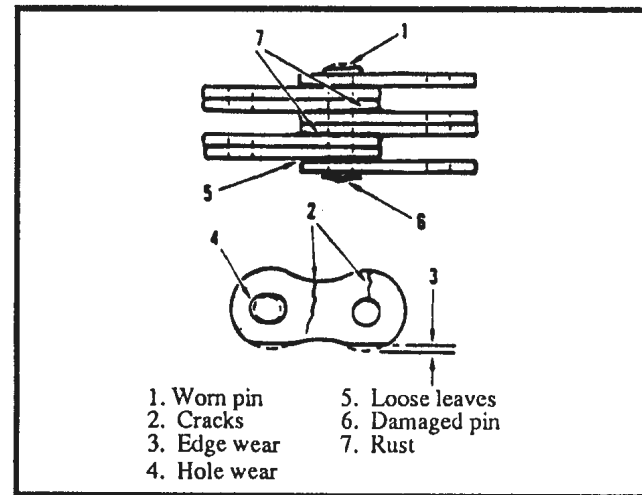


Figure 10-7. Checking Extend Chains

5. Measure down from the midpoint of the intermediate boom section to the centerline of the extend chains. This dimension must be 3.75 to 4.00 inches (9.5 to 10.1 cm). Refer to Figure 10-8.

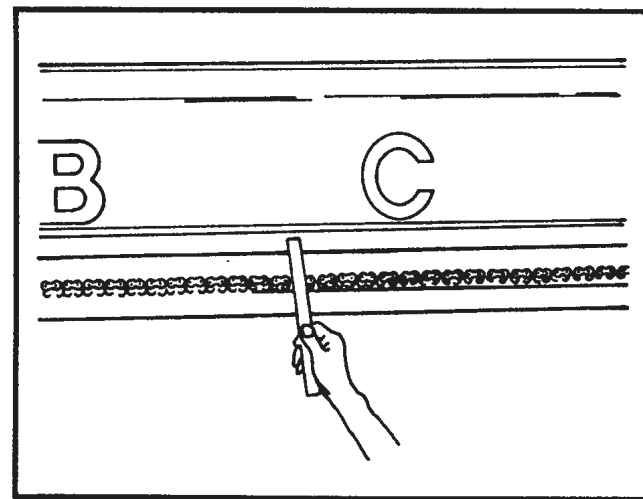


Figure 10-8. Boom Chain Adjustment

Continued

BOOM CHAINS - CONT.

6. If adjustment is required, tighten or loosen the chain by adjusting the extend chain anchors, located on the bottom of the outer boom section, in or out as required. Refer to Figure 10-9. The retract chain is automatically adjusted when the extend chains are correctly adjusted.

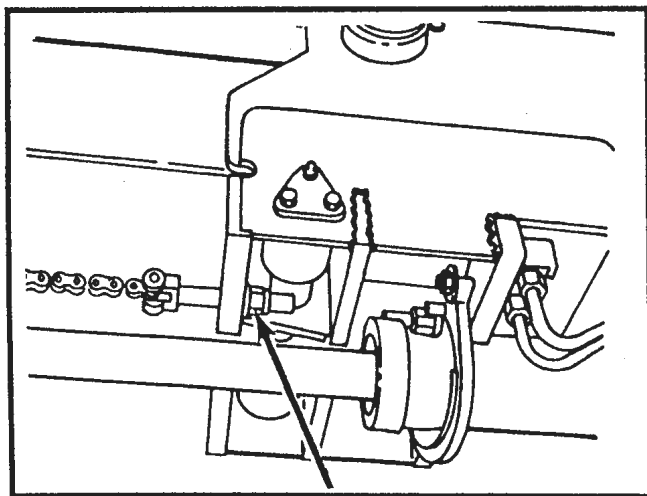


Figure 10-9. Extend Chain Anchor

7. Check the boom chains for correct lubrication. Use SAE 30 oil or Chain and Cable Lubricant (available from your Ingersoll-Rand Road Machinery dealer).
8. Inspect the chain sheaves and hose sheaves for damage and the correct lubrication.
9. Inspect the chain anchors and pins.
10. Make sure that the pairs of boom chains are adjusted so that they have equal tension. If the boom chains need repair or adjustment, this must be done by trained personnel.

FORK PINS

Check the fork pins for operation and replace if damaged. Lubricate the fork pins using multipurpose grease with 2-4 percent molybdenum disulphide. Refer to Figure 10-10.

Continued

BOOM CHAINS - CONT.

6. If adjustment is required, tighten or loosen the chain by adjusting the extend chain anchors, located on the bottom of the outer boom section, in or out as required. Refer to Figure 10-9. The retract chain is automatically adjusted when the extend chains are correctly adjusted.

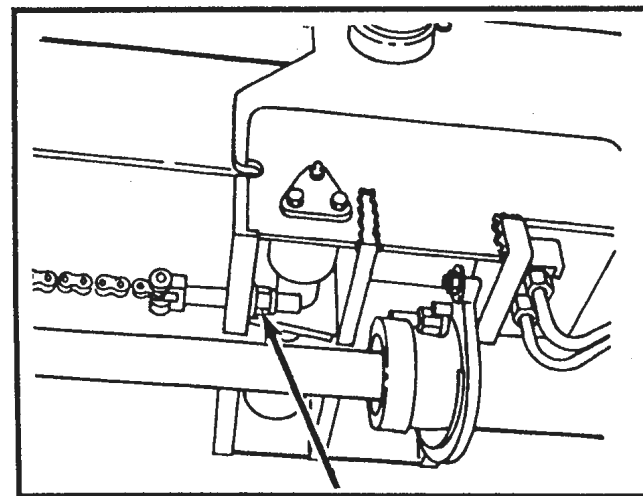


Figure 10-9. Extend Chain Anchor

7. Check the boom chains for correct lubrication. Use SAE 30 oil or Chain and Cable Lubricant (available from your Ingersoll-Rand Road Machinery dealer).
8. Inspect the chain sheaves and hose sheaves for damage and the correct lubrication.
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10. Make sure that the pairs of boom chains are adjusted so that they have equal tension. If the boom chains need repair or adjustment, this must be done by trained personnel.

FORK PINS

Check the fork pins for operation and replace if damaged. Lubricate the fork pins using multipurpose grease with 2-4 percent molybdenum disulphide. Refer to Figure 10-10.

Continued

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

FORK PINS - CONT.

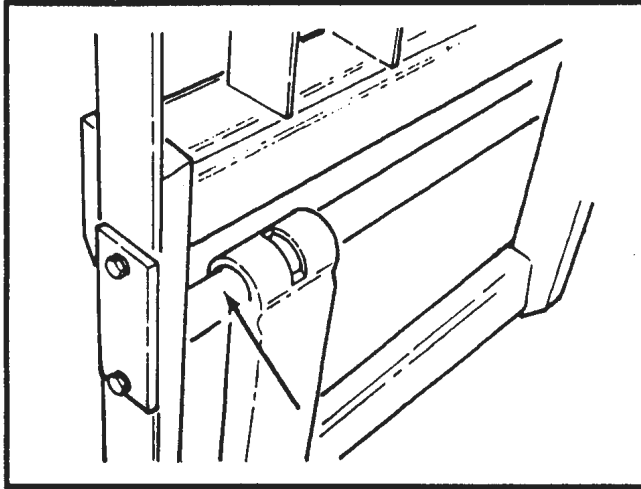


Figure 10-10. Fork Pins

BRAKE ACCUMULATOR

Operate the engine so that the hydraulic pump will charge the accumulator. When the accumulator is charged and the engine is stopped, the accumulator must apply the brakes a minimum of ten (10) times in sequence when the brake pedal is pushed. If the Low Brake Pressure Warning Light is illuminated when the brake pedal is pushed, the accumulator is not charged or has a defect.

The operation of the accumulator must be checked regularly. When an accumulator is first put into service (a new lift truck or a rebuilt accumulator), the operation of the accumulator must be checked within 72 hours during the first week of operation.

FUEL/WATER SEPARATOR

The diesel fuel/water separator is to be changed at this service interval. Refer to Figure 8-10. Replacement separators are available from your Ingersoll-Rand Road Machinery dealer.

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

FORK PINS - CONT.

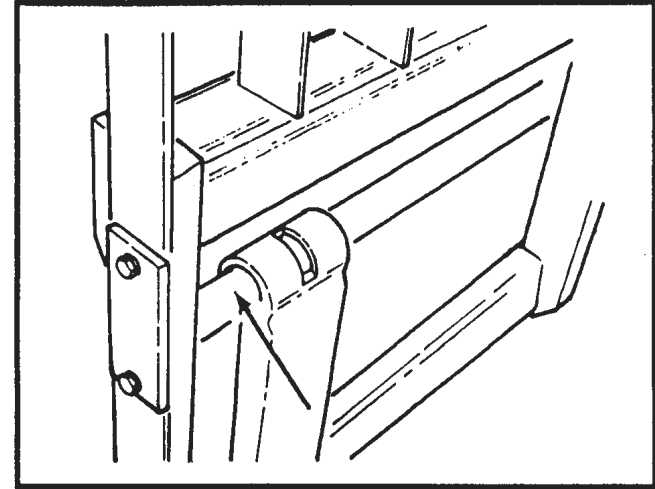


Figure 10-10. Fork Pins

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SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

PARKING BRAKE ADJUSTMENT

Check the adjustment and operation of the parking brake. Check the linkage and brake shoes for wear. Check the brake shoes for wear. Lubricate the linkage with SAE 30 oil. The Parking Brake Indicator should be illuminated when the parking brake is applied.

