CEAMW16041
REPLACES SEAMU416KD10

OPERATION & MAINTENANCE MANUAL

KOMATSU

WA120-1LC

WHEEL LOADER

SERIAL NUMBERS
WA120-1LC A20001 and up

MAR 94

PRODUCT PUBLICATIONS INFORMATION

VARIOUS PRODUCT PARTS & SERVICE PUBLICATIONS ARE AVAILABLE TO ALL **KOMATSU** CONSTRUCTION EQUIPMENT OWNERS, INCLUDING OPERATION & MAINTENANCE MANUALS, PARTS BOOKS AND SHOP MANUALS.

SPECIAL PUBLICATIONS SUCH AS SERVICE TOOL, AIR CONDITIONING, AND TURBOCHARGER SHOP MANUALS ARE ALSO AVAILABLE AS WELL AS SELECTED OPERATION & MAINTENANCE AND SHOP MANUALS IN FOREIGN LANGUAGES.

THE PUBLICATIONS LISTED BELOW ARE AVAILABLE FOR THIS PARTICULAR MACHINE(S).

DESCRIPTION	FORM NUMBER
PARTS BOOK - PAPER:	
Engine and Chassis	BEPBW16041
PARTS BOOK - MICROFICHE:	
Engine and Chassis	BEPMW16041
OPERATION & MAINTENANCE MANUAL:	
Chassis English	CEAMW16041
Chassis French	CFAMW16041
SHOP MANUAL:	
Chassis	CEBMW16040
Engine:	
SET (Includes the following manuals)	CEBM610001
Shop Manual	CEBM610SH0
Specifications Manual	CEBM610SP0
Trouble Shooting & Repair Manual	CEBM610TR0
SAFETY MANUAL	1085 883 R3

PARTS AND SERVICE PUBLICATIONS CAN *ONLY* BE ACQUIRED BY AUTHORIZED KOMATSU DISTRIBUTORS, USING THE KDC PARTS INFORMATION PROCESSING SYSTEM (PIPS).

IF THE PIPS SYSTEM IS NOT AVAILABLE AT THE DISTRIBUTOR LOCATION, THEN THE FOLLOWING REQUISITION FOR TECHNICAL SERVICE PUBLICATIONS AND SERVICE FORMS CAN BE USED, FORM KDC91B, SHOWN ON THE REVERSE SIDE OF THIS PAGE.

REQUISITION FOR TECHNICAL SERVICE PUBLICATIONS AND SERVICE FORMS

COMPLETE FORM AND RETURN TO ⟶

Komatsu America International Company
440 North Fairway Drive
Vernon Hills, IL 60061-8112 U.S.A.
Attn: Technical Publications
Fax No. (847) 970-4186
Tel No. (847) 970-5887

SHIP TO ⟶

TYPE or PRINT ONLY ⟶

COMPANY NAME
ATTN.
STREET ADDRESS
CITY, STATE, ZIP CODE
COUNTRY

PURCHASE ORDER NO.

ORDER DATE

PHONE NO.	FAX NO.	SHIPPING METHOD	DISTR/BRANCH CODE

IMPORTANT - TO ASSURE SHIPMENT OF THE CORRECT PUBLICATION(S), THE MODEL NUMBER AND MACHINE SERIAL NUMBER MUST BE SHOWN.

QTY.	PUBLICATION FORM NO.	PARTS BOOK ⬇ P-Paper M-Microfiche	PUBLICATION DESCRIPTION	MODEL NUMBER	SERIAL NUMBER

KDC91D 081696

CURRENT PRICES WILL BE CHARGED

FOREWORD

This manual provides rules and guidelines, which will help you use this machine safely and effectively.

Keep this manual handy and have all personnel read it periodically. If this manual is lost or becomes dirty and can not be read, request a replacement manual from your local distributor if you are the owner or end user or from Komatsu Dresser Co. if you are a distributor.

If you sell the machine, be sure to give this manual to the new owner.

Continuing improvements in the design of this machine can lead to changes in detail, which may not be reflected in this manual. Consult your local distributor if you are the owner or end user or consult Komatsu Dresser Co. if you are a distributor for the latest available information on your machine or for questions regarding information in this manual.

WARNING! Improper operation and maintenance of this machine can be hazardous and could result in serious injury or death. Operators and maintenance personnel must read this manual thoroughly before operating or maintaining this machine. This manual should be kept near the machine for reference and periodically reviewed by all personnel who come across it. Some actions involved in operation and maintenance of the machine can cause a serious accident, if they are not performed in the manner described in this manual. The precautions and procedures given in this manual apply only to the intended uses of the machine. If you use the machine for any unintended uses that are not specifically prohibited, you must be sure that it is safe for you and others. In no event should you or others engage in prohibited uses or actions as described in this manual.

NOTICE: Komatsu Dresser Co. delivers machines that comply with all applicable regulations and standards of the country to which it has been shipped. If the machine has been purchased in another country or purchased from someone in another country, it may lack certain safety features and specifications that are necessary for use in your country. If there is any question about whether your product complies with the applicable regulations and standards of your country, consult your local distributor or Komatsu Dresser Co. before operating the machine.

- Operation, inspection, and maintenance should be carefully carried out, and safety must be given first priority. The safety information contained in this manual is intended only to supplement safety codes, insurance requirements, local laws, rules and regulations.
- Some photographs and illustrations are different from your machine as technical improvement is continually reflected on it. Revision to up-to-date manual's content is performed in later editions.
- This operation & maintenance manual may contain attachments and optional equipment that is not available in your area. Please consult your local Komatsu Dresser distributor for those items you may require.

Materials and specifications are subject to change without notice.

SAFETY INFORMATION

Most accidents are caused by the failure to follow fundamental safety rules for the operation and maintenance of machines.

To avoid accidents, read, understand and follow all precautions and warnings in this manual and on the machine before performing operation and maintenance.

To identify safety messages in this manual and on machine product graphics, the following signal words are used.

DANGER! - This word is used on safety messages and product graphics where there is a high probability of serious injury or death if the hazard is not avoided. These safety messages and product graphics usually describe precautions that must be taken to avoid the hazard. Failure to avoid this hazard may also result in serious damage to the machine.

WARNING - This word is used on safety messages and product graphics where there is a potentially dangerous situation, which could result in serious injury or death if the hazard is not avoided. These safety messages and product graphics usually describe precautions that must be taken to avoid the hazard. Failure to avoid this hazard may also result in serious damage to the machine.

CAUTION! - This word is used on safety messages and product graphics for hazards, which could result in minor or moderate injury if the hazard is not avoided. These safety messages and product graphics might also use this word for hazards where the only result could be damage to the machine.

NOTICE - This word is used for precautions that must be taken to avoid actions, which could shorten the life of the machine.

Komatsu Dresser cannot predict every circumstance that might involve a potential hazard in operation and maintenance. Therefore the safety message in this manual and on the machine may not include all possible safety precautions. If any procedures or actions not specifically recommended or allowed in this manual are used, you must be sure that you and others can do such procedures and actions safely and without damaging the machine. If you are unsure about the safety of some procedures, contact your local distributor if you are the owner or end user or Komatsu Dresser Co. if you are a distributor.

BREAKING IN THE NEW MACHINE

Each machine is carefully adjusted and tested before shipment. However, a new machine requires careful operation during the initial 100 hours as indicated by the service meter.

If a machine is subjected to unreasonably hard use at the initial operation stage, the potential of performance will prematurely deteriorate and the service life will be reduced. A new machine must be operated with care, particularly with regard to the following items.

During breaking in:

- After starting, let the engine idle for 5 minutes to allow proper engine warm-up prior to actual operation.
- Avoid operation with heavy loads or at high speeds.
- Avoid sudden starts or acceleration, unnecessarily abrupt stops and sharp steering except in cases of emergency.
- At the first 250 hours of operation, the machine should be maintained in the manner described in Section 3 "MAINTENANCE". In addition:
  1) Replace the transmission oil filter element.
  2) Replace the engine oil filter cartridge and oil.
  3) Check and adjust the engine valve clearance.

★ If the machine is delivered without any cooling water in the radiator, flush the cooling system with ample clean water to clean the system, then fill the radiator with cooling water.

★ When replacing oil filters elements (cartridges), check their interiors for dirt and dust. If heavily collected, check for possible cause before starting operation.

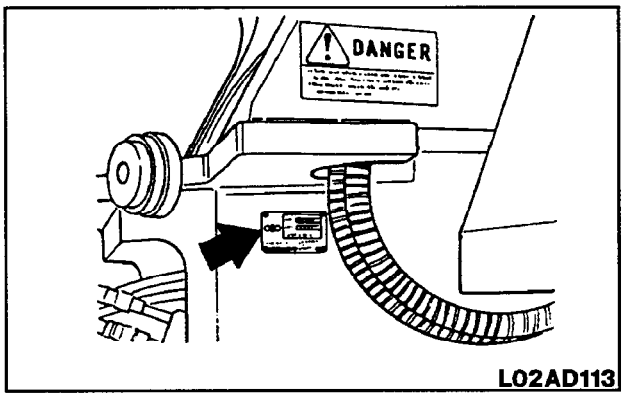
★ Hours of operation are indicated by the service meter.

MACHINE AND ENGINE SERIAL NUMBERS

When calling for service of a mechanic or when making a replacement parts order, be sure to give your distributor the machine and engine serial numbers as well as the service meter reading before mentioned. These numbers are found on the number plates shown in the following figures.

- Location of the machine serial number plate

  It is located on the center right side of the front frame.

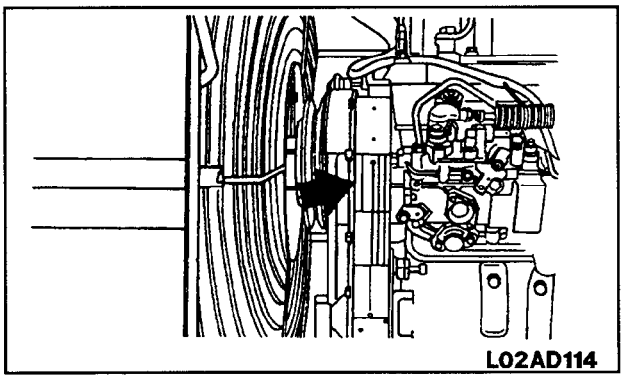


L02AD113

- Location of the engine data plate

  It is located on the right side of the engine timing gear box when seen from the fan side.

★ The engine data plate, shows specific information about your engine and provides the information for ordering parts and service needs.


L02AD114

QUICK REFERENCE INFORMATION

MACHINE MODEL NAME & MACHINE SERIAL NO. _____

ENGINE MODEL NAME & ENGINE SERIAL NO. _____

DISTRIBUTOR'S NAME: _____

DISTRIBUTOR'S ADDRESS & TELEPHONE NO. _____

NOTES OR REMARKS: _____

PERIODIC SERVICE

ITEM	DATE	SERVICE METER READING
DELIVERY		
PERIODIC		
PERIODIC		
PERIODIC		

CONSUMABLE PARTS

PART NO.	PART DESCRIPTION	QTY.

CONTENTS

DESCRIPTION **PAGE**

FORWARD 0-1

INTRODUCTION 0-2
- SAFETY INFORMATION 0-2
- BREAKING IN THE NEW MACHINE 0-3
- MACHINE AND ENGINE SERIAL NUMBERS 0-4
- QUICK REFERENCE INFORMATION 0-5
- CONTENTS 0-6

SAFETY PRECAUTIONS -- SECTION 1

GENERAL PRECAUTIONS 1-2
- PERSONNEL PRECAUTIONS 1-2
- MACHINE PRECAUTIONS 1-2

OPERATION 1-3
- BEFORE STARTING 1-3
- START-UP 1-4
- GENERAL OPERATING PRECAUTIONS 1-4
- DRIVING THE MACHINE 1-5
- OPERATING THE ATTACHMENTS 1-6
- PULLING/TOWING 1-6
- SHUTDOWN 1-7

MAINTENANCE 1-7
- GENERAL MACHINE PRECAUTIONS 1-7
- GENERAL WORK PRECAUTIONS 1-8
- ATTACHMENTS 1-9
- BRAKES 1-9
- CAB/ROPS 1-9
- COOLING 1-9
- ELECTRICAL 1-10
- ENGINE 1-10
- FUEL SYSTEM 1-11
- HYDRAULICS 1-11
- TIRES AND RIMS 1-11
- TURBOCHARGER 1-11

SAFETY PRODUCT GRAPHICS AND LOCATIONS 1-12

OPERATION -- SECTION 2

GENERAL VIEW 2-2

INSTRUMENTS AND CONTROLS 2-3
- CLUSTER GAUGE 2-3
  - TORQUE CONVERTER OIL TEMPERATURE GAUGE 2-3
  - ENGINE COOLING WATER TEMPERATURE GAUGE 2-4
  - FUEL GAUGE 2-4
  - VOLTMETER 2-4
- PILOT LAMPS, METERS 2-5
  - BRAKE OIL LEVEL PILOT LAMP 2-5
  - PARKING BRAKE PILOT LAMP 2-5
  - EMERGENCY STEERING NORMAL PILOT LAMP (OPT) 2-6
  - EMERGENCY STEERING PILOT LAMP (OPT) 2-6

TURN SIGNAL PILOT LAMP 2-6
SPEEDOMETER 2-6
WORKING PILOT LAMP 2-7
HIGH BEAM PILOT LAMP 2-7
SERVICE METER 2-7
SWITCHES 2-8
PARKING LAMP AND TRANSMISSION CUT-OFF SELECTOR SWITCH 2-8
WORKING LAMP AND CLUSTER GAUGE CHECK SWITCH 2-9
LAMP SWITCH 2-9
STARTING SWITCH 2-10
HORN BUTTON 2-10
ETHER START SWITCH 2-11
CAB DOME LAMP SWITCH 2-11
FRONT WIPER SWITCH 2-11
REAR WIPER SWITCH 2-11
PEDALS AND LEVERS 2-12
DIRECTIONAL LEVER 2-12
SPEED CONTROL LEVER 2-12
SAFETY LOCK (FOR DIRECTIONAL LEVER) 2-13
SPEED CONTROL LEVER STOPPER 2-13
TURN SIGNAL LEVER 2-13
ACCELERATOR PEDAL 2-13
BRAKE PEDALS 2-14
WORK EQUIPMENT CONTROL LEVER 2-15
WORK EQUIPMENT CONTROL LEVER LOCK 2-16
PARKING BRAKE LEVER 2-16
CAB DOOR HOLD OPEN LOCK 2-16
FUSE BOX 2-17
FUSE BOX I 2-18
FUSE BOX II 2-18
OPERATOR'S SEAT 2-19
RIGID TYPE 2-19
FORWARD-BACKWARD ADJUSTMENT 2-19
SEAT HEIGHT ADJUSTMENT 2-19
BACKREST ADJUSTMENT 2-19
BUCKET TYPE SEAT (OPT) 2-19
FORWARD-BACKWARD ADJUSTMENT 2-19
SEAT ANGLE ADJUSTMENT 2-19
SEAT CUSHION ADJUSTMENT 2-19
BACKREST ADJUSTMENT 2-19
SEAT HEIGHT ADJUSTMENT 2-19
SEARS SEAT 2-20
FORWARD-BACKWARD ADJUSTMENT 2-20
SEAT ANGLE ADJUSTMENT 2-20
WEIGHT ADJUSTMENT 2-20
BACKREST TILT ADJUSTMENT 2-20
HEIGHT ADJUSTMENT 2-20
KAB SEAT 2-21
WEIGHT ADJUSTMENT 2-21
HEIGHT ADJUSTMENT 2-21
BACKREST ANGLE ADJUSTMENT 2-21
FORE AND AFT ADJUSTMENT 2-21
HEADREST ADJUSTMENT 2-21
RIGHT SIDE ARMREST 2-21
SEAT BELT 2-22

CIGARETTE LIGHTER 2-23

AIR CLEANER SERVICE INDICATOR 2-23

FRAME LOCKING BAR 2-23

CONTENTS

DRAWBAR PIN 2-24

CAB HEATER AND DEFROSTER 2-25
CONTROL PANEL 2-25
FAN SPEED SWITCH 2-25
FOOT / DEFROSTER SELECT LEVER 2-25
AIR INTAKE SELECTOR LEVER 2-25

CHECK BEFORE STARTING 2-26
WALK-AROUND CHECK 2-26
CHECK AND REFILL COOLANT 2-26
CHECK OIL LEVEL AND REFILL IN ENGINE OIL PAN 2-27
CHECK FUEL LEVEL AND REFILL FUEL 2-27
CHECK AIR CLEANER SERVICE INDICATOR 2-28
CHECK AND REFILL OF OIL IN BRAKE OIL TANK 2-28
ADDITIONAL CHECKS 2-29
CHECK ELECTRICAL WIRING 2-29
DRAIN THE WATER FROM PRIMARY FUEL FILTER/WATER SEPARATOR 2-29

OPERATING YOUR MACHINE 2-30
BEFORE STARTING THE ENGINE 2-30
STARTING ENGINE 2-31
SPECIAL STARTING 2-31
COLD WEATHER STARTING 2-32
CHECKS AFTER STARTING 2-34
COLD WEATHER WARM-UP PROCEDURE 2-34
MOVING MACHINE OFF 2-35
CHANGING GEAR SPEED 2-36
CHANGING DIRECTION 2-36
TURNING 2-37
TO STOP THE MACHINE 2-38
TO STOP THE ENGINE 2-39
OPERATIONS AFTER STOPPING ENGINE 2-39
OPERATIONAL PRECAUTIONS 2-40
WORKING IN DUSTY LOCATIONS 2-40
MAXIMUM DEPTH OF WATER 2-40
IF WHEEL BRAKE DOES NOT WORK 2-41
PRECAUTIONS WHEN DRIVING UP OR DOWN SLOPES 2-41
LOWER THE CENTER OF GRAVITY WHEN TURNING 2-41
BRAKING ON DOWNHILL SLOPES 2-41
IF ENGINE STOPS 2-41
POSSIBLE WORK USING LOADER 2-42
EXCAVATION 2-42
LEVELING 2-44
LOAD AND CARRY OPERATIONS 2-45
LOADING 2-45
Cross Drive Loading 2-45
V-Shape Loading 2-45
PARKING MACHINE 2-46
PRECAUTIONS WHEN TIRE CHAINS ARE FITTED 2-46
PROCEDURE FOR MOVING R.H. LADDER 2-46
PROCEDURE FOR MOVING L.H. LADDER 2-47