The parking brake, when in good condition and correctly adjusted, will hold a lift truck with a capacity load on a 15 percent grade (1.5 foot rise in 10 feet [1.5 meter rise in 10 meters]). Turn the knob on the end of the hand lever to adjust the parking brake. Do not tighten the adjustment so that the brake is still applied when the hand lever is released.

LATCHES, HINGES, AND LINKAGES

Use engine oil and multipurpose grease as required on the following linkages and pivots:

1. Shift lever bushings.
2. Throttle linkage pivots.
3. Hinges.
4. Pedal linkage pivots
5. Seat rails.

WARNING DECALS

Check the condition of the machine's WARNING decals. Replace any decals that are damaged or that cannot be read. See the Safety-Related Decal Chart, Figure 1-4, for general location of the WARNING decals.

SECTION 10 - 150 HOUR OR SIX WEEK MAINTENANCE

PARKING BRAKE ADJUSTMENT

Check the adjustment and operation of the parking brake. Check the linkage and brake shoes for wear. Check the brake shoes for wear. Lubricate the linkage with SAE 30 oil. The Parking Brake Indicator should be illuminated when the parking brake is applied.

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SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

Contents

Fuel Filter _____	2	Axle Differential Oil _____	4
Powershift Transmission Oil Filter—	3	Final Drive Oil (Planetary Hubs)—	4

! WARNING



Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine.

! WARNING



11

Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

Contents

Fuel Filter _____	2	Axle Differential Oil _____	4
Powershift Transmission Oil Filter—	3	Final Drive Oil (Planetary Hubs)—	4

! WARNING



Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine.

! WARNING



11

Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

⚠ WARNING



Hot oil and/or components can burn.

Oil must be at operating temperature when draining.

Avoid contact with hot oil or components.

FUEL FILTER

The fuel filter is to be changed at this interval using the following procedure. Refer to Figure 11-1.

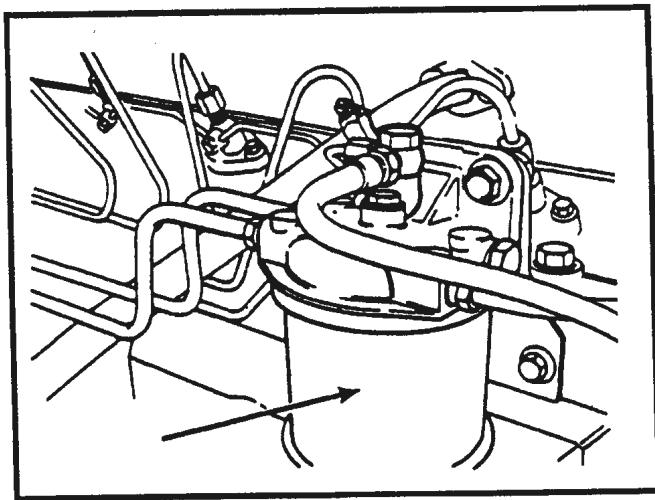
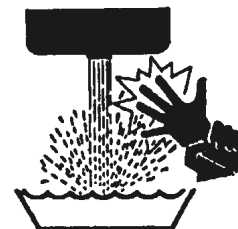


Figure 11-1. Fuel Filter

1. Unscrew the old filter and discard.

Continued

⚠ WARNING



Hot oil and/or components can burn.

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The fuel filter is to be changed at this interval using the following procedure. Refer to Figure 11-1.

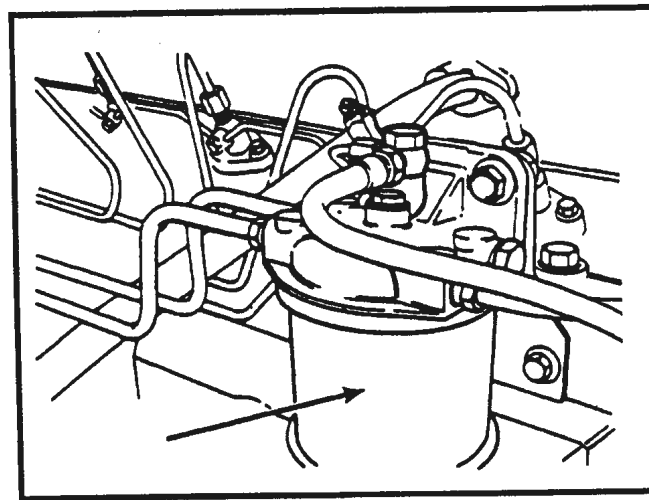


Figure 11-1. Fuel Filter

1. Unscrew the old filter and discard.

Continued

SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

FUEL FILTER - CONT.

2. Fill the new replacement filter with clean fuel.
3. Install the new filter assembly after lightly lubricating the gasket with clean oil and tighten it one-half (1/2) turn beyond gasket contact.
4. Remove the air from the fuel system if necessary. Refer to "REMOVING AIR FROM FUEL SYSTEM" in SECTION 14 - ROUTINE ADJUSTMENTS. When the air has been removed from the fuel system and the engine can be operated, start the engine and check the area around the fuel filter for leaks.

POWERSHIFT TRANSMISSION OIL FILTER

Change the powershift transmission oil filter after the first 20 hours of operation and again after the first 250 hours of operation on a new or rebuilt transmission. To install a new transmission oil filter, apply clean oil to the surface of the gasket of the new oil filter. Turn the filter until the gasket touches the base and then tighten 1/2 to 3/4 turn with your hand. Refer to Figure 11-2.

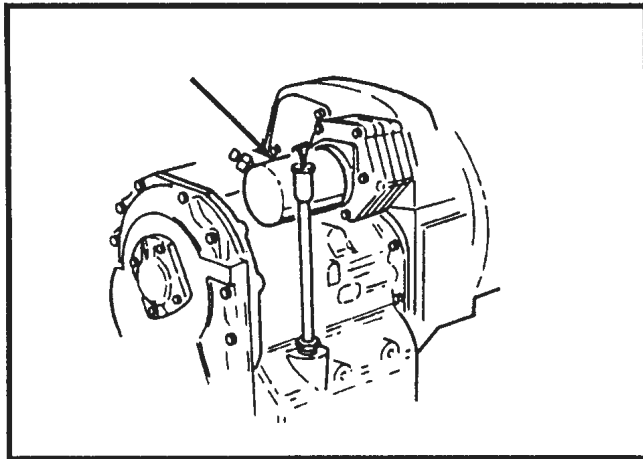


Figure 11-2. Powershift Transmission Oil Filter

SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

FUEL FILTER - CONT.

2. Fill the new replacement filter with clean fuel.
3. Install the new filter assembly after lightly lubricating the gasket with clean oil and tighten it one-half (1/2) turn beyond gasket contact.
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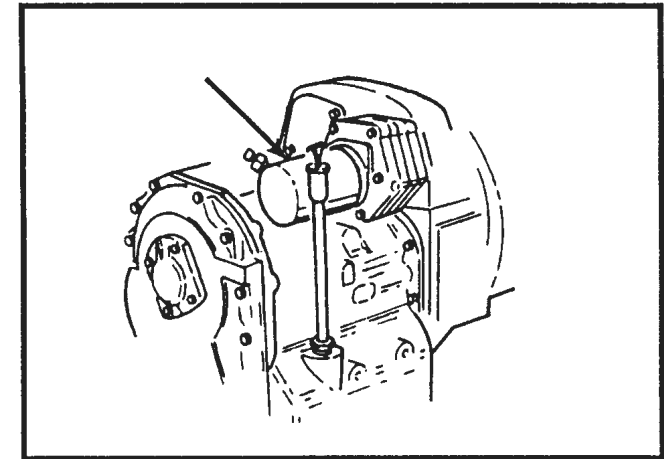


Figure 11-2. Powershift Transmission Oil Filter

SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

AXLE DIFFERENTIAL OIL

The axle differential oil is to be changed at this service interval by the following procedure.

1. Remove the fill and drain plugs from the differential and allow the oil to drain out. Be careful; hot oil and/or components can burn. Refer to Figure 11-3.

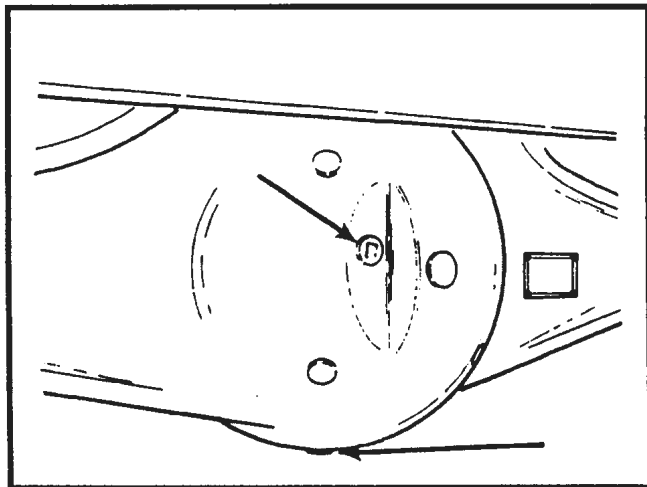


Figure 11-3. Axle Differential Fill and Drain Plugs

2. Clean and install the drain plug.
3. Fill the differential with SAE 90EP gear oil to the fill plug.
4. Clean and install the fill plug.
5. Repeat for other differential..

FINAL DRIVE OIL (PLANETARY HUBS)

The final drive oil is to be changed at this service interval (planetary hubs). Refer to Figure 11-4.

Continued

SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

AXLE DIFFERENTIAL OIL

The axle differential oil is to be changed at this service interval by the following procedure.

1. Remove the fill and drain plugs from the differential and allow the oil to drain out. Be careful; hot oil and/or components can burn. Refer to Figure 11-3.

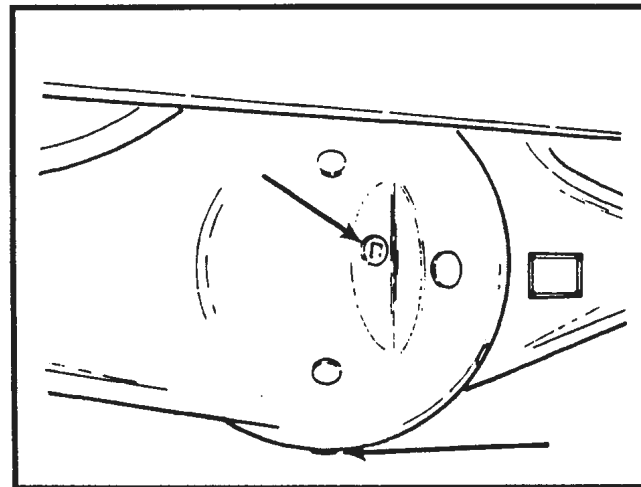


Figure 11-3. Axle Differential Fill and Drain Plugs

2. Clean and install the drain plug.
3. Fill the differential with SAE 90EP gear oil to the fill plug.
4. Clean and install the fill plug.
5. Repeat for other differential..

FINAL DRIVE OIL (PLANETARY HUBS)

The final drive oil is to be changed at this service interval (planetary hubs). Refer to Figure 11-4.

Continued

SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

FINAL DRIVE OIL (PLANETARY HUBS) - CONT.

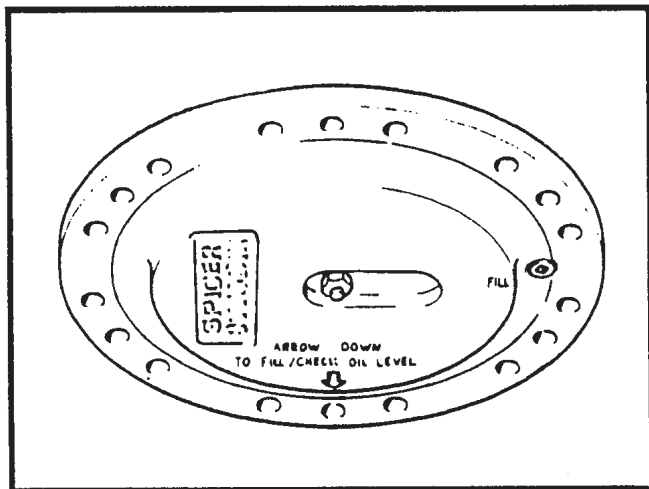


Figure 11-4. Planetary Hub

1. Rotate the planetary hub until the drain/fill plug is at the bottom.
2. Remove the drain/fill plug and allow the oil to drain out. Be careful; hot oil and/or components can burn.
3. Rotate the planetary hub until the indicator arrow points straight down.
4. Fill the planetary hub to the fill/drain hole with GL-5 gear oil (EP 80W 90) and four ounces (4 oz.) of friction modifier, Part No. 58791476 (available from your Ingersoll-Rand distributor).
5. Clean and install the drain plug.
6. Repeat for each of the other three planetary hubs.

SECTION 11 - 500 HOUR OR SEMIANNUAL MAINTENANCE

FINAL DRIVE OIL (PLANETARY HUBS) - CONT.

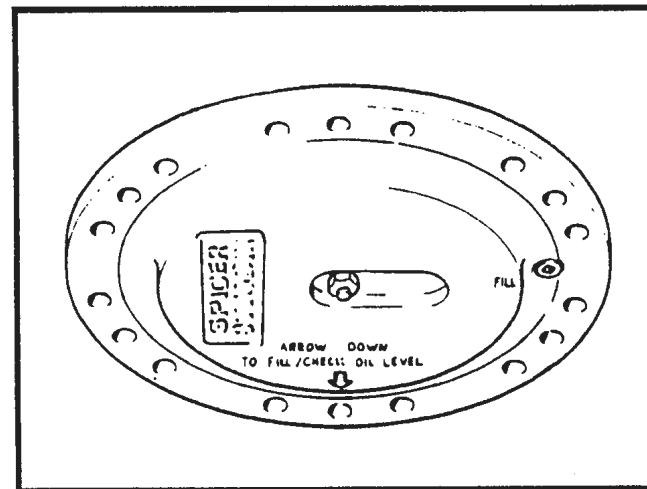


Figure 11-4. Planetary Hub

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5. Clean and install the drain plug.
6. Repeat for each of the other three planetary hubs.

SECTION 12 - 1000 HOUR OR ANNUAL MAINTENANCE

Contents

Powershift Transmission Oil and Sump Screen	2	Lift Pump (Fuel Pump) Strainer Screen	5
Engine Cooling System	4	Hydraulic Oil	6
		Hydraulic Oil Filter	7

! WARNING



Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine.

! WARNING



12

Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

SECTION 12 - 1000 HOUR OR ANNUAL MAINTENANCE

Contents

Powershift Transmission Oil and Sump Screen	2	Lift Pump (Fuel Pump) Strainer Screen	5
Engine Cooling System	4	Hydraulic Oil	6
		Hydraulic Oil Filter	7

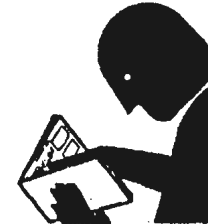
! WARNING



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! WARNING

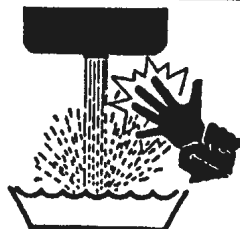


12

Improper maintenance can be hazardous.

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

! WARNING



Hot oil and/or components can burn.

Oil must be at operating temperature when draining.

Avoid contact with hot oil or components.

POWERSHIFT TRANSMISSION OIL AND SUMP SCREEN

Drain the oil from the powershift transmission when it is at operating temperature (150–200 degrees F [65–93 degrees C]). Be careful; hot oil and/or components can burn.

1. There are two magnetic drain plugs, one on each end of the powershift transmission case. Remove the drain plugs and drain the transmission oil. Clean the magnetic drain plugs. Refer to Figure 12-1.

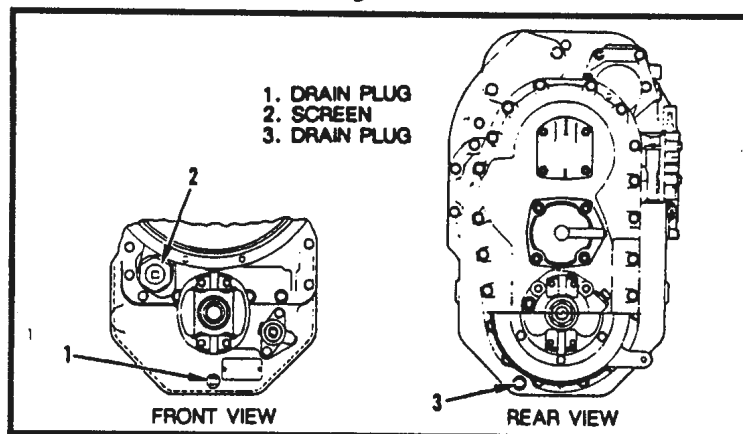
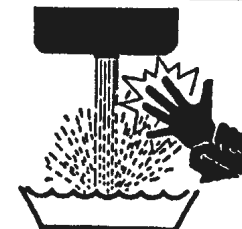


Figure 12-1. Powershift Transmission Drain Plugs and Sump Screen
Continued

! WARNING



Hot oil and/or components can burn.

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Avoid contact with hot oil or components.

POWERSHIFT TRANSMISSION OIL AND SUMP SCREEN

Drain the oil from the powershift transmission when it is at operating temperature (150–200 degrees F [65–93 degrees C]). Be careful; hot oil and/or components can burn.

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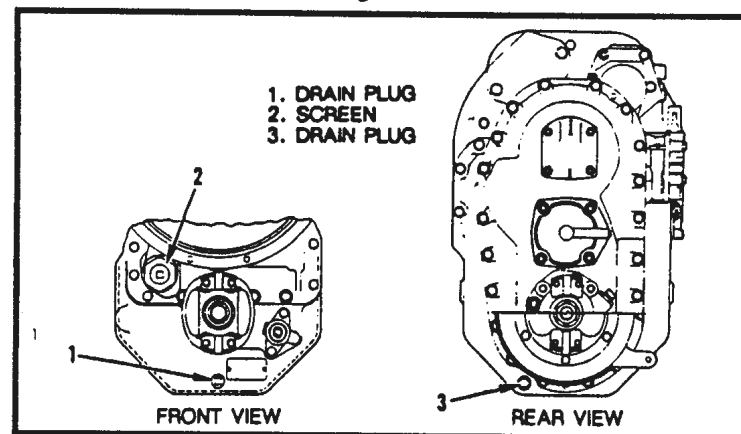


Figure 12-1. Powershift Transmission Drain Plugs and Sump Screen
Continued

SECTION 12 - 1000 HOUR OR ANNUAL MAINTENANCE

POWERSHIFT TRANSMISSION OIL AND SUMP SCREEN - CONT.

2. Use a square drive to remove the sump screen from the powershift transmission case under the torque converter. Refer to Figure 12-1. Clean the sump screen. Install the sump screen with new gaskets.
3. Remove and discard the transmission oil filter. Install a new oil filter. Apply clean oil to the surface of the gasket of the new oil filter. Turn the filter until the gasket touches the base and then tighten $1/2$ to $3/4$ turn with your hand. Refer to Figure 12-2.