ADJUSTMENT OF WORK EQUIPMENT 2-48
ADJUSTING BOOM KICKOUT 2-48
ADJUSTING BUCKET POSITIONER 2-49
BUCKET LEVEL INDICATOR 2-49

HANDLING TIRES 2-50
PRECAUTIONS WHEN HANDLING TIRES 2-50
PRECAUTIONS WHEN DRIVING MACHINE 2-50

TIRE PRESSURE 2-50

TOWING 2-52
TOWING THE MACHINE 2-52
WHEN ENGINE CAN BE USED 2-52
WHEN ENGINE CANNOT BE USED 2-52

TRANSPORTATION 2-52

COLD WEATHER OPERATION 2-53
PREPARATION FOR LOW TEMPERATURE 2-53
FUEL AND LUBRICANTS 2-53
COOLANT 2-53
BATTERY 2-53
CAUTIONS AFTER COMPLETION OF WORK 2-53

AFTER COLD WEATHER 2-54

LONG TERM STORAGE 2-54
BEFORE STORAGE 2-54
DURING STORAGE 2-54
AFTER STORAGE 2-54

HANDLING OF BATTERY 2-55
PRECAUTIONS FOR CHARGING BATTERY 2-55
REMOVAL AND INSTALLATION OF BATTERY 2-55
STARTING ENGINE WITH BOOSTER CABLES 2-55
BEFORE CONNECTING BOOSTER CABLES 2-55
CONNECTING BOOSTER CABLES 2-56
STARTING ENGINE 2-56
DISCONNECTING BOOSTER CABLES 2-56

TROUBLESHOOTING 2-57
ELECTRICAL SYSTEM 2-57
ENGINE 2-57
CHASSIS 2-58
TRANSMISSION 2-58
DRIVE AXLES 2-58
WHEEL BRAKES 2-58
PARKING BRAKE 2-58
STEERING 2-58
EQUIPMENT HYDRAULIC SYSTEM 2-58

MAINTENANCE -- SECTION 3

PERIODIC MAINTENANCE 3-2

MAINTENANCE GUIDELINES 3-2

OUTLINES OF SERVICE 3-3
LUBRICATION WHEN SHIPPED 3-3
RELATING TO ENGINE 3-4
ENGINE OIL 3-4
COOLANT 3-4
DIESEL FUEL 3-4
RELATING TO HYDRAULIC SYSTEM 3-4
RELATING TO ELECTRICAL SYSTEM 3-4
RELATING TO LUBRICATION 3-5
BLEEDING AIR 3-5
BLEEDING AIR FROM HYDRAULIC TANK 3-5

CONTENTS

BLEEDING AIR FROM THE WHEEL BRAKE HYDRAULIC CIRCUIT 3-6
BLEEDING AIR FROM FUEL SYSTEM 3-7

WEAR PARTS REPLACEMENT 3-9

PERIODICAL PART REPLACEMENT 3-9

LUBRICANTS, FUEL AND COOLANT 3-10
PROPER SELECTION TABLE 3-10
ENGINE OIL 3-11
Normal Operation 3-11
Arctic Operation 3-11
AXLE OIL 3-12
GREASE 3-12
DIESEL FUEL 3-12
COOLANT 3-12

SCHEDULED MAINTENANCE GUIDE 3-19

OIL FILLER AND LEVEL GAUGE POSITIONS 3-23

INITIAL 250 HOURS SERVICE ONLY 3-24
TRANSMISSION OIL FILTER 3-24

WHEN REQUIRED 3-24
COOLANT ADDITIVE CONCENTRATION - DCA4 3-24
AIR CLEANER ELEMENT 3-24
CHECKING 3-24
CLEANING OR REPLACING OUTER ELEMENT 3-25
REPLACING INNER ELEMENT 3-25
CLEANING OUTER ELEMENT 3-26
TRANSMISSION OIL 3-27
RADIATOR CORE 3-27
WINDSHIELD WASHER TANKS 3-28
DRIVE AXLE OIL 3-28
DRIVE AXLE HOUSING BREATHERS 3-29
LUBRICATING 3-29
BUCKET BOLT-ON CUTTING EDGE - IF EQUIPPED 3-31
BUCKET TEETH - IF EQUIPPED 3-31
BUCKET IS EQUIPPED WITH BOLT-ON TEETH 3-31
BUCKET IS EQUIPPED WITH WELDED ON OR REPLACEABLE TIP TEETH 3-32
PARKING BRAKE 3-33
INSPECTION 3-33
ADJUSTMENT 3-33

CHECK BEFORE STARTING 3-34

EVERY 50 HOURS SERVICE 3-34
FUEL TANK 3-34
TIRES 3-34

EVERY 100 HOURS SERVICE 3-34
HYDRAULIC TANK 3-34
LUBRICATING 3-35

EVERY 250 HOURS SERVICE 3-37
LUBRICATING 3-37
WHEEL HUB BOLTS 3-39
ENGINE OIL PAN AND FILTER 3-40
BATTERY ELECTROLYTE 3-41
AIR INTAKE SYSTEM 3-42

EVERY 500 HOURS SERVICE 3-42
LUBRICATING 3-42
FUEL FILTERS 3-43
GENERAL 3-43
REPLACEMENT 3-43
TRANSMISSION OIL FILTER 3-45
ANTIFREEZE CONCENTRATION 3-45

EVERY 1000 HOURS SERVICE 3-46
LUBRICATING 3-46
HYDRAULIC TANK AND FILTER 3-48
TRANSMISSION CASE BREATHER 3-49
TRANSMISSION OIL AND STRAINER 3-49
ENGINE VALVES 3-50
DRIVE BELT 3-53
DRIVE BELT, TENSIONER BEARING AND FAN HUB 3-53

EVERY 2000 HOURS SERVICE 3-54
DRIVE AXLES 3-54
HYDRAULIC TANK BREATHER 3-56
BRAKE DISC 3-56
VIBRATION DAMPER 3-56
COOLING SYSTEM 3-57

SPECIFICATIONS -- SECTION 4

GENERAL SPECIFICATIONS 4-1

STANDARD TIGHTENING TORQUES 4-7
STANDARD TIGHTENING TORQUE OF BOLTS AND NUTS 4-7
TIGHTENING TORQUE OF SPLIT FLANGE BOLTS 4-7
TIGHTENING TORQUE FOR NUTS OF FLARED FITTINGS 4-8

UNIT CONVERSIONS 4-9
AREA 4-10
DENSITY (Mass Density) 4-10
FORCE 4-11
FORCE PER LENGTH 4-11
HEAT 4-11
LENGTH 4-12
MASS (WEIGHT) 4-12
POWER 4-13
PRESSURE 4-13
TEMPERATURE 4-13
TEMPERATURE INTERVAL OR TOLERANCE 4-14
VOLUME 4-14
TORQUE 4-15
VELOCITY 4-15

CONTENTS

MEMORANDUM

SECTION 1
SAFETY PRECAUTIONS

WARNING ! REFER TO AND READ ALL SAFETY PRECAUTIONS IN SECTION 1.

SAFETY PRECAUTIONS

AVOID ACCIDENTS

WORK SAFETY -- FOLLOW THESE RULES

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT

This symbol is used throughout this manual to call your attention to instructions concerning personal safety. Observe and follow these instructions. Be certain anyone operating or servicing this machine is aware of these rules. Failure to follow these rules may result in injury or death.

GENERAL PRECAUTIONS

PERSONNEL PRECAUTIONS

Operating and servicing this machine can be hazardous if performed improperly. Personnel must have the necessary skills, information and equipment and use safe and proper procedures. Study the Operation and Maintenance Manual before operating or servicing this machine. Consult your Distributor for information and service.

Only trained and authorized personnel should be allowed to operate and service this machine.

Read all warning product graphics before starting, operating, maintaining or repairing this machine.

DO NOT wear jewelry or loose fitting or hanging clothing because they could catch on moving parts and cause injury or death. Wear proper safety equipment, such as a hard hat, rough-soled work shoes or safety shoes, ear protectors, reflective vests, respirators, safety glasses, goggles and heavy gloves. Consult your employer for specific requirements.

DO NOT jump on or off the machine. Keep two hands and one foot, or two feet and one hand, in contact with the steps and handholds at all times. Place objects on machine from ground level before climbing on. Always face the machine when climbing on or off to reduce the chances of slipping and injury.

Think before you act. Careful operators and service personnel are the best insurance against accidents.

Do not rush. Hurrying can lead to accidents. Haste, carelessness and lack of training are the primary causes of equipment-related injuries.

MACHINE PRECAUTIONS

Carefully evaluate your application's particular safety needs. Each machine application can have unique requirements. You may need such attachments as: rear windshield wipers, windshield washers, heater, defroster fan, warning lights, air conditioning, ROPS, mirrors, backup alarm, fire extinguisher, spark arrestor, fire suppression system, cab screens, sound suppression, rotating beacon, additional lights, anti-vandalism attachments, guards, tow hook, Lexann windows, water glycol, communication radios, ground driven steering, turn signals, and slow moving vehicle sign. Consult your Distributor for information.

Be sure the machine has the correct equipment required by local rules and regulations.

A rollover protective structure (ROPS) with a seat belt is required by OSHA in almost all applications. DO NOT operate this machine without a ROPS.

It is recommended that the machine be equipped with a fully charged fire extinguisher with an Underwriter's Laboratory (UL) rating of 2A:10B:C (or higher). Personnel should be instructed in proper usage. Recharge immediately after use.

If the machine will be used for tree removal or site clearing, install approved operator guards per S.A.E. or OSHA requirements. Consult your Distributor for information.

If the machine will be working under conditions of flying combustible material, install screens and guards to reduce the chance of fire.

If the machine is equipped with a suction fan (or a reversible fan in the suction position), check the engine exhaust system periodically for leaks. Exhaust gases are dangerous to the operator. On machines

equipped with a cab, keep a vent open to outside air.

Keep shields and guard in place for your protection. Be sure to replace them after servicing the machine.

A first-aid kit should be available in case of an injury.

When transporting the machine, use caution when loading and unloading it. Load and unload the machine in a level area which fully supports the machine and transport vehicle. Block the transport vehicle so it cannot move. Use loading ramps of adequate strength, low angle and proper height. Keep the trailer bed and the machine's tires clean of clay, oil and other slippery materials. Lock the machine's front and rear frames together with the frame locking bar and pins. Apply the machine's parking brake. Block the tires and securely tie down the machine and the machine tires, to the trailer bed.

OPERATION

BEFORE STARTING

Before entering the operator's compartment, walk completely around the machine and clear the area of personnel and obstructions.

Perform a visual check of the machine before starting the engine. Look for such things as missing protective devices, leaks, improper fluid levels, trash buildup and loose, damaged or missing parts. DO NOT start the engine until any unsafe conditions are corrected.

Before operating the machine, check that the frame locking bar and pins are in the storage position on the rear frame. A broken or lost frame locking bar or pins should be replaced immediately so that this device is always available for use.

Be sure all filler caps, dipsticks, plugs, latches, service doors, etc., are secure before starting.

BE SURE the operator's compartment, mounting steps and handholds are free of oil, grease, snow, ice, mud and foreign objects to reduce the possibility of slipping and injury. Repair any damaged steps or handholds. Remove or secure all maintenance and personal items which might interfere with the operator or jam the controls.

Do not use the machine's controls or hoses as handholds when climbing on or off the machine. Controls and hoses can move and do not provide solid support. Movement of the controls may cause unexpected machine movement and injury.

Understand all control functions before starting the engine.

Know the alternate exit routes from the operator's compartment for use in an emergency.

If the machine is equipped with a cab, the right hand side door of the cab serves as an emergency exit. Use only if the left hand side door is blocked.

The operator must be alert, physically fit and free from the influences of alcohol, drugs and medications that might affect his eyesight, hearing or reactions.

Safety must always be the operator's most important concern. He must refuse to operate when he knows it is unsafe and consult his supervisor when safety is in doubt.

START-UP

Never start the engine indoors unless proper exhaust ventilation is provided to remove deadly exhaust gases. Once the engine is running, move the machine outdoors as soon as possible. Exhaust gases are hazardous and can cause unconsciousness and death.

Sit in the operator's seat before operating any controls. Keep hands and footwear free of grease, water and mud to insure positive control movement.

Before starting the engine, or when machine is standing with the engine running: place the transmission directional lever in neutral (N), apply the parking brake and lower any raised equipment.

DO NOT SMOKE when using the ether start. Do not use the ether start when the air temperature is above freezing. Follow the correct method for starting the engine. Refer to "STARTING ENGINE" in Section 2.

Before driving the machine, adjust the seat and fasten the seat belt. Adjust the seat for maximum comfort and control of the machine. Adjust the seat belt to fit snugly and low around the hips to lessen the chance and severity of injury in the event of an accident. Never wear the seat belt across the abdomen.

Use of the seat belt with the ROPS is strongly recommended. In the event of a rollover, stay with the machine. Experience has shown this will reduce the chance and seriousness of injury.

Before moving the machine, check the brakes, steering, attachment controls and safety devices. DO NOT operate the machine until any unsafe conditions have been corrected.

Before moving the machine, sound the horn to warn nearby personnel.

Release the parking brake before moving the machine. The brake could burn or be damaged if the machine is driven with it applied.

Turn off the defroster fan before adjusting it to avoid injury.

NEVER HAUL PASSENGERS. Only the operator should be on the machine when it is moving.

Use caution and follow the manufacturer's instructions when using external heaters to warm the power train in cold weather.

GENERAL OPERATING PRECAUTIONS

Stay alert and aware of what you are doing. Use common sense. Do not operate when fatigued or ill. Know your machine and its capabilities. Use the machine only for its intended purposes. For your safety, read the Operation and Maintenance Manual carefully and follow all instructions and precautions.

Provide proper ventilation when operating in a closed area to minimize the danger of exhaust gases. Exhaust gases are hazardous and can cause unconsciousness and death.

Maintain clear vision of all work and travel areas. Keep windows and mirrors clean and repaired.

Look in the intended travel direction to be sure personnel and allied equipment do not interfere with the machine's work pattern. Do not operate if exposed personnel enter the immediate work area.

Turn on the machine's lights at night and times of poor visibility to see and be seen.

DO NOT adjust the seat while the machine is moving because a loss of control may result. Stop the machine, apply the parking brake and then adjust the seat.

Keep head, limbs and body inside the operator's compartment at all times because of the chance of being injured by hazards outside the operator's compartment.

NEVER allow anyone near the center articulation pivot. If the machine turned, they could be crushed.

NEVER allow anyone to stand on the ladder when the bucket is raised or the machine is moving or turning to prevent injury from falling, crushing or falling material.

NEVER get on or off the machine while it is moving because serious injury or death could result.

After starting and while operating, observe instruments and warning lights frequently. Investigate any unusual indications or noises in the machine.

If the engine has a tendency to stall, investigate immediately. Do not operate the machine until the cause has been corrected.

If noise exposure exceeds 90 dBA for eight hours, wear ear protective equipment.

DRIVING THE MACHINE

Carry the bucket low for maximum visibility and stability when traveling.

Before operating in areas with overhead obstructions, carefully check overhead clearance. Obstructions, such as guy wires, power lines, tree branches, bridges and building doors could cause a rollover accident.

Drive slowly enough to insure complete control. Slow down when traveling in congested areas or on mud, ice or other slippery surfaces. Keep a safe distance away from other vehicles, according to the load and ground conditions.

Avoid crossing obstacles, such as ridges, curbs, logs and rocks. If you cannot avoid them, reduce speed and cross at an angle. Ease up to the breakover point, pass the balance point slowly and ease down on the other side.

Cross ditches and gullies slowly and at an angle after checking that the ground will safely support the machine.

Avoid sidehill travel whenever possible. Drive straight up and down the hill. If the machine starts slipping sideways, turn downhill immediately.

When traveling on hills with a loaded bucket, travel forward up the hill and in reverse down the hill.

Stop, look and listen before entering a highway. Stay on the right side of the road. Slow down and signal when turning off.

When roading the machine, engage the hydraulic control lever lock to guard against accidental actuation of the levers. Personal injury could result if the bucket catches on a ledge in the road.

Do not use the transmission disconnect brake pedal when traveling fast or going downhill because this shifts the transmission into neutral. Loss of control or damage to the power train could result when the pedal is released and the transmission is re-engaged.

Never shift the transmission into neutral (N) when traveling downhill. The machine could go out of control or the power train could be damaged when the transmission is shifted into gear again.

Do not overspeed the engine. Excessive speeds can be hazardous and harmful to the power train. Select the proper gear before starting downhill. Control speed with the brakes.

Never use the bucket as a brake except in an emergency. It might catch on the ground and result in personal injury.

If the main steering light comes on, IMMEDIATELY stop the machine in a safe place. Shut off the engine and apply the parking brake. Correct the cause before operating again.

If the brake system warning light or buzzer comes on during operation, IMMEDIATELY stop the machine in a safe place. Apply the parking brake. Correct the cause before operating again.

Know the traffic flow pattern of the job site. Obey flagmen, signs and signals.

Give the right-of-way to loaded machines. On narrow or hilly roads, loaded machines should stay next to the high wall.

Keep the machine as close to the side of the road as safely as possible to leave room for oncoming and passing vehicles.

Pass other vehicles only when the road is clear and the machine has enough distance and reserve power to pass.

OPERATING THE ATTACHMENTS

Check the work area for hazardous conditions. Be alert for soft ground conditions, especially when working on slopes, near dropoffs or excavations or on fill material, which could lead to sudden tipping of the machine.

Keep the work area free from obstructions and as smooth as possible.

Know the locations of underground cables, water mains, gas lines, etc. A broken gas line or electrical cable could cause personal injury or death.

Avoid operating too close to an overhang, deep ditch or excavation because the machine's weight and vibration may cause the edge to collapse and result in personal injury. If this cannot be avoided, use extra caution and face the machine toward the edge while operating.

Avoid undercutting high banks because the bank may cave in. Ramp up and remove the top layers first.

Trucks should be loaded from the driver's side whenever possible. When the truck is being loaded, be sure the driver either stays in the cab (on cab-protected trucks) or away from the truck and loader.

When loading trucks, be careful not to hit the truck with the loader or its bucket.

Use extra caution when moving with the bucket raised to minimize the chance of machine upset.

DO NOT swing a load over the heads of other workers or a truck cab.

If the loader begins to tip over because of an overload, IMMEDIATELY lower the bucket to regain stability.

There in no substitute for good judgment when working on a slope. Slope operation should be limited by ground and traction conditions, the load being carried and the speed of the machine.

NEVER operate sideways on a steep slope because a rollover and serious injury could result.