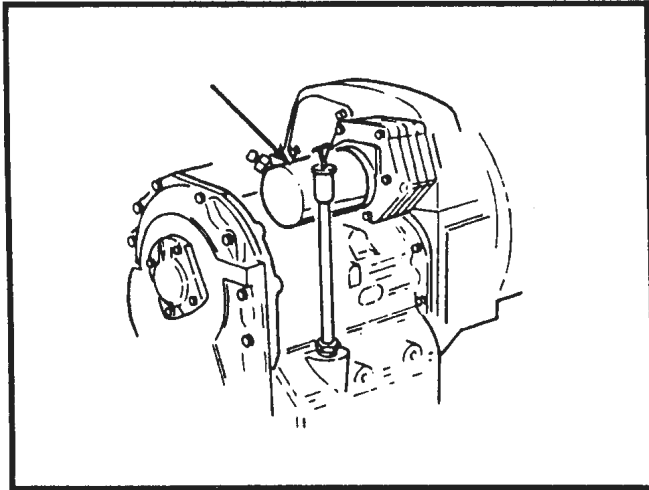


Figure 12-2. Powershift Transmission Oil Filter

4. Replace the drain plugs. Fill the transmission with the new oil to the LOW mark on the dipstick. Use tractor transmission oil or oil that meets JD20A specifications (TDH).
5. Run the engine at 500 to 600 rpm with the Directional Control Lever in "Neutral" (N) to fill the torque converter and oil lines. Check the oil level and add oil to the LOW mark.
6. When the transmission oil is at operating temperature (180–200 degrees F [82–93 degrees C], add oil to the FULL mark with the engine running and the Directional Control Lever in "Neutral" (N).

SECTION 12 - 1000 HOUR OR ANNUAL MAINTENANCE

POWERSHIFT TRANSMISSION OIL AND SUMP SCREEN - CONT.

2. Use a square drive to remove the sump screen from the powershift transmission case under the torque converter. Refer to Figure 12-1. Clean the sump screen. Install the sump screen with new gaskets.
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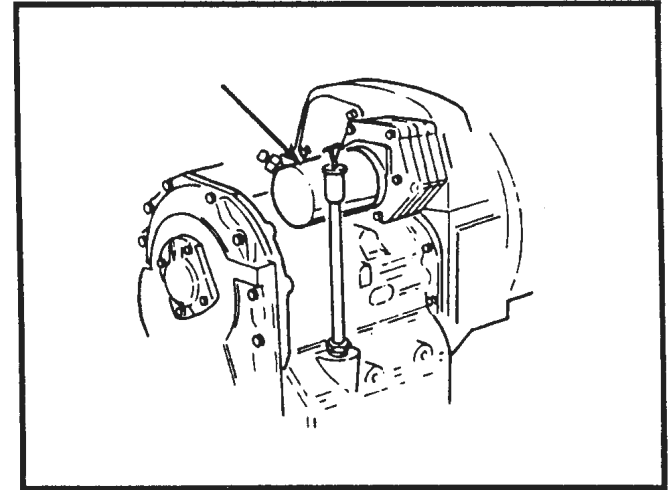
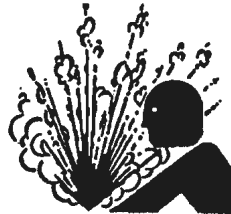


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ENGINE COOLING SYSTEM

! WARNING



Injury can occur when removing the radiator cap.

Steam or fluids escaping from the radiator can burn. Inhibitor contains alkali; avoid contact with skin and eyes.

Always shut down the engine and allow to cool down before removing the radiator cap. Remove the cap slowly to relieve pressure. Avoid contact with steam or escaping fluid.

Change the engine coolant using the following procedure.

1. Put the lift truck on a level surface, shut down the engine, and chock the wheels.
2. Remove the drain plugs or open the drain valves. Remove the radiator cap. Flush the cooling system. Check the hoses and fittings for damage. Replace with new hoses and fittings as needed. Refer to Figure 12-3.

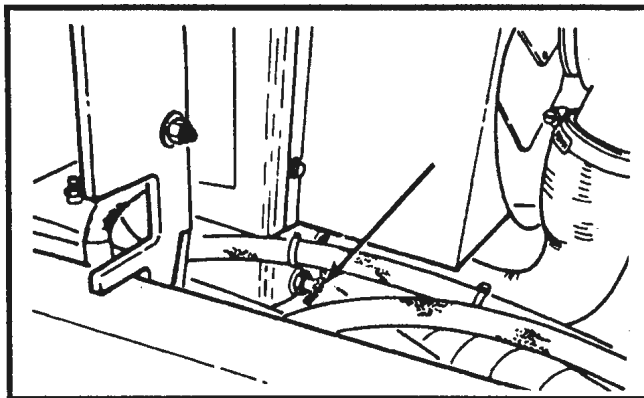
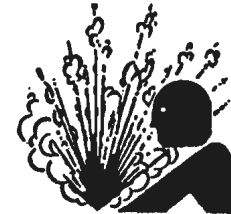


Figure 12-3. Radiator Drain Valve

Continued

ENGINE COOLING SYSTEM

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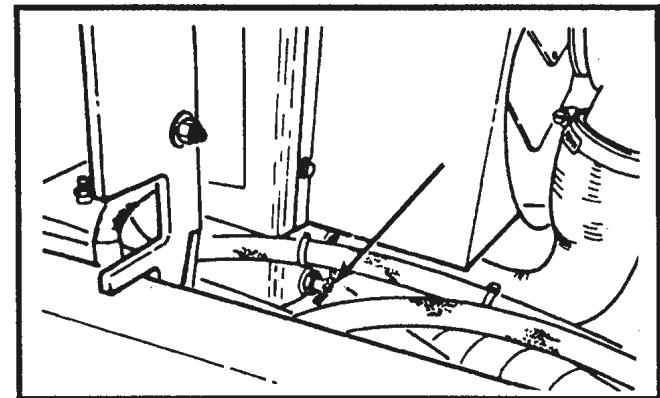


Figure 12-3. Radiator Drain Valve

Continued

SECTION 12 - 1000 HOUR OR ANNUAL MAINTENANCE

ENGINE COOLING SYSTEM - CONT.

3. Install the drain plugs or close the drain valves. Fill the cooling system with the correct coolant (50 percent water/50 percent ethylene glycol).
4. Install the radiator cap.
5. Start the engine. Check for leaks.
6. Add coolant to the auxiliary coolant bottle as needed. Refer to Fig. 12-4.

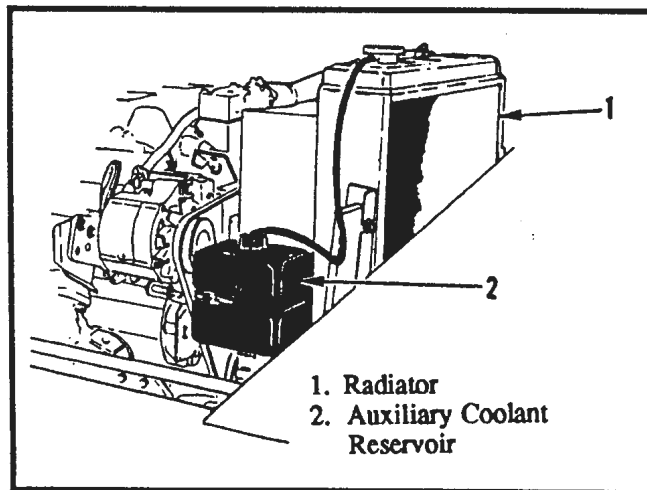


Figure 12-4. Engine Cooling System

LIFT PUMP (FUEL PUMP) STRAINER SCREEN

The lift pump (fuel pump) strainer screen should be cleaned annually, or more often if poor quality fuel is encountered.

Clean the strainer screen using the following procedure:

1. Remove the cover and seal from the top of the lift pump.
2. Remove the strainer screen.
3. Wash all sediment from the pump, cover, and strainer screen. Inspect the strainer screen for any damage and replace if necessary. Refer to Figure 12-5.

Continued

SECTION 12 - 1000 HOUR OR ANNUAL MAINTENANCE

ENGINE COOLING SYSTEM - CONT.

3. Install the drain plugs or close the drain valves. Fill the cooling system with the correct coolant (50 percent water/50 percent ethylene glycol).
4. Install the radiator cap.
5. Start the engine. Check for leaks.
6. Add coolant to the auxiliary coolant bottle as needed. Refer to Fig. 12-4.

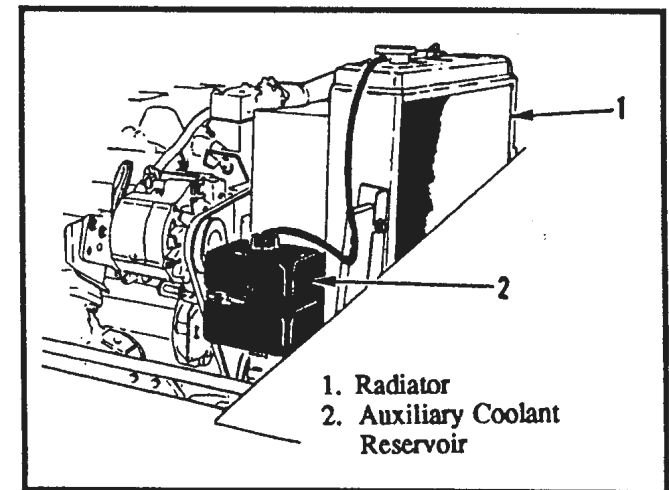


Figure 12-4. Engine Cooling System

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Clean the strainer screen using the following procedure:

1. Remove the cover and seal from the top of the lift pump.
2. Remove the strainer screen.
3. Wash all sediment from the pump, cover, and strainer screen. Inspect the strainer screen for any damage and replace if necessary. Refer to Figure 12-5.

Continued

LIFT PUMP (FUEL PUMP) STRAINER SCREEN - CONT.

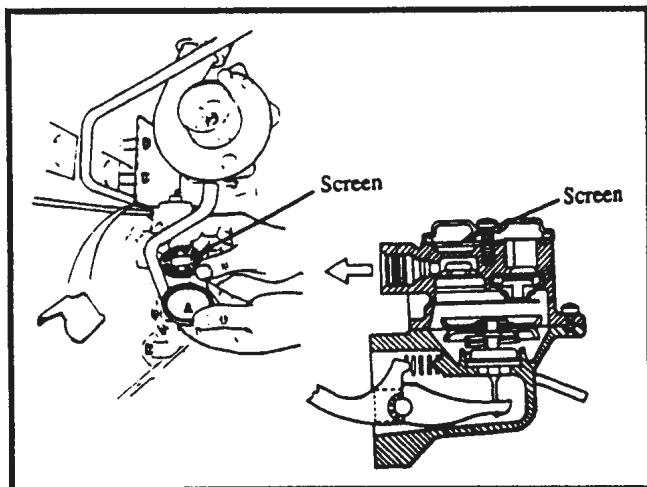


Figure 12-5. Lift Pump Strainer Screen

4. Assemble the lift pump using a new seal.

HYDRAULIC OIL

1. Hydraulic oil must be at operating temperature to drain. Put the lift truck on a level surface and lower the boom and carriage to the ground. Put a container under the hydraulic tank capable of holding up to 110 quarts (105 liters).
2. Remove the hydraulic drain plug, which is located on the underside of the hydraulic tank. Allow the hydraulic oil to drain. Be careful; hot oil and/or components can burn.
3. When the hydraulic oil has drained, clean and reinstall the hydraulic drain plug.
4. Fill the hydraulic tank with the oil shown in the Lubrication Chart, Figure 6-1. The hydraulic system holds approximately 110 quarts (105 liters) of hydraulic oil.

LIFT PUMP (FUEL PUMP) STRAINER SCREEN - CONT.

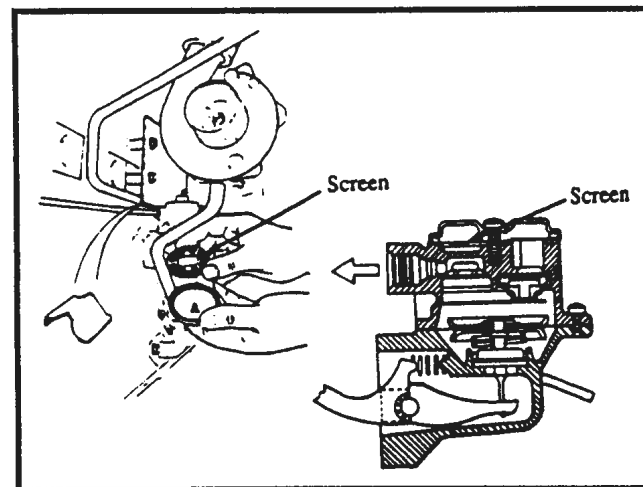


Figure 12-5. Lift Pump Strainer Screen

4. Assemble the lift pump using a new seal.

HYDRAULIC OIL

1. Hydraulic oil must be at operating temperature to drain. Put the lift truck on a level surface and lower the boom and carriage to the ground. Put a container under the hydraulic tank capable of holding up to 110 quarts (105 liters).
2. Remove the hydraulic drain plug, which is located on the underside of the hydraulic tank. Allow the hydraulic oil to drain. Be careful; hot oil and/or components can burn.
3. When the hydraulic oil has drained, clean and reinstall the hydraulic drain plug.
4. Fill the hydraulic tank with the oil shown in the Lubrication Chart, Figure 6-1. The hydraulic system holds approximately 110 quarts (105 liters) of hydraulic oil.

HYDRAULIC OIL FILTER

1. Remove and discard the hydraulic system oil filter. Refer to Figure 12-6.

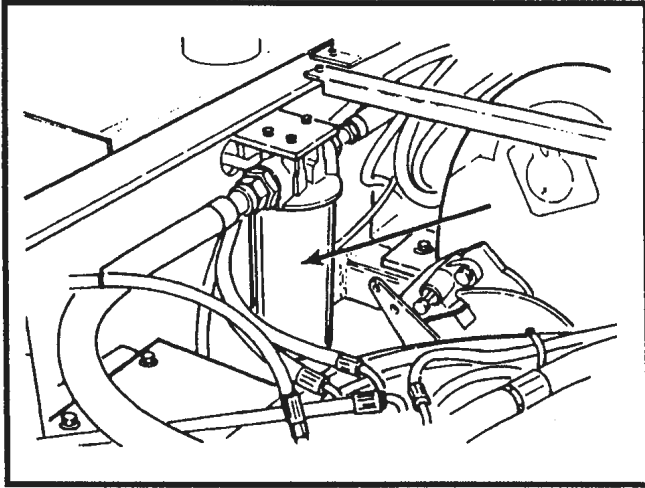


Figure 12-6. Hydraulic Oil Filter

2. Apply clean oil to the surface of the gasket of the new oil filter.
3. Turn the filter until the gasket touches the base, then tighten 1/2 to 3/4 of a turn with your hand.

HYDRAULIC OIL FILTER

1. Remove and discard the hydraulic system oil filter. Refer to Figure 12-6.

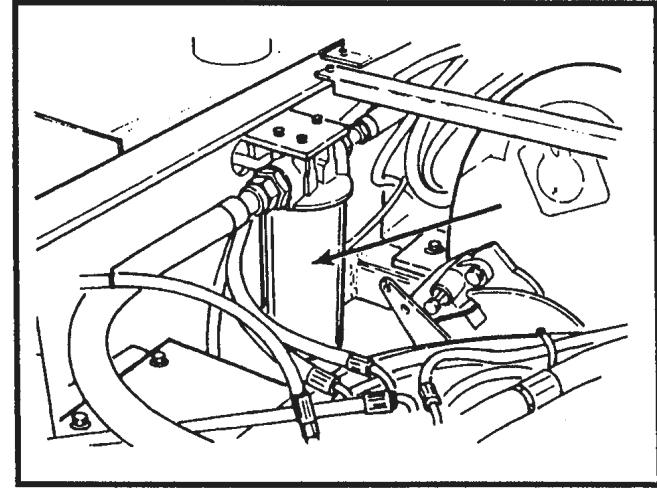


Figure 12-6. Hydraulic Oil Filter

2. Apply clean oil to the surface of the gasket of the new oil filter.
3. Turn the filter until the gasket touches the base, then tighten 1/2 to 3/4 of a turn with your hand.

SECTION 13 - 2000 HOUR OR BIENNIAL MAINTENANCE

NOTE

There are no scheduled routine maintenance items for the VR60B and VR70B at this time interval.

13

SECTION 13 - 2000 HOUR OR BIENNIAL MAINTENANCE

NOTE

There are no scheduled routine maintenance items for the VR60B and VR70B at this time interval.

13

SECTION 14 - ROUTINE ADJUSTMENTS

Contents

Removing Air from Fuel System	1	Jacking and Blocking the Lift Truck	3
Fuel Injectors	2	Wheels and Tires	4

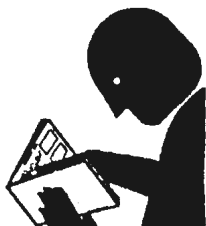
⚠ WARNING



Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine.

⚠ WARNING



Improper maintenance can be hazardous.

14

Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

REMOVING AIR FROM FUEL SYSTEM

The engine cannot be started if there is air in the fuel system. The air must be removed from the fuel system if any part of the fuel system has been disconnected or there is a leak in the low pressure part of the fuel system during operation of the

Continued

SECTION 14 - ROUTINE ADJUSTMENTS

Contents

Removing Air from Fuel System	1	Jacking and Blocking the Lift Truck	3
Fuel Injectors	2	Wheels and Tires	4

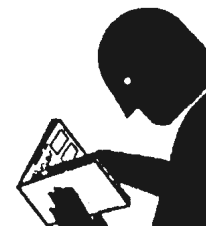
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Read and understand SECTION 1 - SAFETY PRECAUTIONS AND GUIDELINES before you perform any maintenance, service, or repairs.

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Continued

SECTION 14 - ROUTINE ADJUSTMENTS

REMOVING AIR FROM FUEL SYSTEM - CONT.

engine. Under normal conditions, the fuel system of the VR60B and VR70B is self-bleeding, and the engine will start after a few seconds of cranking without further procedure. Should the fuel tank be run dry for some reason, however, it will be necessary to operate the priming lever of the lift pump (fuel pump) until fuel again fills the system. Refer to Figure 14-1. *NOTE:* If the priming lever will not operate, the lobe on the camshaft has moved the internal lever of the fuel pump to the highest point of its lift. The crankshaft must be rotated one revolution to move the lobe on the camshaft. "Bump" the crankshaft by operating the starter momentarily until the priming lever will operate.