Using the loader to carry large objects which do not fit into the bucket is NOT recommended. Handling large objects can be extremely dangerous because the objects may roll or slide down the lift arms onto the operator. NEVER lift large objects higher than the operator unless the machine has a device which prevents the objects from falling back onto the operator.

When pushing over trees, the machine must have approved operator protection. Back away immediately when the tree starts to fall. Use extreme care when pushing over trees with dead branches which may fall. To reduce the chance of machine upset, never allow the machine to climb up the root structure.

PULLING/TOWING

For your safety, never push or tow a disabled machine farther than absolutely necessary to load it onto a truck.

When using a chain or cable, be sure it is strong enough for the expected load and properly secured to the drawbar pin.

Hitch only to the drawbar pin. Machine upset can result if pulling from the wrong location.

When pulling, position the machine so that the chain or cable aligns with the long axis of the machine.

Inspect chains and cable for flaws before using. Avoid kinking. Do not pull with a kinked chain or cable because the high stresses could cause a failure in the kinked area. Wear heavy gloves when handling chain or cable.

When pulling with a chain or cable, take up the slack slowly to avoid jerking. A chain or cable which fails under load can whip and cause serious injury. STAND CLEAR. DO NOT PULL OR TOW UNLESS THE OPERATOR'S COMPARTMENT IS GUARDED AGAINST OR OUT OF REACH OF A WHIPPING CHAIN OR CABLE.

SHUTDOWN

Never leave the machine with the engine running or the bucket raised. When parking the machine, shut off the engine, lower the bucket to the ground, place the transmission directional lever in neutral (N), apply the parking brake, turn off the electrical starting switch and remove the key.

Raised lift arms will drop when the control lever is moved to "LOWER" or "FLOAT" even with the engine off. ALWAYS lower the lift arms when parking the machine.

If the machine is equipped with a multi-purpose bucket, close the clam before dismounting.

Park the machine in a non-traffic area. If parking in traffic lanes cannot be avoided, provide appropriate flags, barriers, flares and warning signals. Also provide advance warning signals in the traffic lane for approaching traffic.

Avoid parking on a slope because unexpected machine movement may occur. If necessary to park on a slope, park at right angle to the slope and block the tires.

Always lock the machine, including any anti-vandalism attachments, when leaving it unattended.

MAINTENANCE

GENERAL MACHINE PRECAUTIONS

Constantly be aware of dangers involved in working on the machine and take proper precautions. It is not possible to anticipate all conceivable ways or conditions under which this machine may be serviced or to provide precautions for all the possible hazards that may result. Safety is always the most important rule. Standard and accepted safety precautions and equipment should be used.

Do not attempt repairs you do not understand. Consult your Distributor for information and service.

NEVER run the engine when cleaning or lubricating the machine because serious injury could result from contacting moving parts.

Before servicing the machine, BE SURE the engine is off, the bucket is lowered, the transmission directional lever is in neutral (N), the parking brake is applied and the electrical starting switch is off and the key is removed. Tag the machine.

Before working on the engine or electrical system, disconnect the negative (ground) battery cable. Tag the cable and controls to warn against starting.

Before working under the machine, block the tires to prevent machine movement.

ALWAYS lock the front and rear frames together with the safety bar and pins before working near the center of the machine. If the frames move, serious injury could result.

NEVER stand near the bucket or the tires while the engine is running.

During servicing, DO NOT allow anyone in the operator's compartment who is not trained and assisting in the servicing.

When it is necessary to make any checks or adjustments with the engine running, use two people. A trained operator must be at the controls to safeguard the mechanic making the checks or adjustments. BE SURE the transmission directional lever is in neutral (N), the parking brake is applied and the front and rear frames are locked together.

Be sure the engine hood or access door(s) is secure in the open position during service work in the engine compartment. Unexpected closing could cause injury.

NEVER remove any guards or shields with the engine running because of the danger of contacting rotating parts.

When service requires access to areas that cannot be reached from the ground or a service platform on the machine, use a ladder or platform of appropriate capacity.

Use only approved parts for repairs and maintenance. Failure to do so could compromise personal safety, machine performance and reliability.

This machine is assembled using high strength fasteners. Replacement fasteners must be of the same size and strength as the originals. DO NOT SUBSTITUTE. Refer to the Parts Book for this machine. Tighten fasteners to the proper torque. Refer to Section 4.

Replace any missing or defaced product graphics. When parts which have product graphics on them are replaced, be sure to install new product graphics.

New product graphics are available from your Distributor. For the proper position of the product graphic, refer to "SAFETY PRODUCT GRAPHICS AND LOCATIONS".

NEVER adjust relief valves higher than the specified pressure because this may damage the machine and lead to an injury. When checking pressures, use the correct gauge for the expected pressure. Consult your Distributor for information and service.

GENERAL WORK PRECAUTIONS

Keep work area clean and dry. Remove water and oil spills immediately to reduce the chance of slipping and injury.

Do not pile up oily or greasy rags; they are a fire hazard. Store them in an approved, closed metal container.

Use a non-toxic, non-flammable commercial solvent for cleaning parts, unless otherwise specified.

Avoid use of gasoline, diesel fuel, kerosene or other flammable solvents for cleaning parts. NEVER place these solvents in an open drain.

Corrosion inhibitors are volatile and flammable. Use them only in a well ventilated area. Keep flames and sparks away. Do not smoke. Store container in a cool, well ventilated place.

Avoid prolonged exposure to volatile corrosion inhibitors because eye and skin irritation may occur.

Excessive or repeated skin contact with sealants or solvents may cause skin irritation. In case of skin contact, remove sealant or solvent promptly by washing with soap and water. Follow the manufacturer's advice whenever cleaning agents or other chemicals are used.

Wear eye protection when using air or water under pressure to clean parts. Limit air pressure to 2.1 kg/cm^2 (30 psi / 200 kPa) and water pressure to 2.8 kg/cm^2 (40 psi / 275 kPa).

When cutting, grinding, pounding, prying or whenever material could fly or fall, wear proper protective equipment such as goggles, hard hat, safety shoes and heavy gloves. Many of the machine's parts are hardened and can chip.

Wear hand and eye protection when draining hot fluids.

When welding, wear proper protective equipment, such as a helmet, dark safety glasses, protective clothing, gloves and safety shoes. DO NOT LOOK AT THE ARC WITHOUT PROPER EYE PROTECTION.

If necessary to do welding on the machine, attach the ground cable close to the weld area. Do not attach the ground cable where the current can flow through bearings or mounting pads because this will damage the parts.

Use extra caution when jacking up the machine. Jacking up the machine can be hazardous if performed improperly. Use jacking equipment of sufficient capacity. Be sure the jacking points are strong enough to support the machine. Be sure the jack is stable and well supported. Before jacking up the machine, block the tires which will not be lifted. Lock the front and rear frames together with the locking bar and pins. If the rear tires are being lifted, block the rear axle to prevent it from pivoting unexpectedly. DO NOT run the engine with the machine on jacks. For your safety, transfer the weight of the machine to approved blocks, before servicing the machine.

Use the proper tool for the job. Be sure all tools are in good condition. Do not use tools which are worn, bent or have mushroomed heads because they can lead to injury.

Never align holes with fingers or hands. Use the proper aligning tool to avoid injury.

Remove sharp edges and burrs from reworked parts.

Do not carry loose objects in pockets because they might catch on the machine and result in a fall or injury.

Use only properly grounded auxiliary power sources for chargers, heaters, electrical drills and similar equipment to reduce the chance of electrical shock.

Lift and handle all heavy parts with lifting devices of adequate capacity. Secure parts with proper slings and hooks. Use lifting eyes provided. Warn nearby personnel to stand clear.

DO NOT use the bucket to lift personnel or as a work platform. Mechanical failure or human error could cause unexpected movement of the attachment and serious injury or death.

ATTACHMENTS

For your protection, use EXTRA caution when adjusting the loader's bucket positioner or boom positioner. Use two trained people and guard against accidental movement of the machine or loader linkage.

For your protection, keep head, body, hands and fingers away from the bucket and linkage when they are in a raised position, unless they are securely blocked.

When replacing cutting edges and teeth, securely block the bucket for your protection.

To install and remove bucket teeth, use a nonferrous hammer. It is hazardous to hammer on the teeth. Wear safety glasses with side shields or goggles to reduce chances of injury.

BRAKES

Block the tires to prevent machine movement before servicing the brakes.

Test the parking brake periodically. If the parking brake does not hold the machine, correct the cause as soon as possible. Until the cause is corrected, park the machine on level ground and block the tires to prevent it from moving.

When testing the parking brake, be sure the area near the machine is clear of personnel and obstructions because the machine may move during the test.

CAB/ROPS

Do not attempt to repair a rollover protective structure (ROPS) after an accident. The ROPS is designed to bend during a rollover to protect the operator from sudden impact loads. Repaired structures do not provide the original strength and protection. O.S.H.A. regulations prohibit repair to damaged ROPS. Contact your Distributor for information on ROPS replacement. Do not operate the machine again until the ROPS has been replaced.

Do not cut, grind, weld or drill holes in the ROPS because this could weaken the structure or affect its energy absorption capability.

Periodically inspect the ROPS for fatigue cracks. Cracks indicate a weakened structure which should be replaced for your protection.

Do not use bleach, dye or solvents on the seat belt because this may weaken the webbing and result in personal injury. Clean the seat belt with warm water and a mild detergent. Replace belts with worn, frayed, torn, faded, stiff or rotted webbing.

COOLING

Hot, scalding coolant can spray out if the radiator cap is removed suddenly. Relieve system pressure by slowly turning cap to the first notch or lifting the safety lever (if equipped). Remove the cap ONLY after the pressure is relieved.

Use extreme caution when adding coolant to a hot radiator to avoid being burned. Wear gloves and goggles and keep face away from the filler neck.

ELECTRICAL

Batteries give off a highly flammable gas. DO NOT SMOKE or allow sparks or open flame near the batteries because a fire or explosion could result.

BE SURE the electrical starting switch is off when connecting or disconnecting batteries to minimize the chance of sparks and explosion.

DO NOT allow metal tools or a jumper cable clamp to contact the positive battery terminal and any other metal on the machine. The resulting sparks could cause an explosion.

When using a booster battery and jumper cables, connect the negative (ground) cable to the machine frame, AWAY FROM THE BATTERY. ALWAYS connect the ground cable last and disconnect it first to avoid sparks near the battery. A spark could cause a battery explosion and injury.

NEVER check the battery charge by placing a metal object across the terminals. The sparks could cause a battery explosion. Use a voltmeter or hydrometer to measure charge.

Battery acid causes severe burns. Avoid contact with eyes, skin or clothing. Wear goggles, rubber gloves and apron. If skin contact occurs, flush with water. If eye contact occurs, flush with water for 15 minutes and get prompt medical attention.

The engine can be started with the transmission in gear if the neutral start switch is bypassed. Do not connect across the terminals on the starter motor. Attach booster batteries as directed in this manual.

DO NOT charge batteries in a closed area. Provide proper ventilation to guard against explosion of an accumulation of the gas given off in the charging process.

ENGINE

Do not go into the engine compartment without securing the engine access panel door. Accidental closure of the door could cause injury.

Do not rework or modify the engine flywheel because this could weaken it and lead to a failure.

Keep the engine exhaust manifold(s) and exhaust system clear of combustible material to reduce the chance of fire.

Ether starting fluid is highly flammable. Follow the precautions on the container. An explosion can result if sparks or flame contact the ether in the container or if the container is stored where the temperature exceeds the temperature listed on the container. Observe the following precautions:

a. Follow the correct method for starting the engine. Refer to "STARTING ENGINE" in Section 2.

b. Do not use the ether start when the air temperature is above freezing.

c. DO NOT SMOKE when using ether starting fluid.

d. DO NOT store fluid containers in the operator's compartment or in direct sunlight. Store containers in a cool, well ventilated place.

e. Keep the fluid containers out of the reach of children.

f. Do not breathe the hazardous ether vapor.

g. Do not let ether contact your skin because it can cause frostbite.

h. NEVER puncture the fluid container or put it into a fire. Dispose of empty containers properly.

i. For your safety, remove the ether container when welding, grinding or using a torch on the machine.

FUEL SYSTEM

NEVER remove the fuel filler cap or fill the fuel tank while the engine is running or when the machine is indoors. The fumes are hazardous and a spark or flame could cause a fire or explosion.

DO NOT SMOKE while filling the fuel tank or servicing the fuel system because a fire or explosion could result.

When filling the fuel tank, place the fuel nozzle against the side of the filler neck to reduce the chances of static electricity sparks.

NEVER mix gasoline, gasohol or alcohol with diesel fuel. This creates a fire or explosion hazard which could result in personal injury or death.

HYDRAULICS

For your safety, lower the bucket before servicing the machine. Be sure no one is standing near the bucket when it is being lowered.

NEVER work under a raised bucket without proper blocking.

Before working on the hydraulic system, be sure the system pressure is relieved by moving the control levers in all directions with the engine off.

This machine has a pressurized hydraulic reservoir. Loosen the filler cap slowly to relieve the pressure before disassembly of any hydraulic system components. DO NOT OVERFILL.

DO NOT use hands to search for hydraulic leaks. Hydraulic oil escaping under pressure from a very small hole can be almost invisible, yet have sufficient force to penetrate the skin. Use a piece of cardboard or wood to search for suspected leaks. If injured by escaping oil, see a doctor immediately because of the possibility of serious infection or reaction to the oil.

TIRES AND RIMS

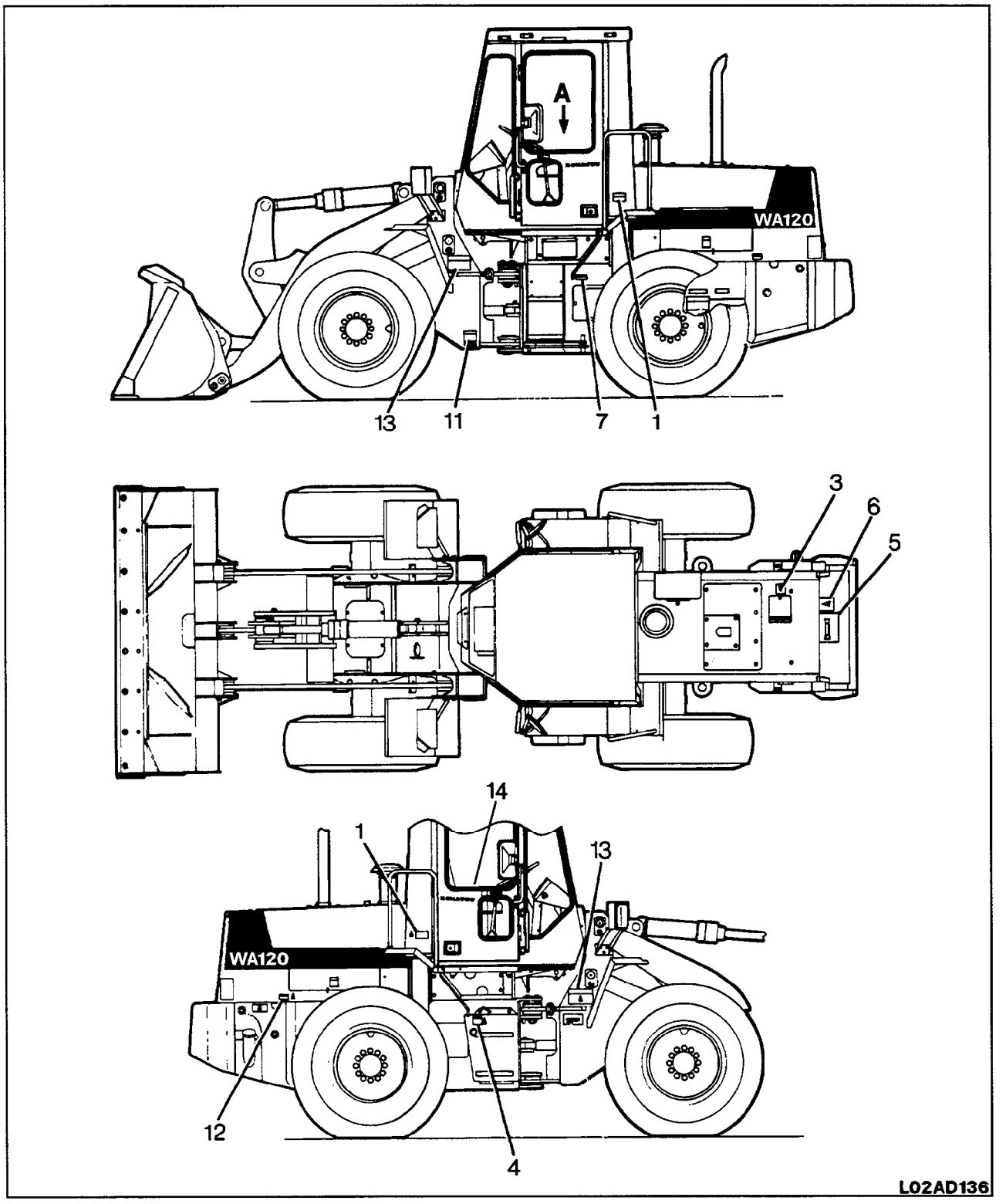
Tire and rim repairs MUST be done by specially trained people using special safety tools. An improperly repaired tire or rim can separate suddenly and cause serious injury.

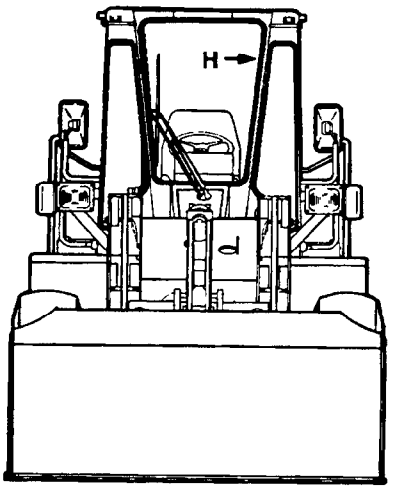
NEVER inflate a flat tire without inspecting the tire, rim and wheel for damage. Be sure all components are properly assembled. Unmounted tires being inflated or deflated should be placed in a tire safety cage. Inflate the tire to 0.3 kg/cm^2 (5 psi / 35 kPa) and check that all components are properly seated. NEVER stand directly in front of a tire and rim assembly while inflating. Use a clip-on chuck with a hose long enough to allow the person inflating the tire to stand to the side. Serious injury could result if the tire and rim were to separate.