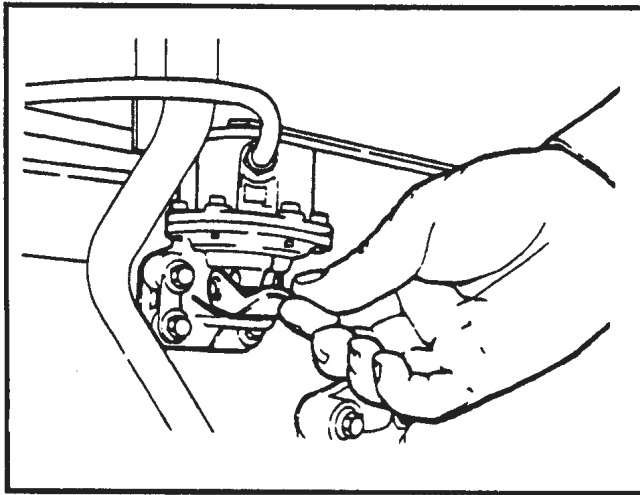


Figure 14-1. Lift Pump Priming Lever

FUEL INJECTORS

The engine will run roughly if a fuel injector has a defect. To find which fuel injector has a defect, operate the engine at approximately 1000 rpm. Loosen and tighten the connection to the inlet of one fuel injector at a time. When the connection to the defective fuel injector is loosened, there will not be a change in the engine speed.

For further fuel injector checks, as well as the procedure for removal and replacement of fuel injectors, consult your Perkins Engine Manual.

SECTION 14 - ROUTINE ADJUSTMENTS

REMOVING AIR FROM FUEL SYSTEM - CONT.

engine. Under normal conditions, the fuel system of the VR60B and VR70B is self-bleeding, and the engine will start after a few seconds of cranking without further procedure. Should the fuel tank be run dry for some reason, however, it will be necessary to operate the priming lever of the lift pump (fuel pump) until fuel again fills the system. Refer to Figure 14-1. *NOTE:* If the priming lever will not operate, the lobe on the camshaft has moved the internal lever of the fuel pump to the highest point of its lift. The crankshaft must be rotated one revolution to move the lobe on the camshaft. "Bump" the crankshaft by operating the starter momentarily until the priming lever will operate.

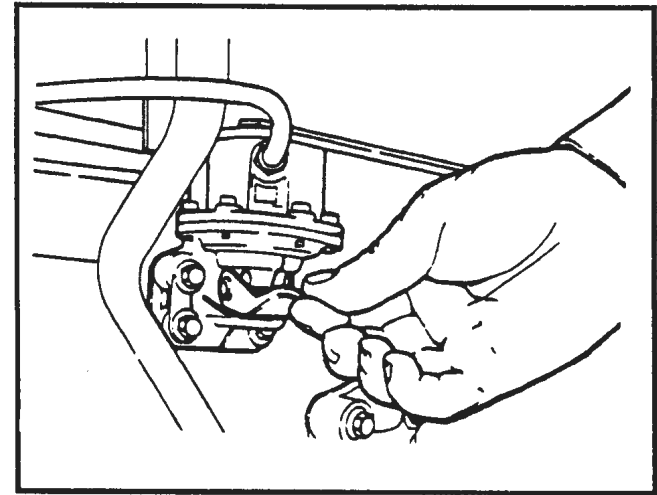


Figure 14-1. Lift Pump Priming Lever

FUEL INJECTORS

The engine will run roughly if a fuel injector has a defect. To find which fuel injector has a defect, operate the engine at approximately 1000 rpm. Loosen and tighten the connection to the inlet of one fuel injector at a time. When the connection to the defective fuel injector is loosened, there will not be a change in the engine speed.

For further fuel injector checks, as well as the procedure for removal and replacement of fuel injectors, consult your Perkins Engine Manual.

JACKING AND BLOCKING THE LIFT TRUCK

 WARNING


Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine. Put the lift truck on blocks only if the surface is solid, even, and level. Make sure that any blocks used to support the lift truck are solid, one-piece units. Put blocks next to the tires that are not being raised to prevent movement of the lift truck.

The lift truck must be put on blocks for some kinds of maintenance and repair. Put the lift truck on blocks only if the surface is solid, even, and level. Make sure that any blocks used to support the lift truck are solid, one-piece units. Put blocks next to the tires that are not being raised to prevent movement of the lift truck.

1. Apply the parking brake. Put blocks on both sides (front and back) of the tires that are not being raised to prevent movement of the lift truck.
2. Since the frame pivots on the axles, blocks must be placed between the frame and axles before jacking. Block both front and rear axles to the frame on both sides.
3. Use a hydraulic jack under the axle to raise one wheel and tire at a time. Make sure that the jack has a capacity of at least one-half (1/2) of the total weight of the lift truck as shown on the nameplate.
4. Put the jack under the axle or frame to raise the lift truck so that a wheel is just raised from the ground. Put additional blocks under the frame to support the lift truck. Refer to Figure 14-2.

JACKING AND BLOCKING THE LIFT TRUCK

 WARNING


Unexpected machine motion or moving parts can cut or crush.

Apply the parking brake and shut down the engine before working on the machine. Put the lift truck on blocks only if the surface is solid, even, and level. Make sure that any blocks used to support the lift truck are solid, one-piece units. Put blocks next to the tires that are not being raised to prevent movement of the lift truck.

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SECTION 14 - ROUTINE ADJUSTMENTS

JACKING AND BLOCKING THE LIFT TRUCK - CONT.

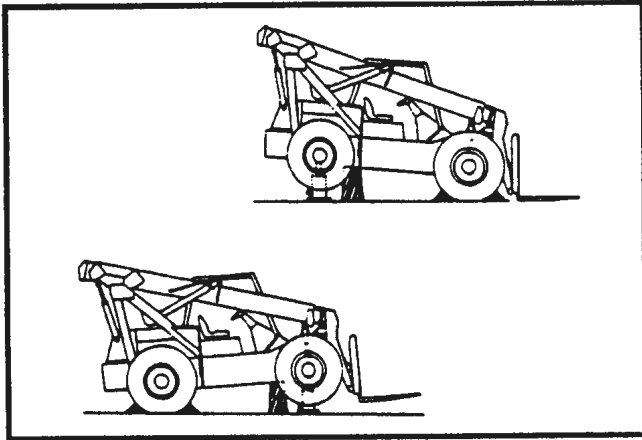
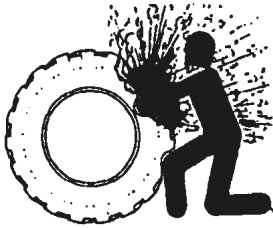


Figure 14-2. Putting a Lift Truck on Blocks

WHEELS AND TIRES

! WARNING



Excessive air pressure may cause tire/rim to burst.
Flying tire/rim parts may cause serious injury or death.
Ingersoll-Rand recommends that tire mounting be done **ONLY** by a qualified person, equipped and trained to perform this service. When mounting a tire, the qualified person should:

- BE SURE rim is clean and rust free.
 - Lubricate generously both tire and rim with rubber lubricant.
 - NEVER inflate to OVER 35 PSI to seat beads.
- Excessive inflation pressure when seating beads may cause tire/rim assembly to burst with force sufficient to cause serious injury or death.
- CHECK to ensure normal operating pressure.

SECTION 14 - ROUTINE ADJUSTMENTS

JACKING AND BLOCKING THE LIFT TRUCK - CONT.

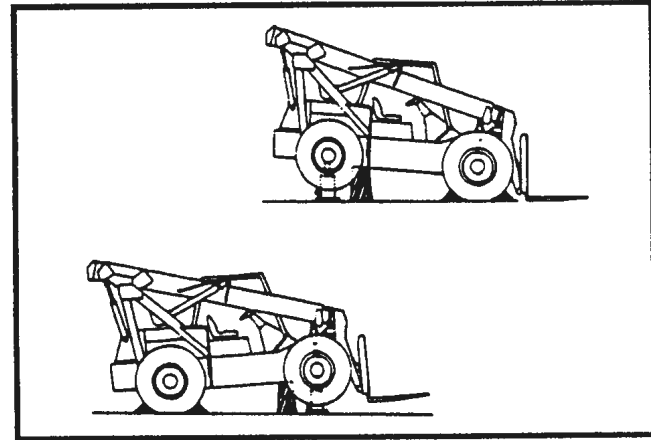
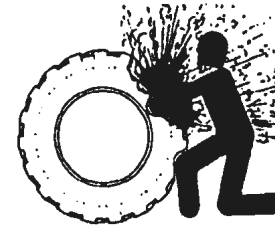


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- CHECK to ensure normal operating pressure.

WHEELS AND TIRES - CONT.

Wheels must be changed and tires repaired **ONLY** by trained and qualified personnel properly equipped to perform this service

Removing Wheel and Tire from the Lift Truck

Completely remove the air pressure before removing the wheel from the lift truck. Air pressure in the tires can cause the tire and rim parts to explode, causing serious injury or death. Always wear safety glasses.

1. Remove the air pressure from the tire. Remove the valve core to make sure that all of the air pressure is out of the tire. Push a wire through the valve stem to make sure that the valve stem does not have a restriction.
2. Remove the wheel nuts and remove the wheel from the lift truck. Lift truck wheels are heavy; make sure the equipment used to move and lift the tires has enough capacity to do the job.

Tire Removal, Repair, and Replacement
 WARNING

Ingersoll-Rand recommends that tire removal from wheel, tire repair, and tire replacement be done **ONLY** by a qualified person who is trained and equipped to perform this service. **DO NOT** repair any parts of the wheel. Always replace any damaged parts. Wheels that have been repaired can explode when inflated or during operation. Make sure that all parts of the wheel are the correct parts for the wheel assembly. Do not mix parts between different types of wheels.

Inflating a New or Repaired Tire
 WARNING

Add air to the tires only in a safety cage. Inspect the safety cage for damage before use. When inflating, use a clip-on chuck with enough hose to permit the operator to stand clear of the cage.

Continued

WHEELS AND TIRES - CONT.

Wheels must be changed and tires repaired **ONLY** by trained and qualified personnel properly equipped to perform this service

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Completely remove the air pressure before removing the wheel from the lift truck. Air pressure in the tires can cause the tire and rim parts to explode, causing serious injury or death. Always wear safety glasses.

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Inflating a New or Repaired Tire
 WARNING

Add air to the tires only in a safety cage. Inspect the safety cage for damage before use. When inflating, use a clip-on chuck with enough hose to permit the operator to stand clear of the cage.

Continued

WHEELS AND TIRES - CONT.

Inflating a New or Repaired Tire - Cont.

1. Put the tire in a safety cage.
2. Add air to the tire to 3 psi (20 kPa).

! WARNING

Do not sit or stand by the safety cage. Do not try to correct the position of the side flange or lock ring by using a hammer when the tire is inflated.

3. Check that all wheel parts are correctly installed and seated. Hit the lock ring lightly to make sure that it is in the seat.
4. If installation is correct, add air to the tire to the correct pressure (See the nameplate).

Wheel Installation

Install the wheel on the hub. Tighten the nuts in a cross pattern to 225 pounds-foot. Do not tighten beyond specification.

When the wheels have been installed, check all wheel nuts after 2-5 hours of operation. Tighten the nuts to 225 pounds-foot. When the nuts stay tight after an 8-hour check, the interval for checking can be extended to 500 hours.

1. Install the wheel on the hub. Tighten the nuts evenly in the sequence shown in Figure 14-3.
2. When the wheel is completely seated, tighten the nuts to 225 pounds-foot.

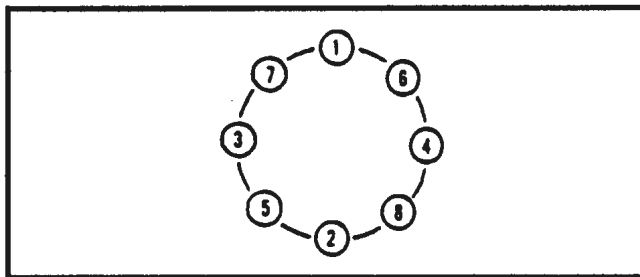


Figure 14-3. Wheel Nut Tightening Sequence

WHEELS AND TIRES - CONT.

Inflating a New or Repaired Tire - Cont.

1. Put the tire in a safety cage.
2. Add air to the tire to 3 psi (20 kPa).

! WARNING

Do not sit or stand by the safety cage. Do not try to correct the position of the side flange or lock ring by using a hammer when the tire is inflated.

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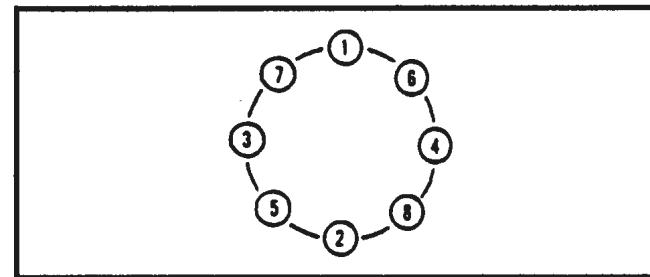


Figure 14-3. Wheel Nut Tightening Sequence

	Contents
Quick-Attach Carriage	1

	Contents
Quick-Attach Carriage	1

WARNING



Unexpected machine motion or moving parts can cut or crush.

Make sure that all personnel are away from the lift truck before the engine is started. Make sure that no one is standing between the wheels and the frame.

WARNING



Never allow anyone under raised forks. Do not put any part of your body in or through the lift or extend mechanism unless all parts of the boom are completely lowered and the engine is SHUT DOWN.

QUICK-ATTACH CARRIAGE

The VR60B and VR70B may be ordered with an optional quick-attach carriage apron that facilitates the change of boom attachments.

Continued

WARNING



Unexpected machine motion or moving parts can cut or crush.

Make sure that all personnel are away from the lift truck before the engine is started. Make sure that no one is standing between the wheels and the frame.

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QUICK-ATTACH CARRIAGE

The VR60B and VR70B may be ordered with an optional quick-attach carriage apron that facilitates the change of boom attachments.

Continued

SECTION 15 - MISCELLANEOUS AND OPTIONAL EQUIPMENT

QUICK-ATTACH CARRIAGE - CONT.

Releasing

To release the quick-attach boom carriage, use the following procedure:

1. Extend the boom four to eight feet and place the mounted carriage on level ground where you wish to lay or store it.
2. Pull the red quick-attach D-handle straight up until it can be locked in place on its bracket. This will retract the lower quick-attach mounting pins. Refer to Figures 15-1 and 15-2.

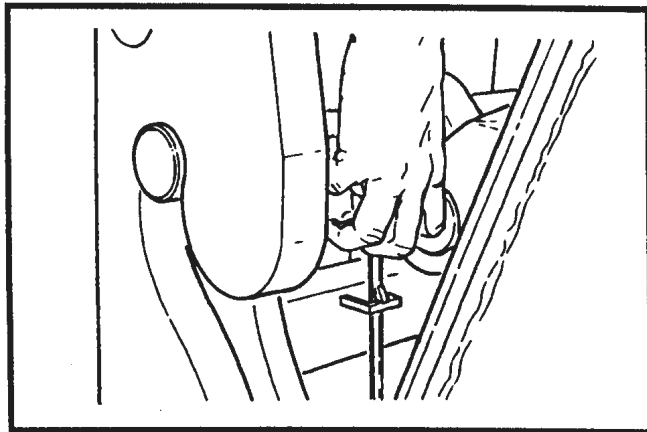


Figure 15-1. Quick-attach D-handle

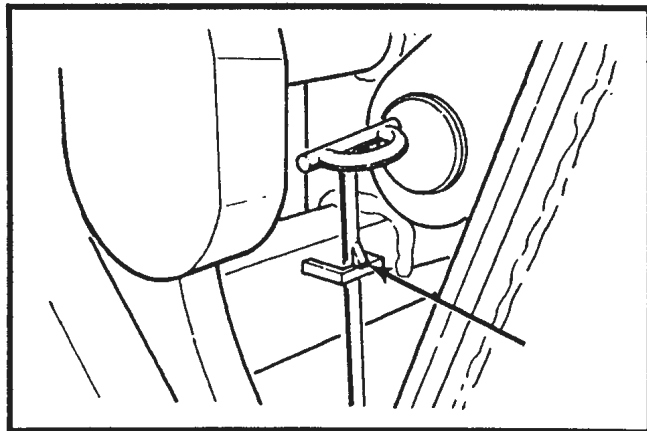


Figure 15-2. D-handle locked in "up" position on bracket

Continued

SECTION 15 - MISCELLANEOUS AND OPTIONAL EQUIPMENT

QUICK-ATTACH CARRIAGE - CONT.

Releasing

To release the quick-attach boom carriage, use the following procedure:

1. Extend the boom four to eight feet and place the mounted carriage on level ground where you wish to lay or store it.
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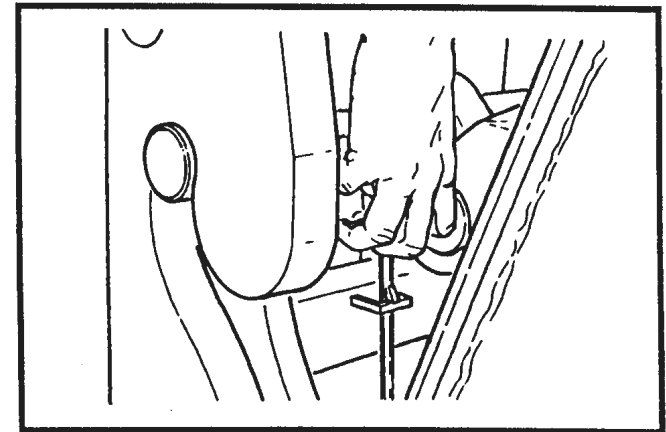


Figure 15-1. Quick-attach D-handle

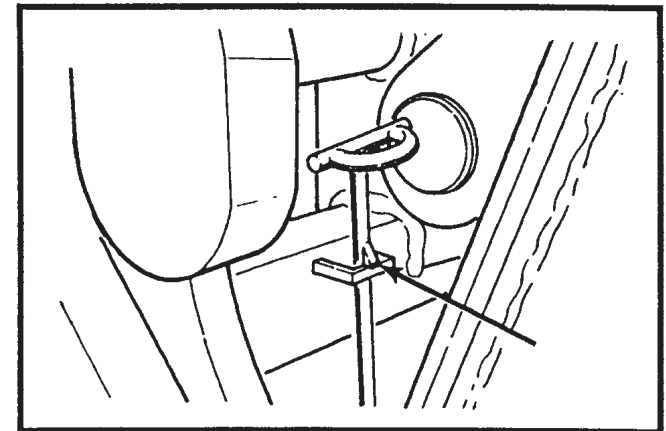


Figure 15-2. D-handle locked in "up" position on bracket

Continued

QUICK-ATTACH CARRIAGE - CONT.

3. Move the Tilt Control Lever forward as if tilting the carriage forks down slightly. Then move the Boom Control Lever forward to lower the boom until the quick-attach apron's upper mounting pins have moved downward and out of the slots on the carriage. Refer to Figure 15-3.