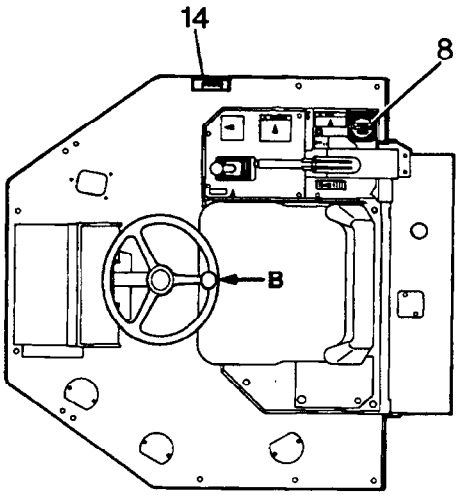
TURBOCHARGER

In certain types of engine service, the turbocharger air inlet hose must be removed so other parts are accessible for service or repairs. When the air inlet hose is removed, THE TURBOCHARGER IMPELLER IS EXPOSED AND CAN CAUSE SERIOUS PERSONAL INJURY AND/OR ENGINE DAMAGE. Engine operation creates a vacuum in the compressor strong enough to suck objects into the impeller. It is imperative to install a safety shield on the turbocharger inlet opening whenever air inlet hoses are removed. Failure to follow this precaution could result in serious injury.

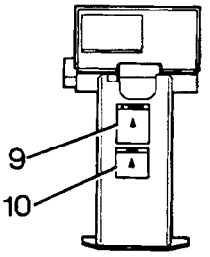
SAFETY PRODUCT GRAPHICS AND LOCATIONS



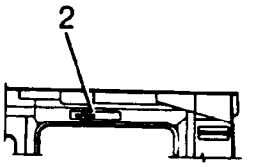




A



B



H

L02AD138

Always keep these product graphics clean. If they are missing or damaged, replace them with a new product graphic. Replacement product graphics can be ordered from your distributor.

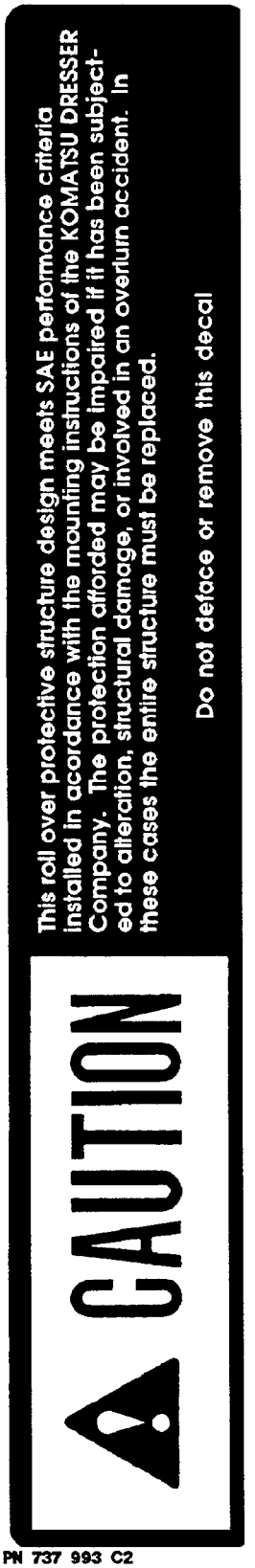
In addition to safety product graphics, the machine has instructional and identification product graphics, which should be treated in the same manner as described above.

Safety product graphics may be available in languages other than English. To find out more information about foreign language product graphics, contact your distributor.

1. Caution for ladder.

PN 161 177 H5 **L02AD101**

2. Caution for rollover.



L02AD102

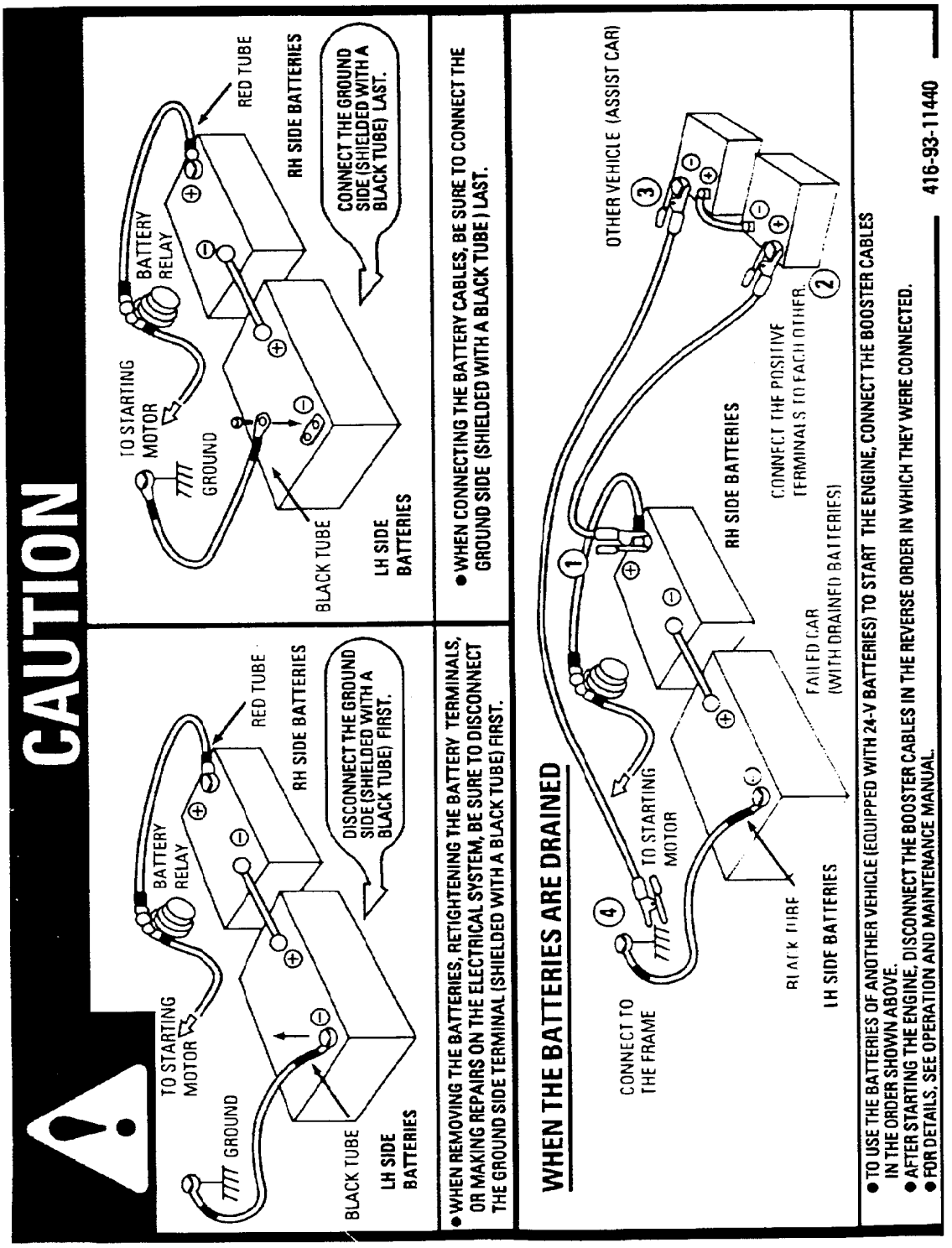
3. Caution for pressurized cooling system.

PN 204 166 C1 L02AD099

4. Caution for hydraulic reservoir.

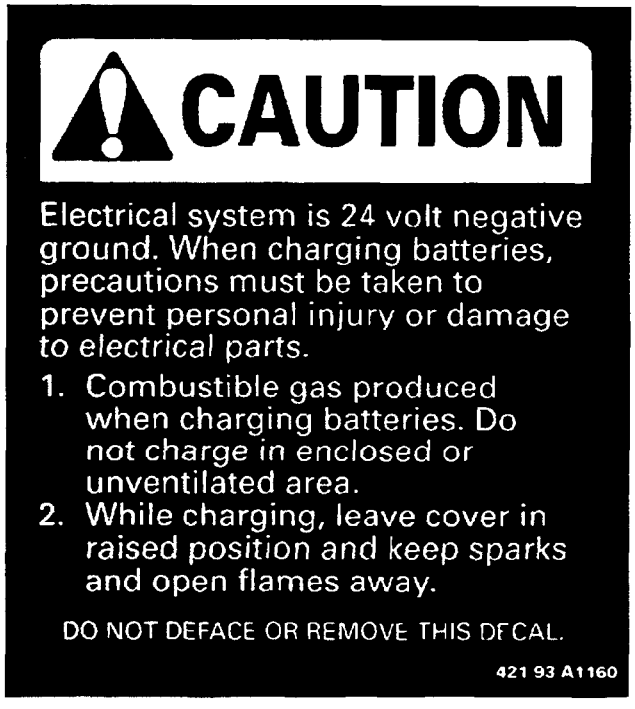
PN 2754 473 R3 L02AD103

5. Caution for battery installation.



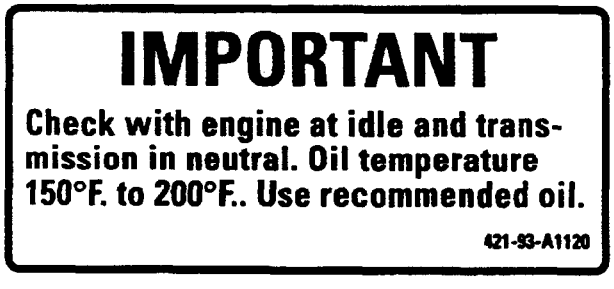
L02AD104

6. Caution for battery charging.



L02AD105

7. Caution for transmission oil level.

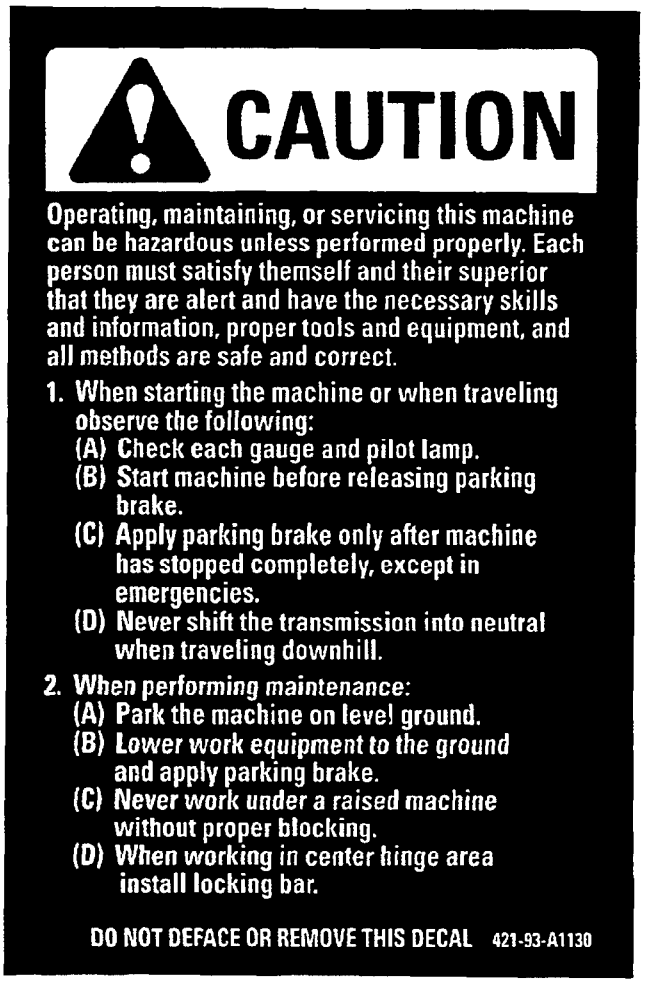


L02AD106

8. Warning for brake oil.

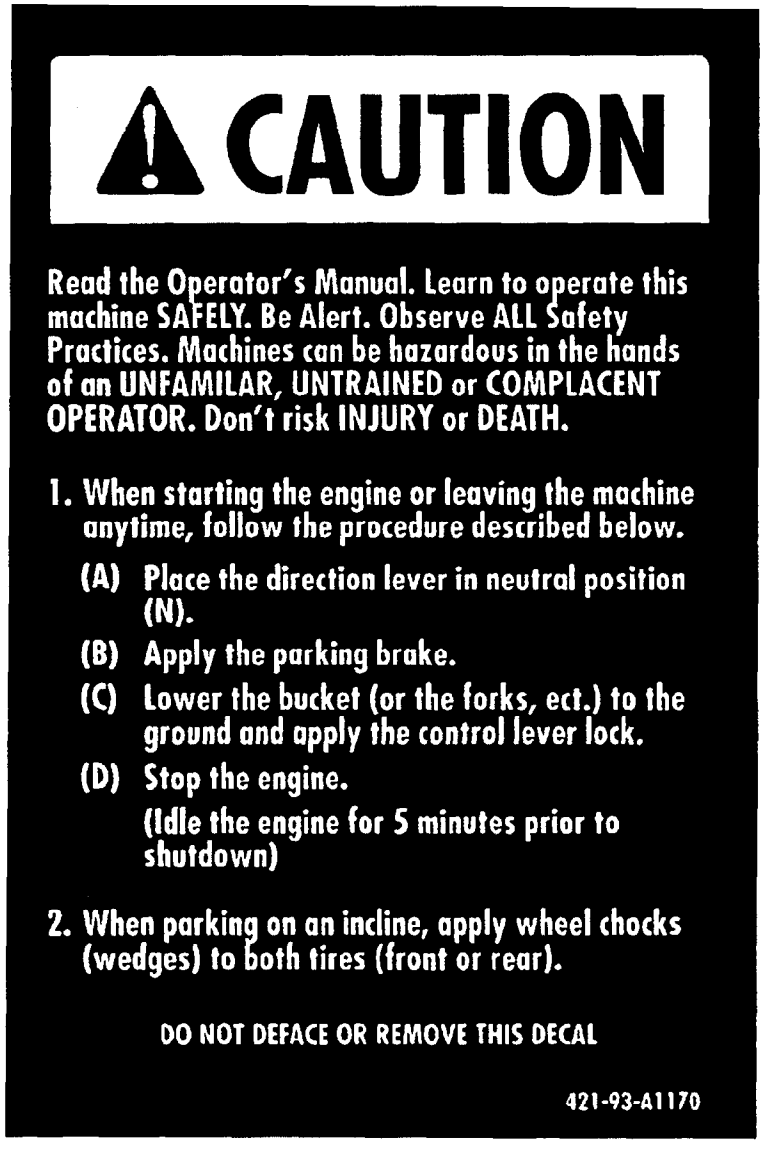
L02AD107

9. Caution for operator instructions.



L02AD108

10. Warning for operator and instructions.



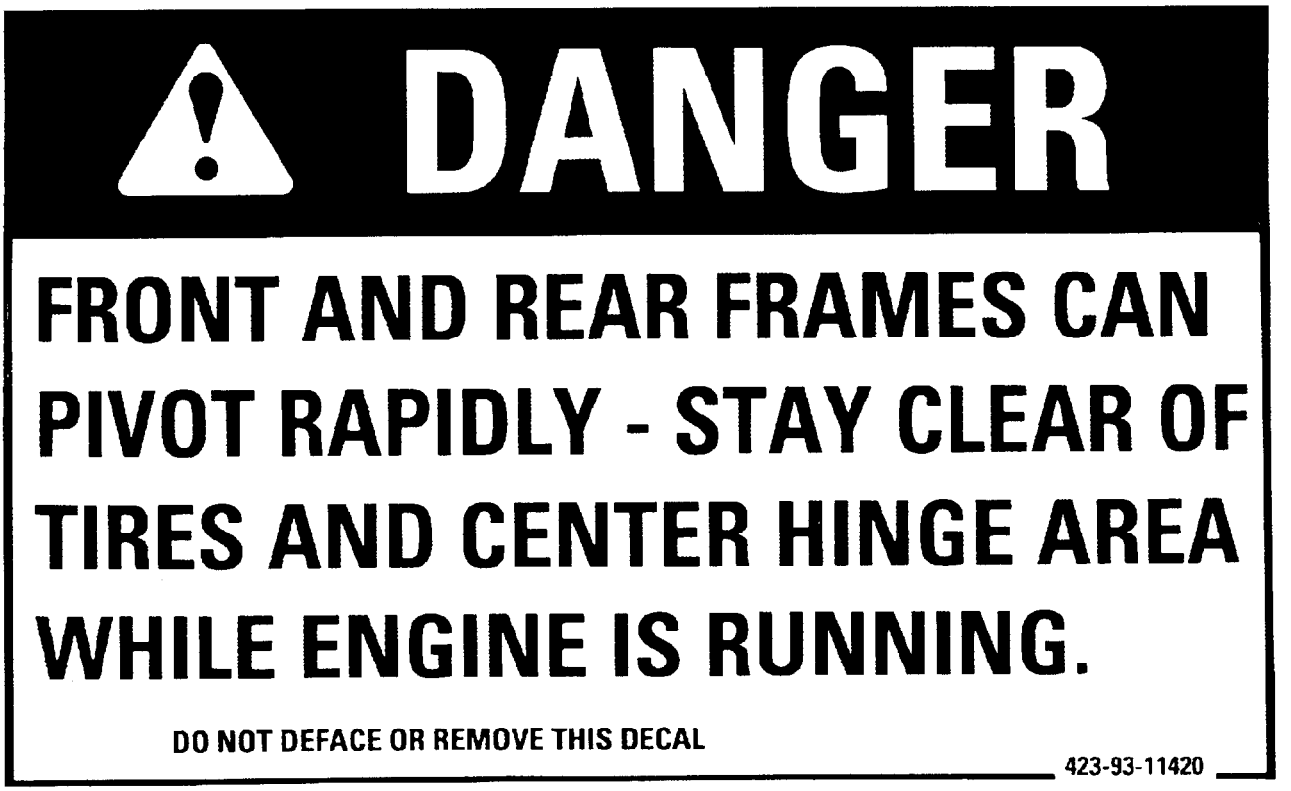
L02AD109

11. Danger for frame locking bar.

12. Caution for engine fan and fan belt.

L02AD111

13. Danger for no clearance between frames.



L02AD112

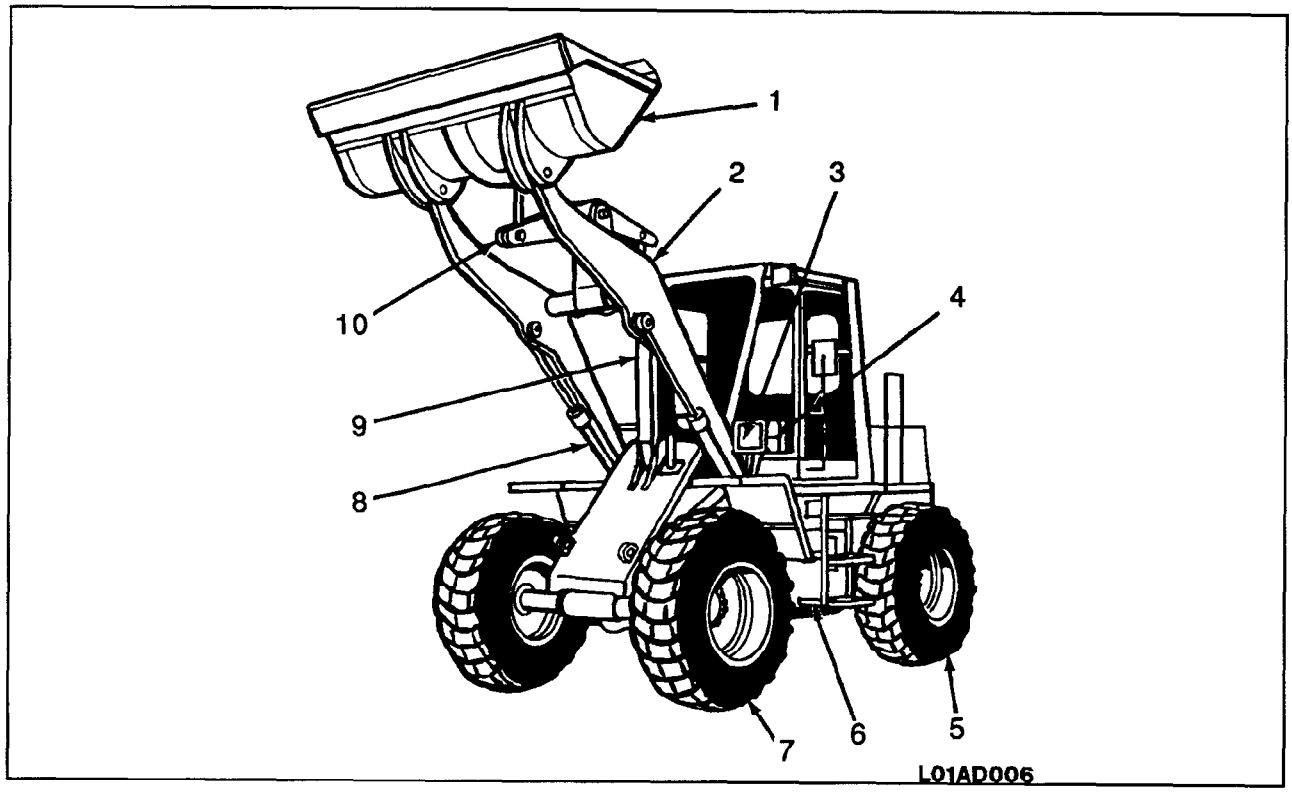
14. Emergency exit.

PN 1170 724 C2 L02AD100

SECTION 2
OPERATION

WARNING ! REFER TO AND READ ALL SAFETY PRECAUTIONS IN SECTION 1.

GENERAL VIEW

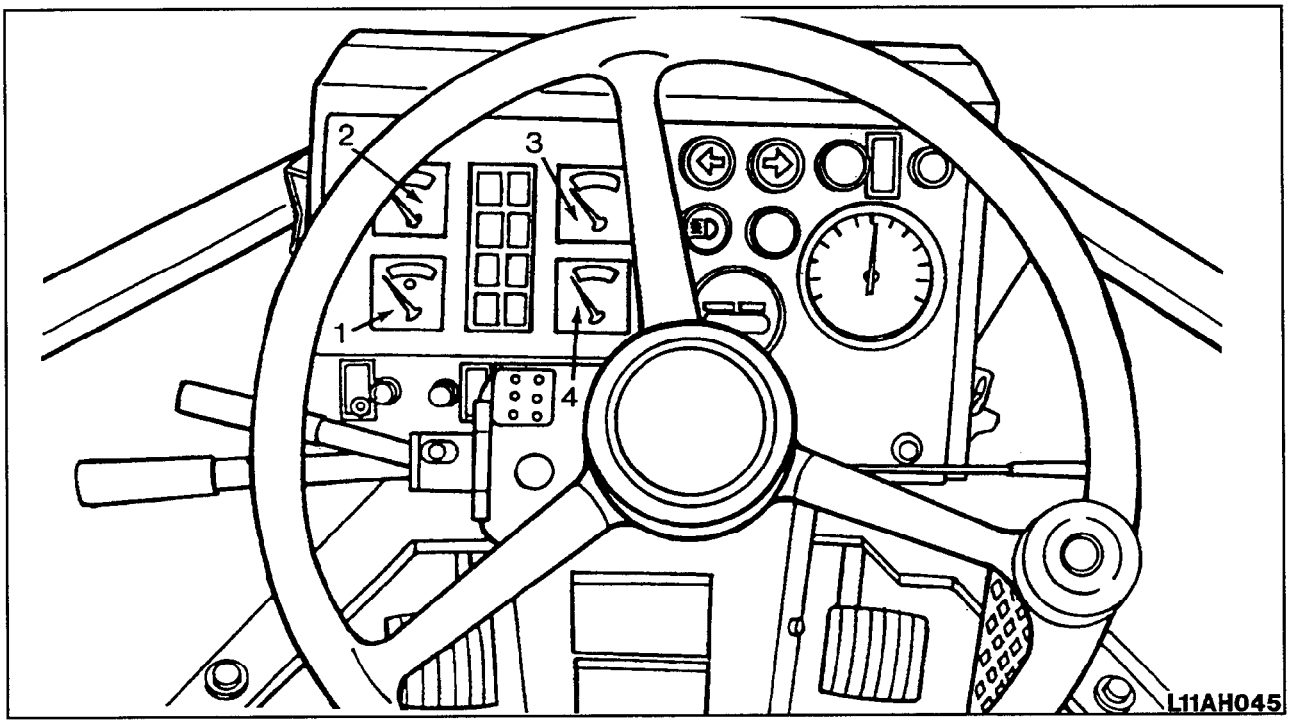


Wheel Loader With Cab and ROPS Canopy

1. Bucket
2. Lift arm
3. Head lamp
4. Turn signal lamp
5. Rear tire and wheel
6. Safety bar
7. Front tire and wheel
8. Lift cylinder
9. Dump cylinder
10. Tilt lever

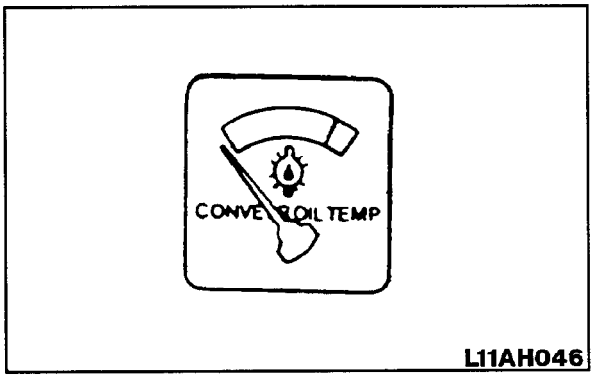
INSTRUMENTS AND CONTROLS

CLUSTER GAUGE



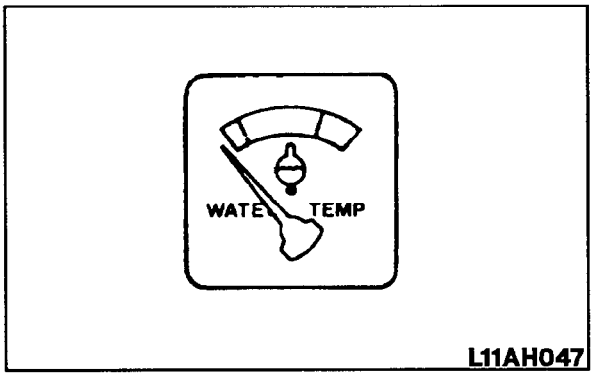
1. TORQUE CONVERTER OIL TEMPERATURE GAUGE

This gauge indicates the temperature of the torque converter oil. If the temperature is normal during operation, the needle indicates the green range. If the needle indicates the red range during operation, stop the machine and run the engine with no load at mid-range speed until the needle returns to the green range.



2. ENGINE COOLING WATER TEMPERATURE GAUGE

This gauge indicates the temperature of the cooling water. If the temperature is normal during operation, the needle indicates the green range. If the needle indicates the red range during operation, stop the machine and run the engine with no load at mid-range sped until the needle returns to the green range.

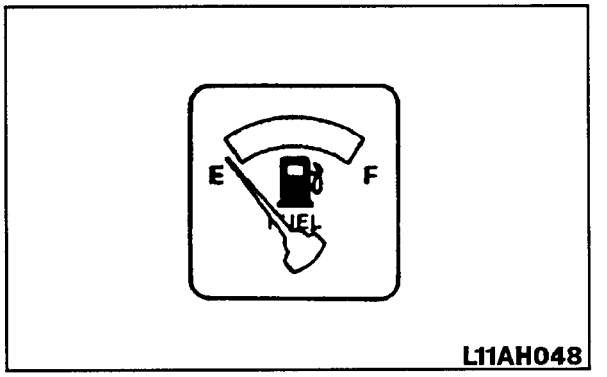


L11AH047

3. FUEL GAUGE

This gauge indicates the available fuel supply in the fuel tank, and "E" indicates the empty condition of the fuel, while "F" indicates the full condition.

★ Fuel tank should always be filled at the end of each day's work.

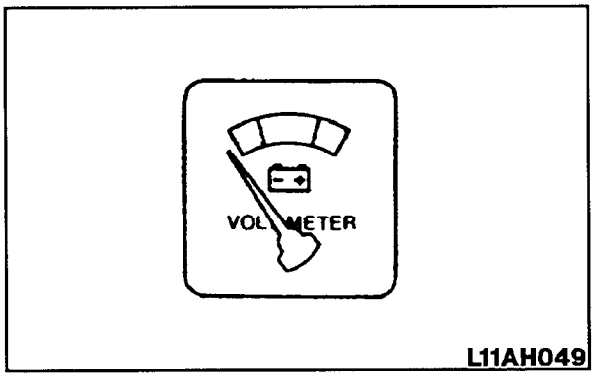


L11AH048

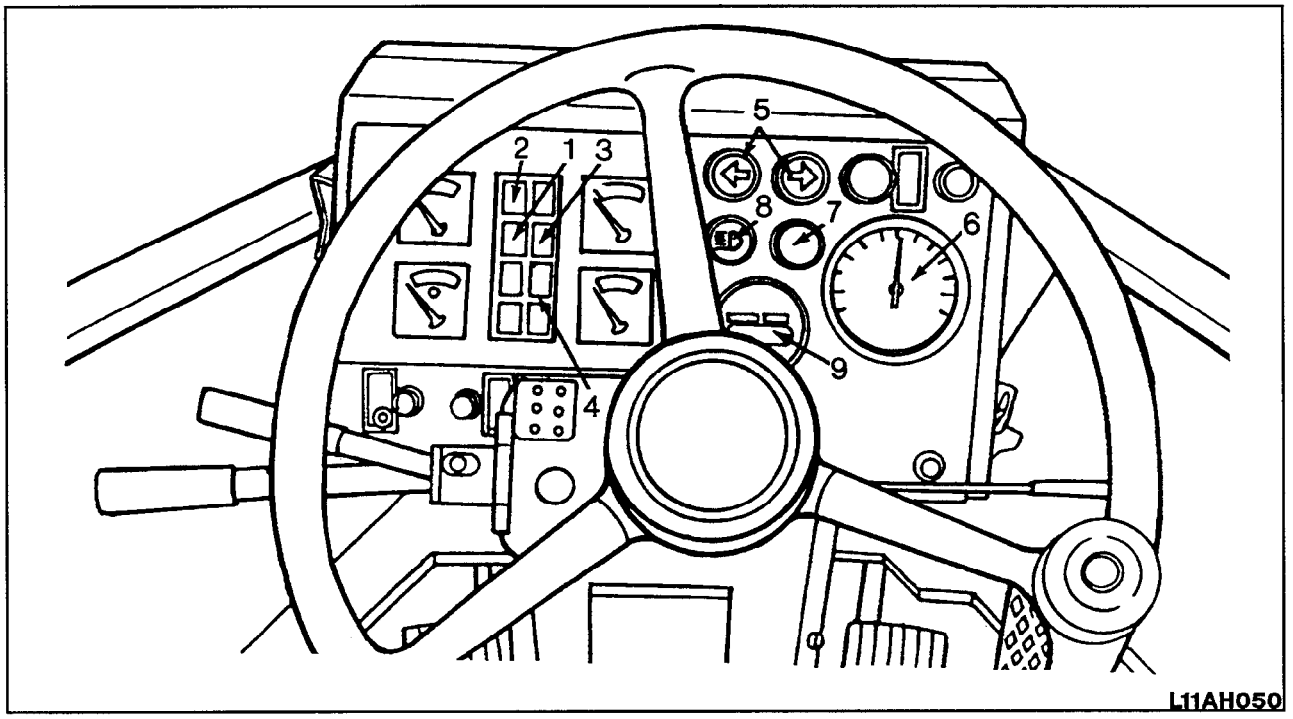
4. VOLTMETER

This meter indicates the voltage of the battery. If the voltage is normal during operation, the needle indicates the gen range. If the needle indicates the red range, stop the engine and inspect the electrical system.

★ Before starting the engine, turn ON the starting switch and check the gauge. If the needle indicates left range, check the battery immediately.


L11AH049

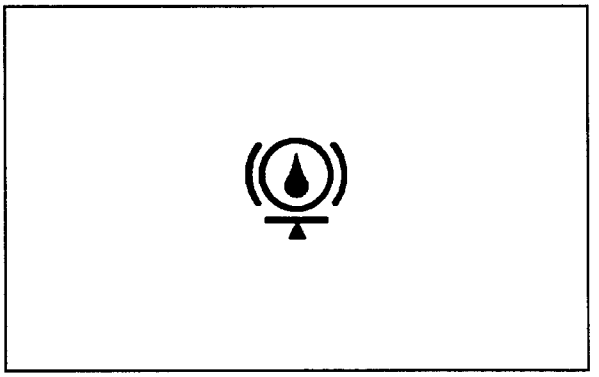
PILOT LAMPS, METERS



1. BRAKE OIL LEVEL PILOT LAMP

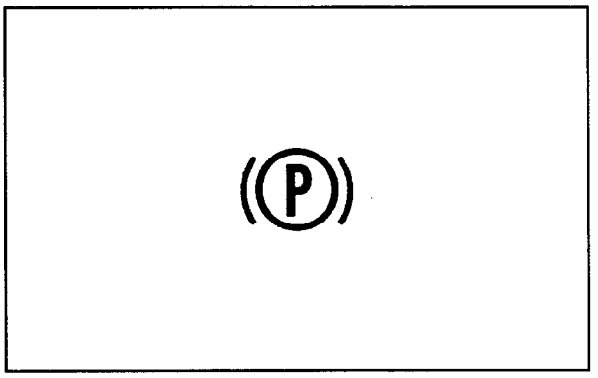
This lamp indicates a low brake oil level.

If the lamp lights, check the oil level and add engine oil to the brake system as required.



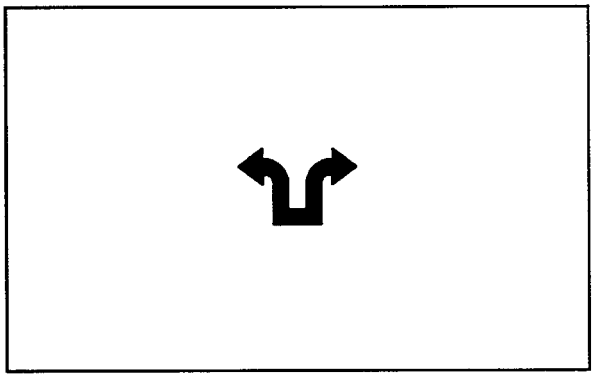
2. PARKING BRAKE PILOT LAMP

This lamp lights up when the parking brake is applied.



3. EMERGENCY STEERING NORMAL PILOT LAMP (OPT)

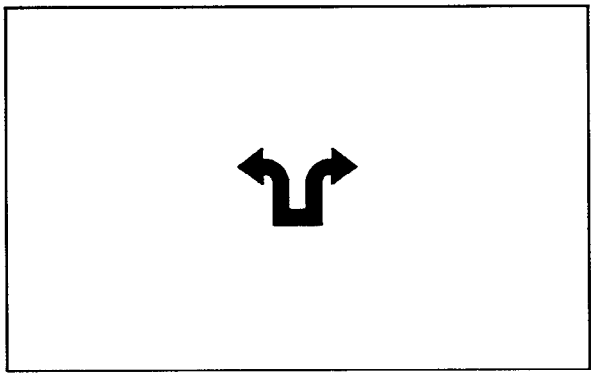
When the machine is traveling, this lamp is on to show that the emergency steering system pump is operating normally.



4. EMERGENCY STEERING PILOT LAMP (OPT)

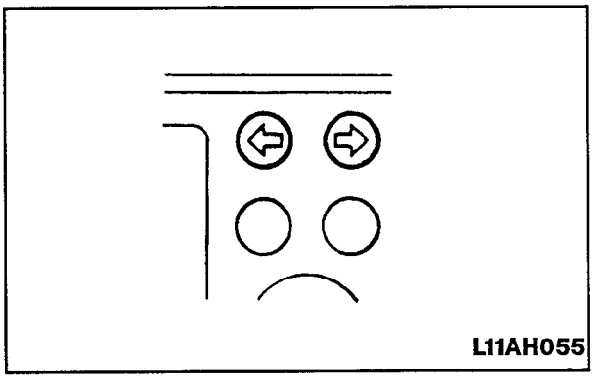
If the engine stops when the machine is traveling, or if the oil pressure in the steering pump drops, the lamp will light up.

WARNING! If the lamp lights up, move the machine immediately to a safe place and stop the machine.



5. TURN SIGNAL PILOT LAMP

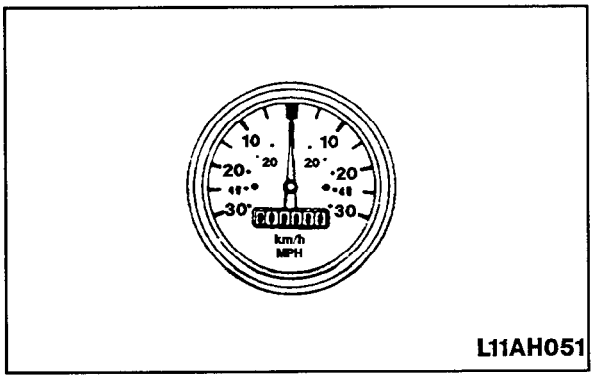
When the turn signal lamp flashes, the pilot lamp also flashes.