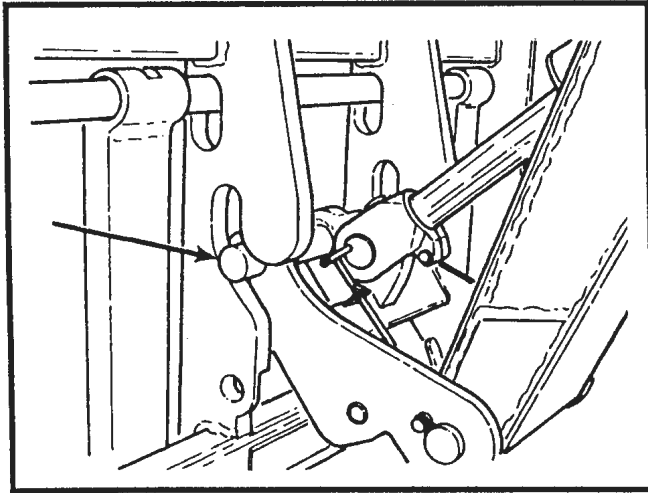


Figure 15-3. Disengaging upper quick-attach mounting pins.

4. Boom may now be retracted. The lift truck may now be backed away from the carriage.

Attaching

To attach the quick-attach boom carriage, use the following procedure:

1. Make sure that the carriage's red quick-attach D-handle is locked on its bracket in the "up" position. Refer to Figure 15-2.
2. Maneuver the lift truck and boom so that the quick-attach apron's upper mounting pins can enter their slots on the carriage. Refer to Figure 15-3.
3. Raise the boom until the upper mounting pins reach the top of their slots.

Continued

QUICK-ATTACH CARRIAGE - CONT.

3. Move the Tilt Control Lever forward as if tilting the carriage forks down slightly. Then move the Boom Control Lever forward to lower the boom until the quick-attach apron's upper mounting pins have moved downward and out of the slots on the carriage. Refer to Figure 15-3.

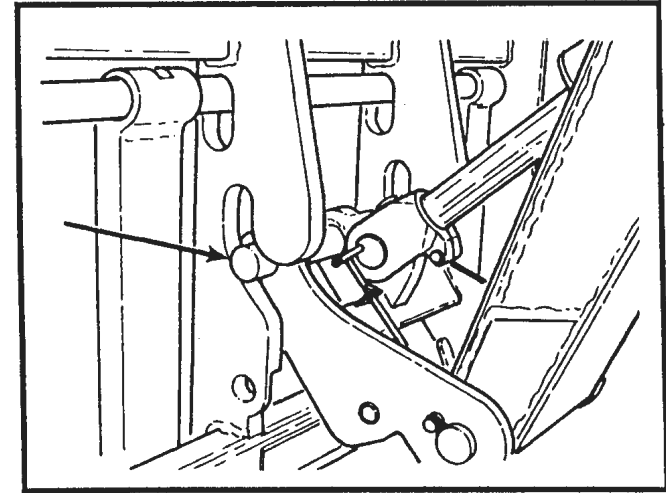


Figure 15-3. Disengaging upper quick-attach mounting pins.

4. Boom may now be retracted. The lift truck may now be backed away from the carriage.

Attaching

To attach the quick-attach boom carriage, use the following procedure:

1. Make sure that the carriage's red quick-attach D-handle is locked on its bracket in the "up" position. Refer to Figure 15-2.
2. Maneuver the lift truck and boom so that the quick-attach apron's upper mounting pins can enter their slots on the carriage. Refer to Figure 15-3.
3. Raise the boom until the upper mounting pins reach the top of their slots.

Continued

SECTION 15 - MISCELLANEOUS AND OPTIONAL EQUIPMENT

QUICK-ATTACH CARRIAGE - CONT.

4. Move the Tilt Control Lever to tilt the carriage back. The quick-attach D-handle will automatically disengage from its upward locked position when the carriage is tilted rearward and the lower quick-attach mounting pins will lock into place.
5. Visually check to ensure that the quick-attach D-handle is now disengaged and the lower quick-attach mounting pins are now locked solidly in place.

SECTION 15 - MISCELLANEOUS AND OPTIONAL EQUIPMENT

QUICK-ATTACH CARRIAGE - CONT.

4. Move the Tilt Control Lever to tilt the carriage back. The quick-attach D-handle will automatically disengage from its upward locked position when the carriage is tilted rearward and the lower quick-attach mounting pins will lock into place.
5. Visually check to ensure that the quick-attach D-handle is now disengaged and the lower quick-attach mounting pins are now locked solidly in place.

SECTION 16 - SCHEMATICS

Contents

Schematics _____ 1

SCHEMATICS

Electrical and hydraulic schematics are available from your Ingersoll-Rand Road Machinery Equipment Distributor. For latest revision of VR60B/VR70B electrical schematic, order Communication No. 58841578. For latest revision of VR60B/VR70B hydraulic schematic, order Communication No. 59493528 (Sheet 11 of 11).

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SECTION 16 - SCHEMATICS

Contents

Schematics _____ 1

SCHEMATICS

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SECTION 17 - SPECIFICATIONS

Contents

ISO Metric Torque Chart — 1 SAE Torque Chart — 2

ISO METRIC TORQUE CHART

Use the following Recommended Torque Chart for bolts and nuts of ISO Metric strength class 8.8 and 10.9. If other torques are required, they will be indicated in the text.

NOTE

Torque values are based on dry zinc-plated capscrews. These values will be approximately 30 percent less if lubricated capscrews are used.

BOLT SIZE (MM)	GRADE 8.8 POUNDS-FOOT (KG-METERS)	GRADE 10.9 POUNDS-FOOT (KG-METERS)
6	8 (1.1)	11 (1.5)
8	20 (2.8)	27 (3.8)
10	39 (5.5)	53 (7.4)
12	68 (9.5)	93 (13.0)
14	107 (15.0)	148 (21.0)
16	156 (22.0)	230 (32.0)
20	306 (43.0)	449 (63.0)
24	529 (74.0)	777 (109.0)
30	1050 (147.0)	1544 (216.0)
36	1835 (257.0)	2696 (377.0)

17

SECTION 17 - SPECIFICATIONS

Contents

ISO Metric Torque Chart — 1 SAE Torque Chart — 2

ISO METRIC TORQUE CHART

Use the following Recommended Torque Chart for bolts and nuts of ISO Metric strength class 8.8 and 10.9. If other torques are required, they will be indicated in the text.

NOTE

Torque values are based on dry zinc-plated capscrews. These values will be approximately 30 percent less if lubricated capscrews are used.

BOLT SIZE (MM)	GRADE 8.8 POUNDS-FOOT (KG-METERS)	GRADE 10.9 POUNDS-FOOT (KG-METERS)
6	8 (1.1)	11 (1.5)
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14	107 (15.0)	148 (21.0)
16	156 (22.0)	230 (32.0)
20	306 (43.0)	449 (63.0)
24	529 (74.0)	777 (109.0)
30	1050 (147.0)	1544 (216.0)
36	1835 (257.0)	2696 (377.0)

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SECTION 17 - SPECIFICATIONS

SAE TORQUE CHART

Use the following Recommended Torque Chart for bolts and nuts of SAE Grade 5 or better quality. If other torques are required, they will be indicated in the text.

NOTE

Torque values are based on plain, unplated hardware, degreased, dried, clamping steel to steel.

SAE Grade 5 (Modified)

Proof Load = 74 - 85 KSI

	Clamp Load (lbs.)	Torque (lbs. ft.)	Torque (NM)
1/4 - 20	2020	96 lb. inch	11
1/4 - 28	2320	120 lb. inch	14
5/16 - 18	3340	17	23
5/16 - 24	3700	19	26
3/8 - 16	4940	30	41
3/8 - 24	5600	35	47
7/16 - 14	6800	50	68
7/16 - 20	7550	55	75
1/2 - 13	9050	75	102
1/2 - 20	10700	90	122
9/16 - 12	11600	110	149
9/16 - 18	12950	120	163
5/8 - 11	14400	150	203
5/8 - 18	16950	180	240
3/4 - 10	21300	260	353
3/4 - 16	23800	300	407
7/8 - 9	27000	400	542
7/8 - 14	29800	440	597
1 - 8	35500	580	786
1 - 12	38800	640	868
1 1/8 - 7	42300	800	1085
1 1/8 - 12	47500	880	1193
1 1/4 - 7	53800	1120	1519
1 1/4 - 12	59600	1240	1681
1 3/8 - 6	64100	1460	1980
1 3/8 - 12	73000	1680	2278
1 1/2 - 6	78000	1940	2631
1 1/2 - 12	87700	2200	2983

All threaded fasteners will have Loctite applied except the following:

1. Wheel Nuts.
2. Nylon Insert Nuts.
3. Whizlock Bolts and Nuts.
4. Fasteners less than 1/4 inch diameter.
5. If instructed to not apply Loctite

Type of Loctite to be used:

1. No. 242 for 5/16 diameter and below.
2. No. 271 for greater than 5/16 diameter.
3. No. 242 for aluminum.

All Loctited fasteners will be degreased and dried. When accelerated Loctite cure times are required, Loctite primer must be used.

SECTION 17 - SPECIFICATIONS

SAE TORQUE CHART

Use the following Recommended Torque Chart for bolts and nuts of SAE Grade 5 or better quality. If other torques are required, they will be indicated in the text.

NOTE

Torque values are based on plain, unplated hardware, degreased, dried, clamping steel to steel.

SAE Grade 5 (Modified)

Proof Load = 74 - 85 KSI

	Clamp Load (lbs.)	Torque (lbs. ft.)	Torque (NM)
1/4 - 20	2020	96 lb. inch	11
1/4 - 28	2320	120 lb. inch	14
5/16 - 18	3340	17	23
5/16 - 24	3700	19	26
3/8 - 16	4940	30	41
3/8 - 24	5600	35	47
7/16 - 14	6800	50	68
7/16 - 20	7550	55	75
1/2 - 13	9050	75	102
1/2 - 20	10700	90	122
9/16 - 12	11600	110	149
9/16 - 18	12950	120	163
5/8 - 11	14400	150	203
5/8 - 18	16950	180	240
3/4 - 10	21300	260	353
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