L11AH055

6. SPEEDOMETER

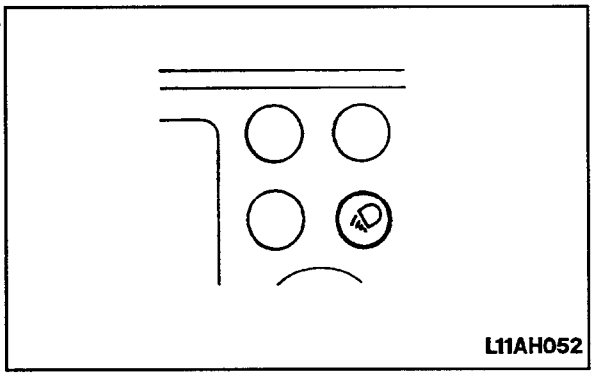
This meter indicates the running speed of the machine.



L11AH051

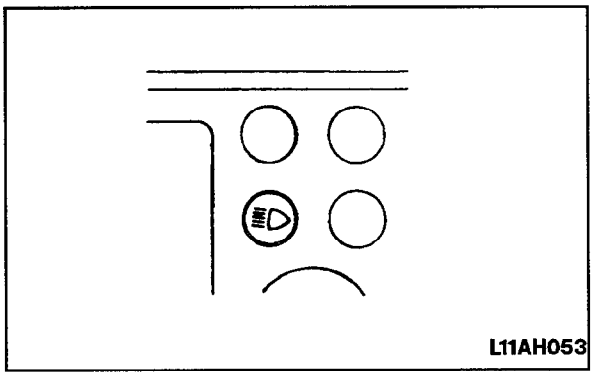
7. WORKING PILOT LAMP

This lamp lights up when the working lamps are switched on.



8. HIGH BEAM PILOT LAMP

This lamp lights up when the head lamp is at high beam.

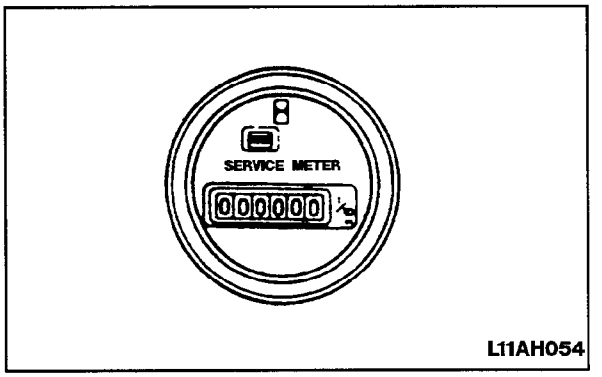


9. SERVICE METER

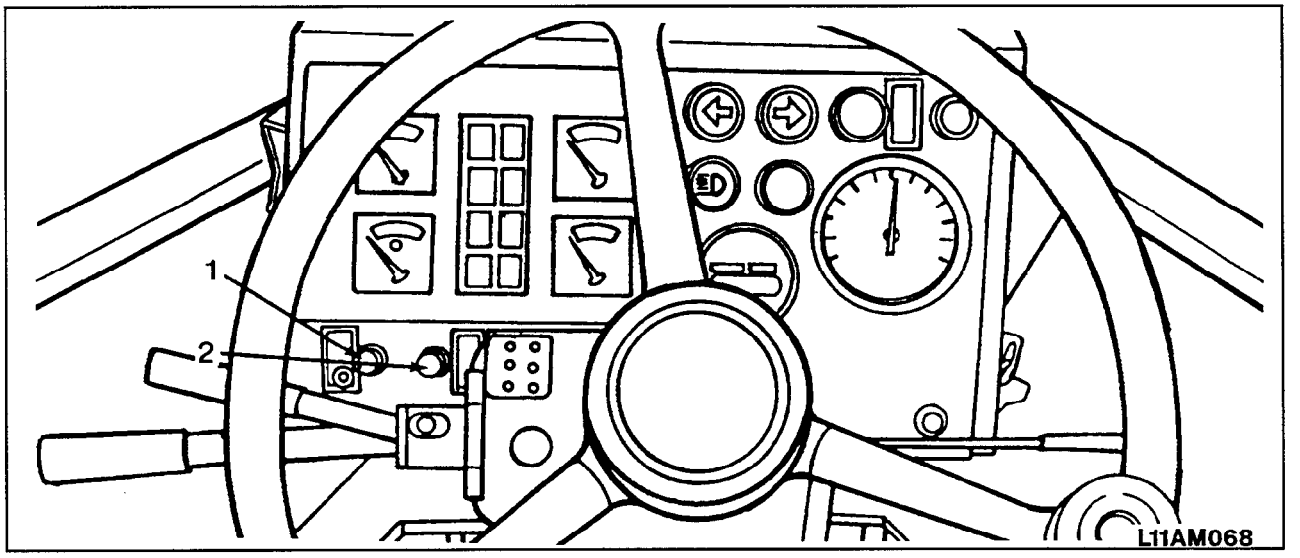
This meter shows the total operation hours of the machine. The service meter advances while the engine is running - even if the machine is not traveling.

Refer to section "SERVICE METER."

★ The indicator under the service meter rotates when the engine is running to show that the meter is running.



SWITCHES



1. PARKING LAMP AND TRANSMISSION CUT-OFF SELECTOR SWITCH

This has the function of turning on the front and rear parking lamps and switching the function of the left brake pedal.

Parking lamp

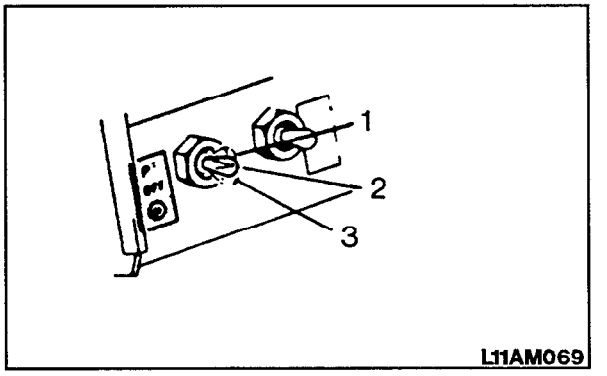
Position 1:
Lamps light

Transmission cut-off selector

(Select the operation of the left brake pedal.)

Position 1,2:
Depressing the left brake pedal operates the wheel brakes (like right brake pedal)

Position 3:
Depressing the left brake pedal operates the wheel brakes, and also returns the transmission to neutral.



★ Normally, put this switch in the ON position.

Position of switch	Parking lamp	Transmission cut-off
1	ON	OFF
2	OFF	OFF
3	OFF	ON

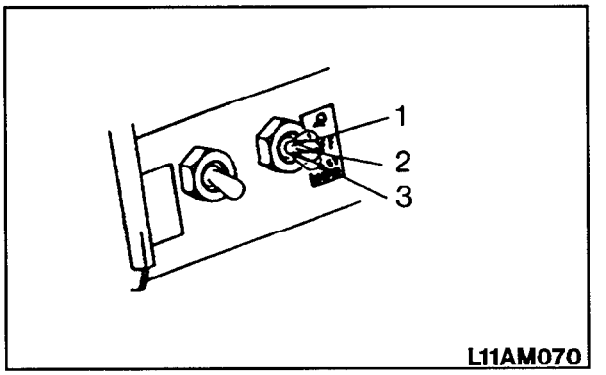
WARNING! If the machine has to be started on a slope, always turn the transmission cut-off selector switch to OFF and depress the left brake pedal. Then depress the accelerator pedal while releasing the left brake pedal to start the machine off slowly.

2. WORKING LAMP AND CLUSTER GAUGE CHECK SWITCH

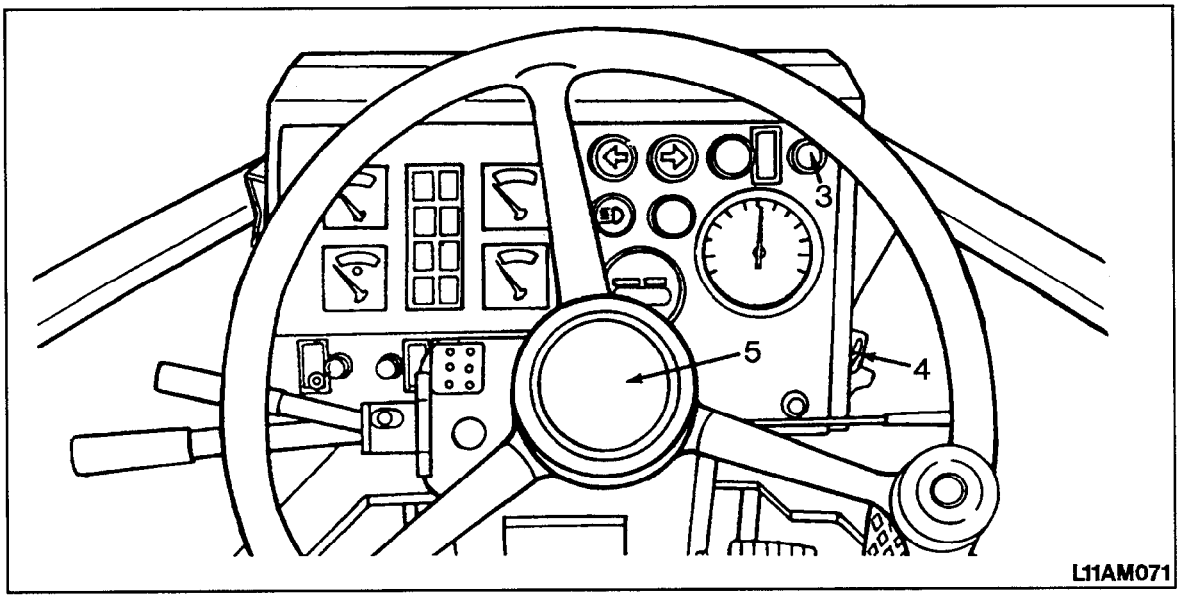
Position 1:
Front and rear working lamps and pilot lamp light.

Position 2:
Center position is OFF.

Position 3:
It is possible to check the lamps of the cluster gauge for blown-out bulbs. If the lamps light when the switch is in this position, the bulbs are normal.



WARNING! Turn off working lamps when traveling on public roads.



3. LAMP SWITCH

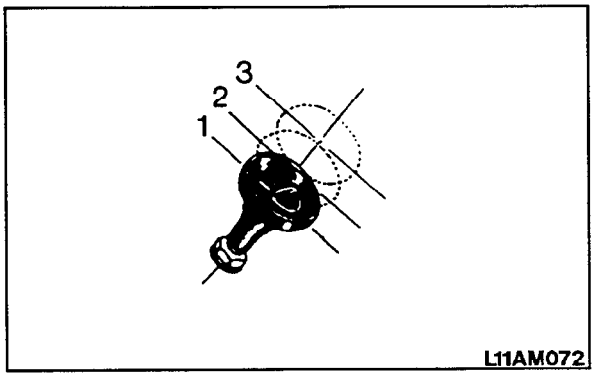
When this switch is pulled, the head lamps light.

Position 1: OFF

Position 2: Low beam

Position 3: High beam

When this switch is operated, the clearance lamps, the tail lamps and the panel lamp will also light up.



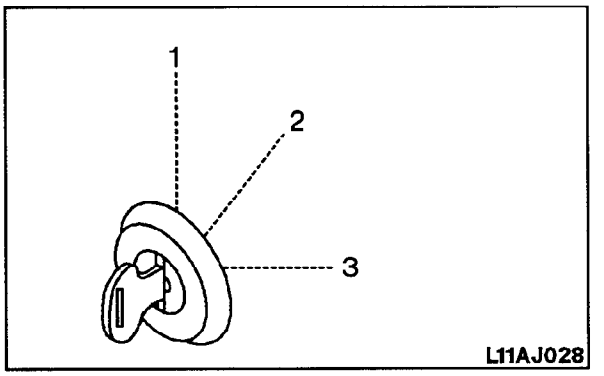
4. STARTING SWITCH

This switch is used to start or stop the engine.

OFF (1)
Key insertion-withdrawal position, None of the electrical circuits activate.

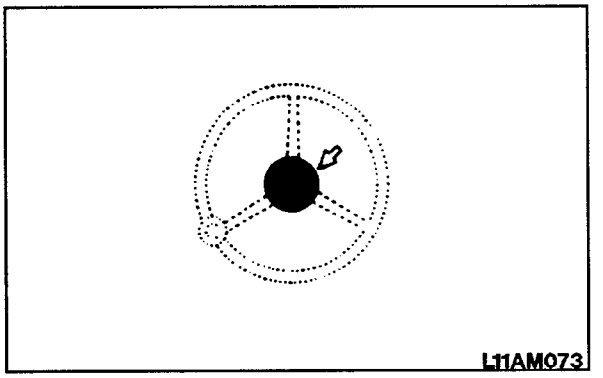
ON (2)
Charging, lamp, and accessory circuits activate. Keep the key at the ON position after starting.

START (3)
At this key position, the starting motor will crank the engine. Release the key immediately after starting, and the key will return automatically to ON.



5. HORN BUTTON

When the button in the center of the steering wheel is pressed, the horn will sound.

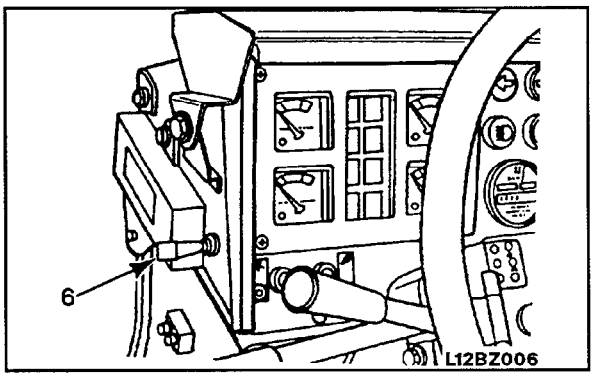


6. ETHER START SWITCH

This switch (6) is used when starting the engine in cold weather.

ON position:
A fixed amount of ether (approx. 3 cc each time) is injected into the engine intake to make it easier to start the engine in cold weather.

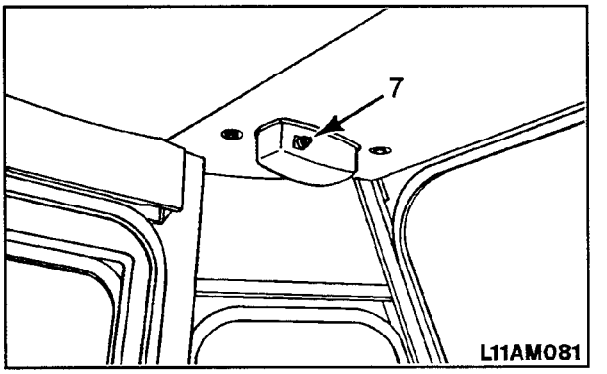
OFF position:
When the switch is released, it automatically returns to the OFF position.

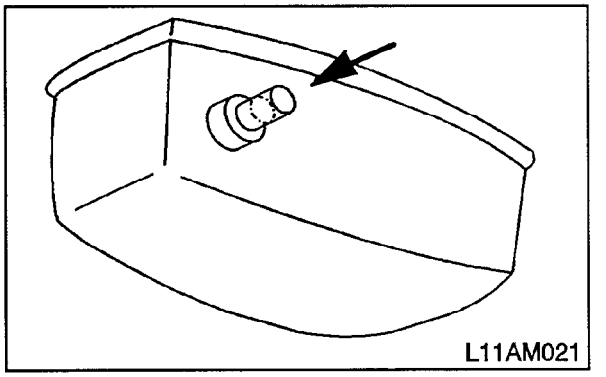


WARNING! Do not keep the switch at the ON position for more than 5 seconds.

7. CAB DOME LAMP SWITCH

When this switch (7) is pushed in, the cab dome lamp should light. When the switch is pushed in again, the cab dome lamp should go out.



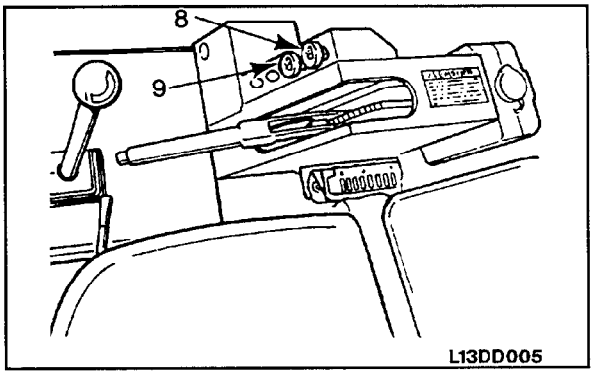


8. FRONT WIPER SWITCH

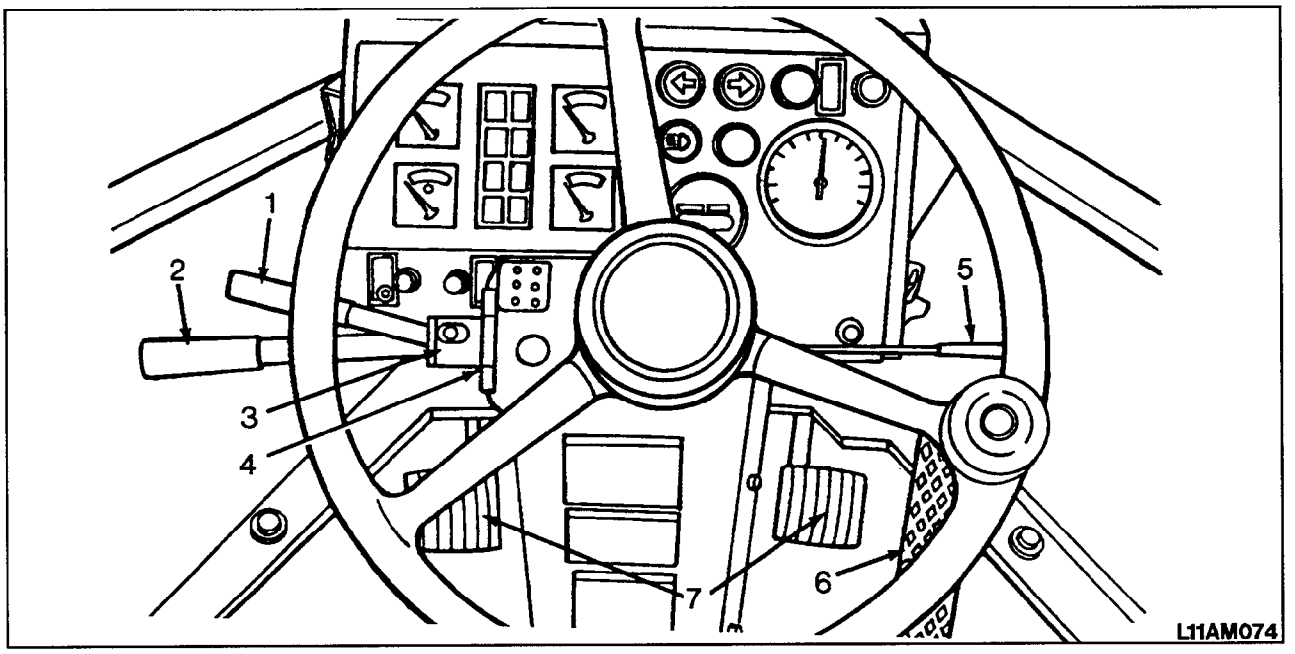
The wiper switch (1) is actuated at low and high speed. When this switch is turned clockwise, solvent will be sprayed onto the glass.

9. REAR WIPER SWITCH

When this switch (2) is pulled to ON position, the wiper operates on the rear glass. When this switch is turned clockwise, solvent will be sprayed onto the glass.



PEDALS AND LEVERS



1. DIRECTIONAL LEVER

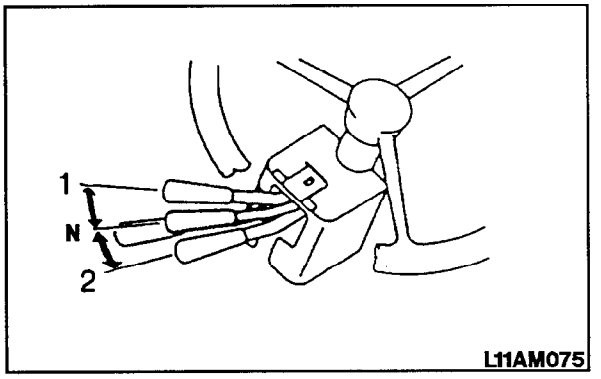
This lever is used to change the direction of travel of the machine.

1 Forward

2 Reverse

N Neutral

★ The engine cannot be started if the directional lever is not at **N** (neutral).

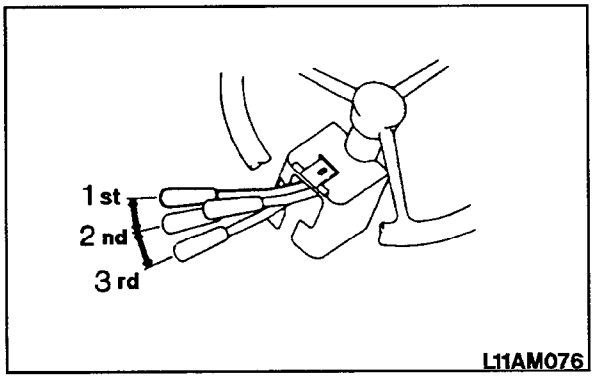


2. SPEED CONTROL LEVER

This lever controls the travel speed of machine.

This machine has a 3-FORWARD, 3-REVERSE speed transmission. Place the speed control lever in a suitable position to obtain the desired speed range.

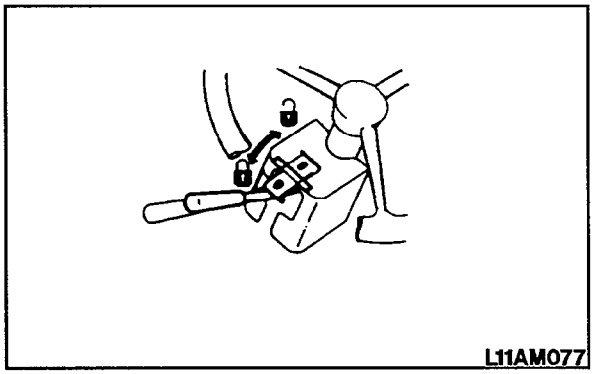
★ 1st and 2nd speeds are used for working. 3rd speed is used for traveling.



3. SAFETY LOCK (FOR DIRECTIONAL LEVER)

The safety lock prevents the directional lever from entering FORWARD or REVERSE positions.

WARNING! Always apply the directional lever safety lock when leaving or servicing the machine.

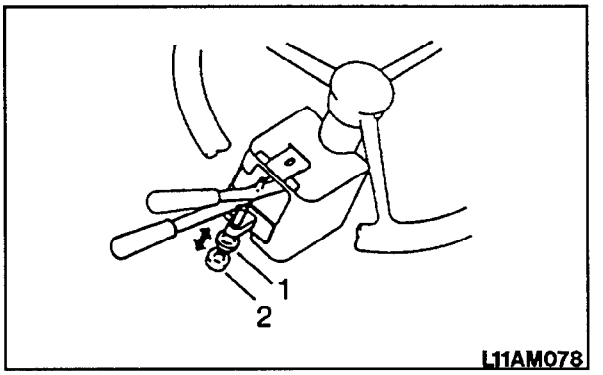


4. SPEED CONTROL LEVER STOPPER

This stopper prevents the speed control lever from entering the 3rd position, when working.

Position 1: Stopper actuated.

Position 2: Stopper released.



5. TURN SIGNAL LEVER

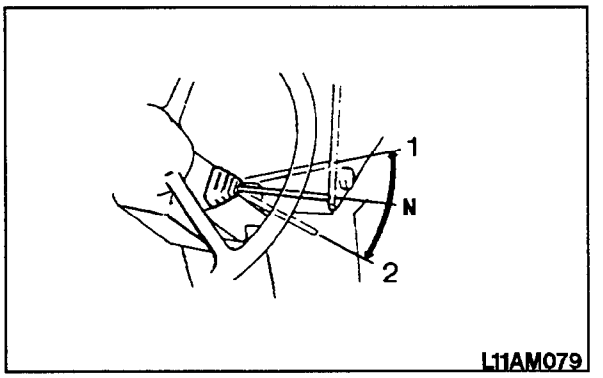
This lever operates the turn signal lamps.

1: LEFT TURN: Push the lever forward.

2: RIGHT TURN: Pull the lever back.

★ When the lever is operated, the turn signal pilot lamp will also light up.

★ Return the switch lever manually to the NEUTRAL position after the steering wheel is returned to the NEUTRAL position from right or left turning.



6. ACCELERATOR PEDAL

This pedal controls the engine speed and output. The engine speed can be freely controlled between low idling and full speed.

7. BRAKE PEDALS

Right brake pedal

The right brake pedal operates the wheel brakes, and is used for normal braking.

WARNING! When traveling downhill, use the engine as a brake, and always use the right brake pedal.

Left brake pedal

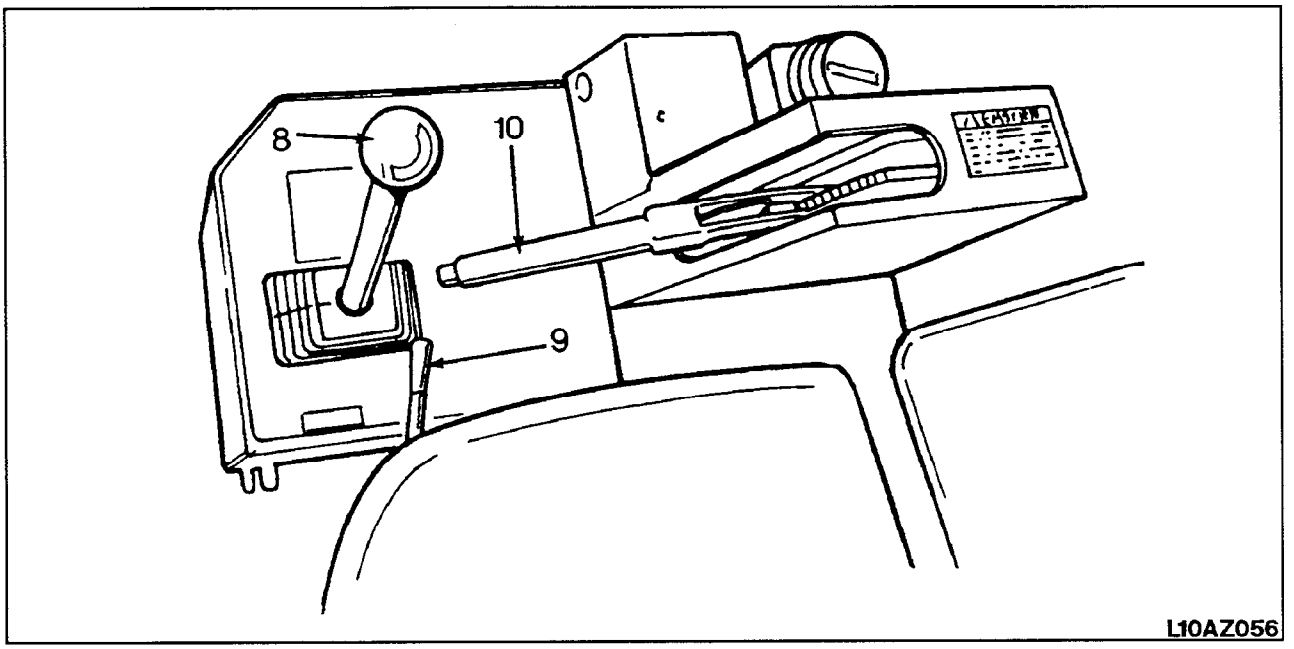
The left brake pedal operates the wheel brakes, and **if** the transmission cut-off selector switch is at ON, it **also** returns the transmission to neutral.

WARNING! Do not use the brake pedals repeatedly unless necessary.

WARNING! Do not use the brake pedals as footrests. Use them only when applying the brakes.

★ When the accelerator is being used for operating the work equipment, always use the left brake pedal to slow or stop the machine after putting the transmission cut-off selector switch in ON.

WARNING! For machines with a booster, when the engine is stopped, the operating force of the brake pedal becomes 3.5 times greater than normal.



8. WORK EQUIPMENT CONTROL LEVER

This lever is used to operate the lift arm and the bucket.

1 Raise

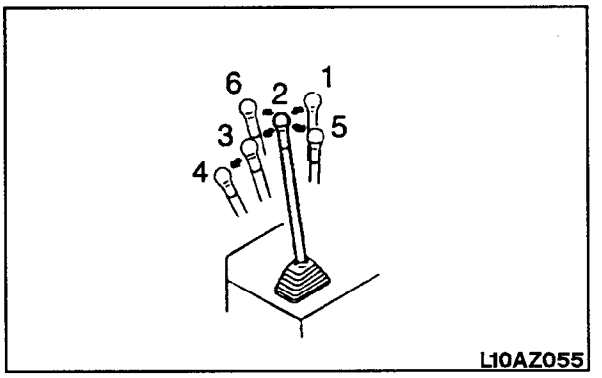
2 Hold: The lift arm and the bucket are kept in the same position.

3 Lower

4 Float: The lift arm moves freely under external force.

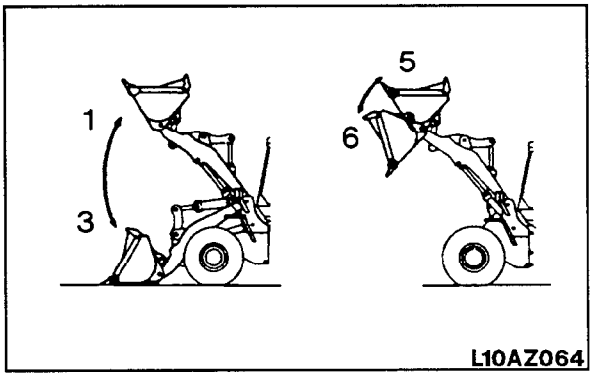
5 Tilt

6 Dump



★ When the work equipment control lever is pulled further from 1 position, the lever is stopped in this position until the left arm reaches the preset position of kick-out, and the lever is backed to hold position.

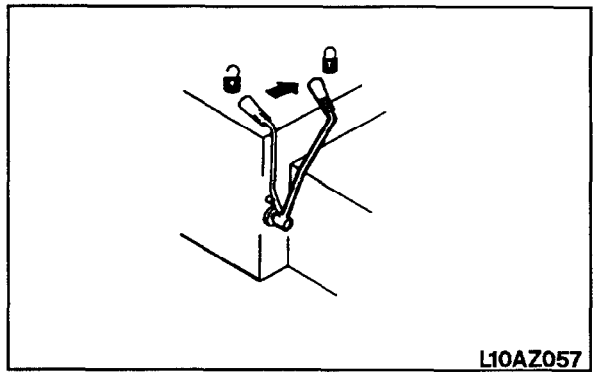
★ When the work equipment control lever is pulled further from 5 position, the lever is stopped in this position until the bucket reaches the preset position of the bucket positioner, and the lever is backed to the hold position.



9. WORK EQUIPMENT CONTROL LEVER LOCK

This is used to lock the work equipment control lever.

WARNING! When parking or leaving the machine, or when performing maintenance, always lower the bucket to the ground, put the work equipment levers in hold position and check that the safety lock lever is locked.

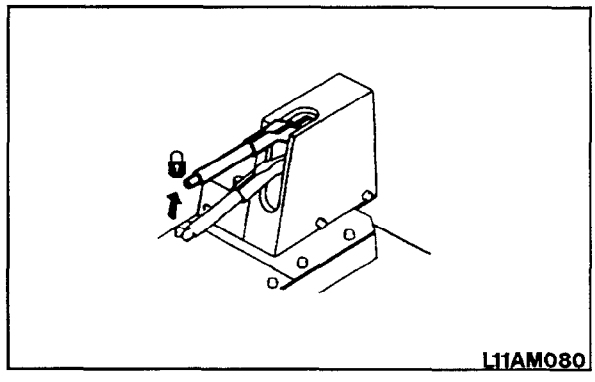


10. PARKING BRAKE LEVER

This lever operates the parking brake. The brake is applied by pulling this lever, and the parking brake pilot lamp lights up. Push the button on the tip of the lever to release the parking brake.

WARNING! Always apply the parking brake when leaving the machine or parking it.

★ The machine does not start when the directional lever is operated with the parking brake applied.



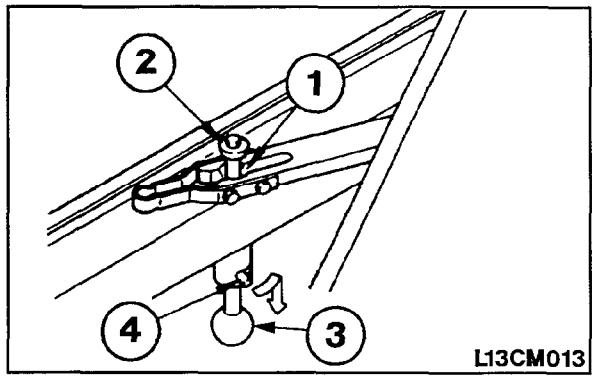
CAB DOOR HOLD OPEN LOCK - IF EQUIPPED

This lock can be used to hold the cab door open.

Open the door so that tip (2) of the lever is aligned with groove (1) for the lock, then pull down knob (3) as shown in the diagram.

When releasing the lock and closing the door, push up knob (3) and insert pin (4) securely in the groove.

★ When using the hold open lock, be sure to apply the lock securely.

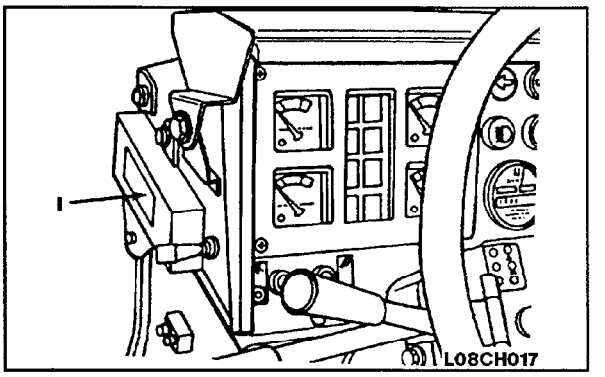


FUSE BOX

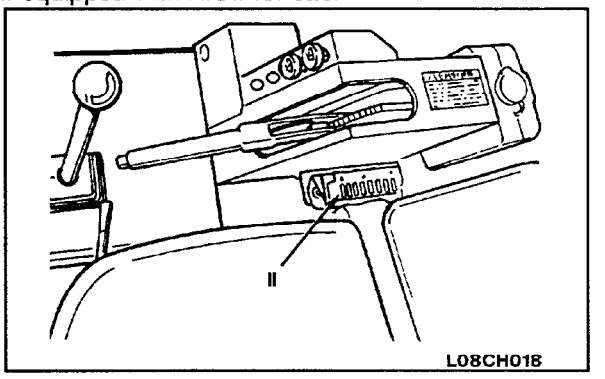
The fuses protect the electric devices and wiring from burning out. If any fuse is rusted or coated with white power, replace it.

★ Replace a fuse with another of the sam capacity.

WARNING! Before replacing a fuse, be sure to turn off the starting switch.



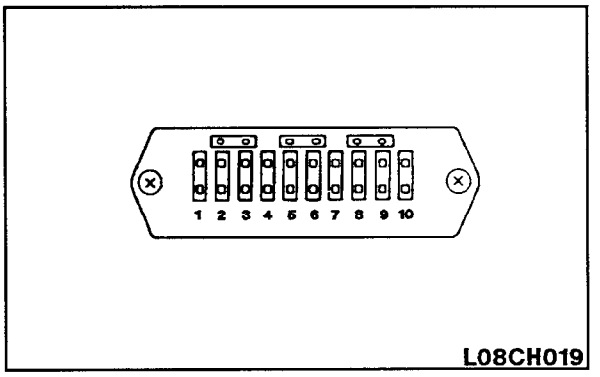
If equipped with R.O.P.S. cab.



FUSE ARRANGEMENT AND CIRCUIT

FUSE BOX I

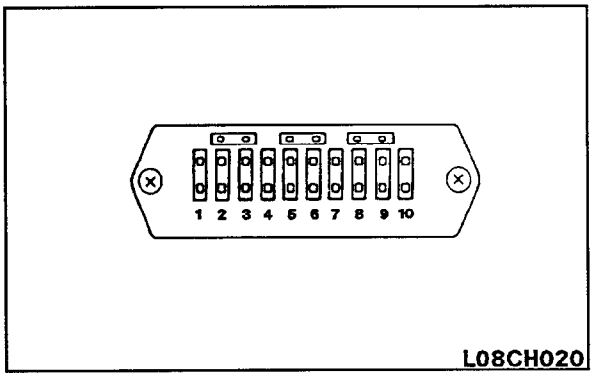
No	Fuse capacity	Circuit
1	15A	Starting switch
2	10A	Engine shut off device
3	10A	Panel lamp clutch cut-off
4	10A	Bucket positioner Boom kick-out
5	20A	Lamp main circuit
6	15A	Horn working lamp
7	10A	Clearance lamp tail lamp
8	10A	Head lamp low beam
9	15A	Head lamp high beam
10	10A	Parking lamp



FUSE BOX II

If equipped with R.O.P.S. cab.

No	Fuse capacity	Circuit
1	20A	Air conditioner
2	20A	Air conditioner
3	10A	Rear wiper
4	10A	Front wiper
5	20A	Radio / Cigarette lighter
6	10A	Auxiliary
7	20A	Operating light
8	10A	Car heater
9	10A	Auxiliary
10		



OPERATOR'S SEAT
RIGID TYPE

Operator's seat adjustment should be checked at the beginning of each shift and when operators change.

WARNING! Park the machine in a safe place and stop the engine when carrying out adjustment of the operator's seat.

A. FORWARD-BACKWARD ADJUSTMENT

Move adjustment lever (1) to the right, move the seat to the best position and release the lever. The seat can be moved forward or backward within a range of 140 mm (5.5 in) in 8 stages.

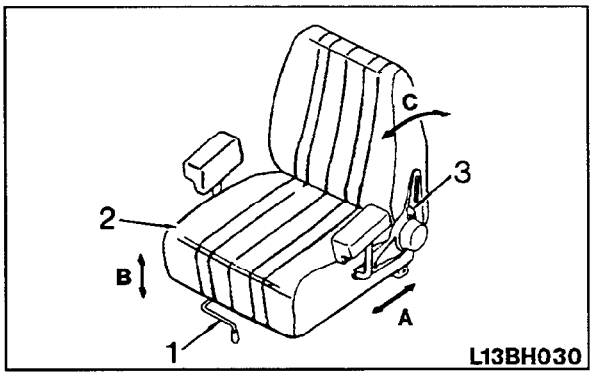
B. SEAT HEIGHT ADJUSTMENT

Move adjustment lever (2) up, set the seat to the desired height and release lever.

The seat can be set within 50 mm in 5 stages.

C. BACKREST ADJUSTMENT

Move lever (3) upward, move the backrest to the best position and release the lever. The backrest can be set to 12 steps.



BUCKET TYPE SEAT (OPT)

Operator's seat adjustment should be checked at the beginning of each shift and when operators change.

WARNING! Park the machine in a safe place and stop the engine when carrying out adjustment of the operator's seat.

FORWARD-BACKWARD ADJUSTMENT

Move adjustment lever (1) to the right, move the seat to the best position and release the lever. The seat can be moved forward or backward within a range of 140 mm (5.5 in) in 7 stages.

SEAT ANGLE ADJUSTMENT

Move adjustment lever (2) up, set the seat to the desired height and release lever.

The seat can be tilted up or down about 3°.

SEAT CUSHION ADJUSTMENT

Rotate grip (3) under the seat to adjust scale (4) on the cushion to your own weight. (50 to 120 kg)

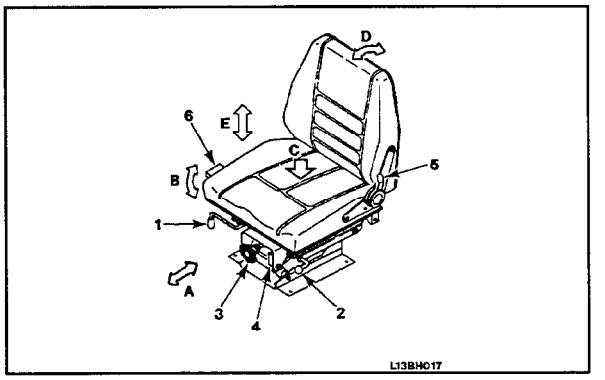
BACKREST ADJUSTMENT

Pull lever (5), move the backrest to the best position and release the lever. The backrest can be set to 11 steps.

SEAT HEIGHT ADJUSTMENT

Move lever (6) upward, set the seat to the desired height and release the lever.

The seat can be set within 50 mm.



SEARS SEAT

Operator's seat adjustment should be checked at the beginning of each shift and when operators change.

WARNING! Park the machine in a safe place and stop the engine when carrying out adjustment of the operator's seat.

A. FORWARD-BACKWARD ADJUSTMENT

Move adjustment lever (1) to the right, move the seat to the best position and release the lever. The seat can be moved forward or backward within a range of 140 mm (5.5 in) in 7 stages.

B. SEAT ANGLE ADJUSTMENT

Move adjustment lever (2) up, set the seat to the desired angle, and release the lever. The seat can be tilted up or down by about 3°.

C. WEIGHT ADJUSTMENT

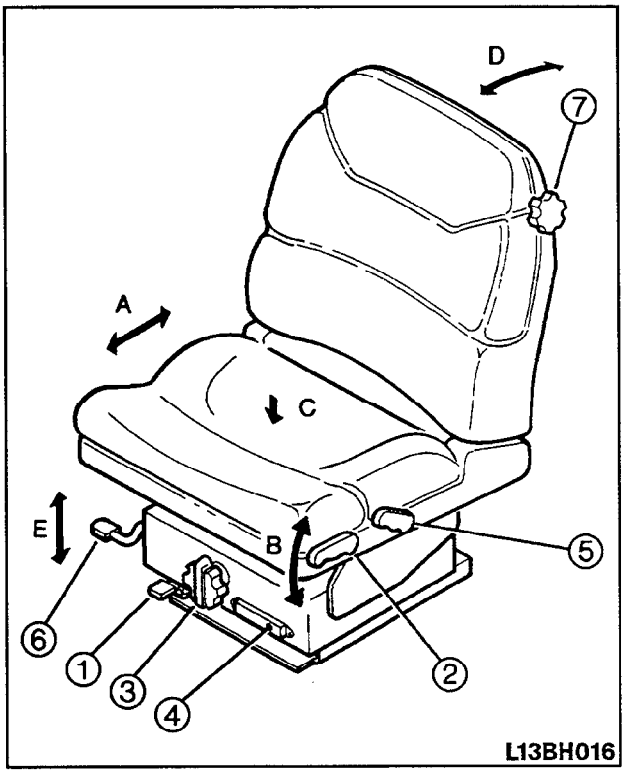
Rotate adjustment knob (3), located in front of the seat, to adjust ride scale (4) to your own weight. The weight adjustment range is 50 to 120 kg (110.2 to 264.6 lb).

D. BACKREST TILT ADJUSTMENT

Pull adjustment lever (5) up, move the backrest to the best position and release the lever. The backrest can be set within a range of 22° in 11 steps.

E. HEIGHT ADJUSTMENT

Move adjustment lever (6) upward, set the seat to the desired height and release the lever. The seat height can be set within a distance of 50 mm (2 in) in 4 stages.



1. Forward-backward adjustment lever
2. Seat angle adjustment lever
3. Weight adjustment knob
4. Ride indicator pointer
5. Backrest tilt adjustment lever
6. Height adjustment lever

KAB SEAT

WEIGHT ADJUSTMENT

For maximum comfort and protection from vibration it is important that the suspension is set correctly for your weight.

Turn the adjuster knob (1) until the indicated weight (seen inside the transparent knob) corresponds to your weight in kilograms.

The optimum adjustment is for the suspension to be in the middle of the vertical stroke ("mid-ride" position) when normally seated.

HEIGHT ADJUSTMENT

After adjusting for weight, the seat height and cushion angle may be adjusted by lifting levers (2 and 3). The front and rear of the seat are adjusted independently.

BACKREST ANGLE ADJUSTMENT

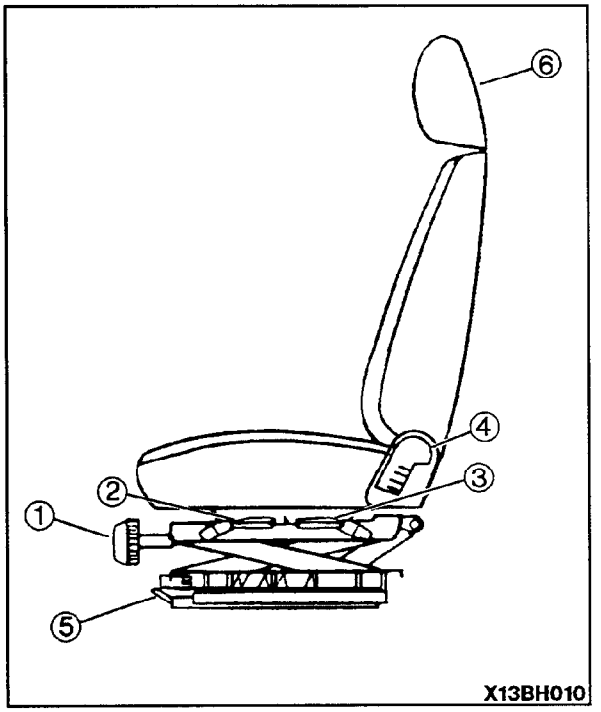
Lift lever (4), set backrest to desired angle and release lever.

FORE AND AFT ADJUSTMENT

Lift control (5), slide seat to the desired position. Ensure mechanism is fully engaged after adjustment.

HEADREST ADJUSTMENT (IF EQUIPPED)

The headrest (6) height is adjusted by sliding up or down, and the angle by pivoting backwards or forwards.



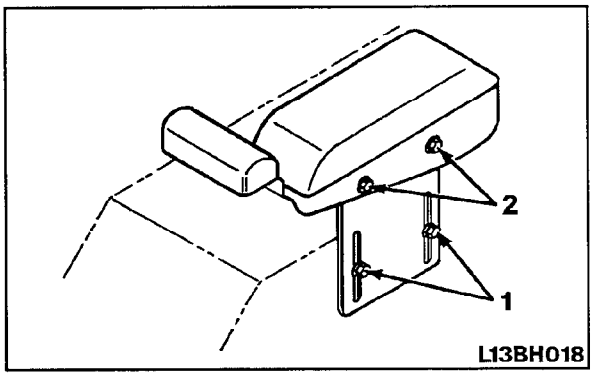
RIGHT SIDE ARMREST

HEIGHT ADJUSTMENT

Loosen mount bolts (1) to move the armrest to the desired position and tighten the bolts.

ANGLE ADJUSTMENT

Loosen mount bolts (2) to move the armrest to the desired angle and tighten the bolts.



SEAT BELT

WARNING! When operating a machine equipped with a ROPS, be sure to use the seat belt.

WARNING! Before fastening the seat belt, inspect the mounting brackets and belt for abnormal conditions.

Fasten the belt and remove it in the following manner.

1. Adjust the seat so that the brake pedal can be depressed all the way with the operator's back against the backrest.
2. After positioning the seat, install the tether belt (1). With the seat unoccupied, tense the belt slightly across the seat and install.

WARNING! Check that there are no kinks in the belt.

3. Sit in the seat. Hold buckle (2) and insert tang (3) into the buckle. Check that the belt has locked by pulling it.
4. When removing the belt, raise the tip of the buckle lever to release it.

★ When leaving the operator's seat, release the seat belt and hang it over the arm rest.

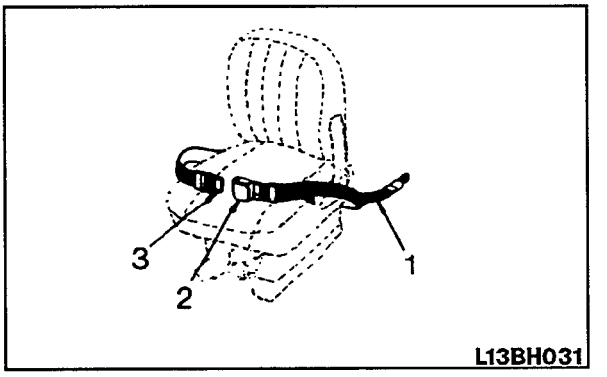
★ Fasten the belt across your body without kinking it. Adjust the lengths of the belt on both the buckle and tang ends so that the buckle is located at the mid-point of your body front.

Adjust the belt length in the following manner.

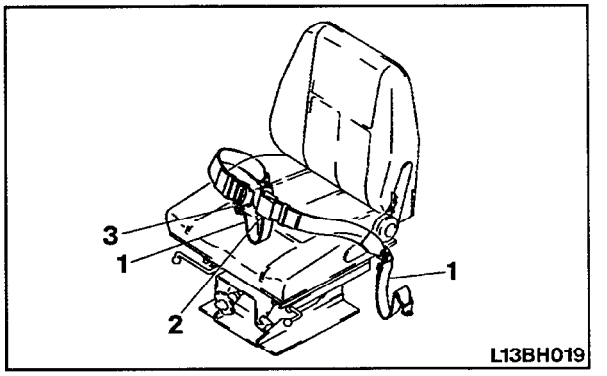
1. To shorten the belt, pull the free end of the belt at either the buckle or tang end or at both ends.
2. To lengthen the belt, pull the belt while holding it at a right angle to the buckle or tang.

★ Inspect the seat belt mounting hardware for tightness. Retighten any loose bolts to a torque of 2 - 3 kgm (14 - 22 lbf ft / 19 - 30 N•m).

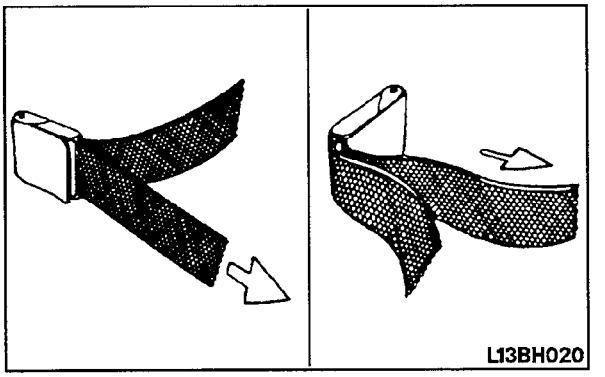
★ If the seat belt is worn or frayed or if the belt buckle and/or tang or any of the mounting brackets are damaged or deformed, replace the seat belt immediately.



Rigid and Bucket Type Seats

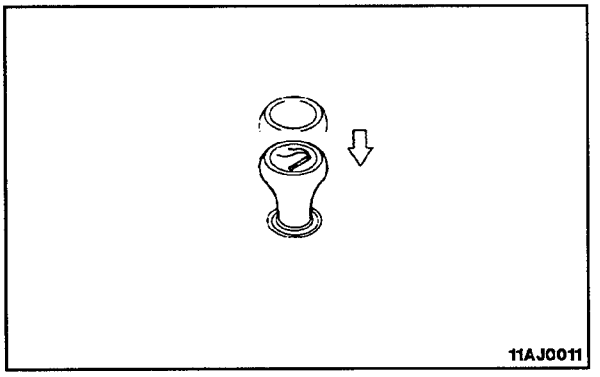


Sears and KAB Type Seats



CIGARETTE LIGHTER

This is used to light cigarettes. To use, push the lighter in. After a few seconds it will spring back. At that time, remove the lighter and light your cigarette.

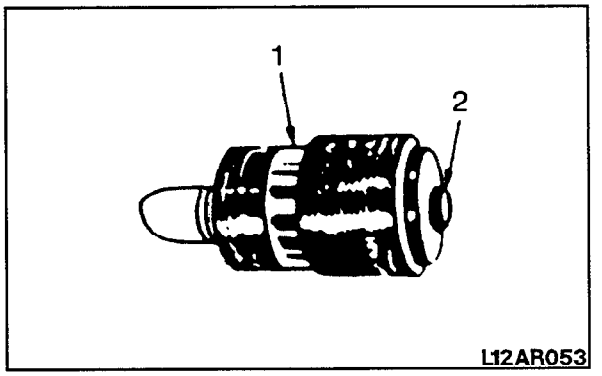


AIR CLEANER SERVICE INDICATOR

This device indicates clogging of the air cleaner element. When the red piston (1) appears in the transparent part of the indicator, the element is clogged. Immediately clean element.

After cleaning, push the indicator reset button (2) to return the red piston to its original position.

The service indicator is located on the air cleaner mounting bracket inside the left side panel.

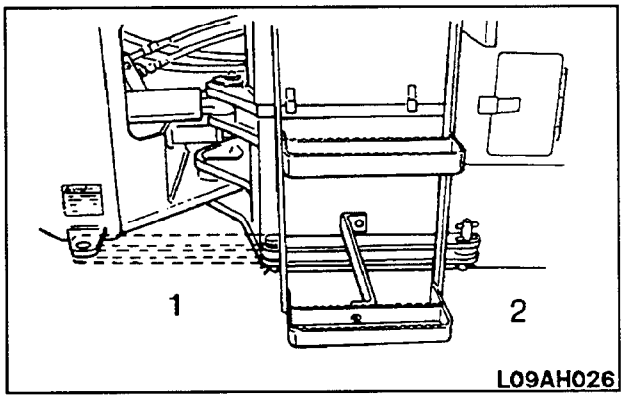


FRAME LOCKING BAR

The frame locking bar is used during maintenance or when transporting the machine. It locks the front frame and rear frame, and prevents the front and rear frames from moving at the articulation point.

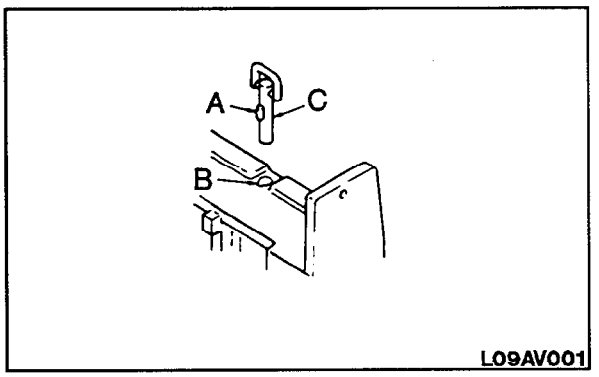
WARNING! Always use the locking bar for maintenance or when transporting the machine.

WARNING! Always remove the locking bar during normal travel operations.



DRAWBAR PIN

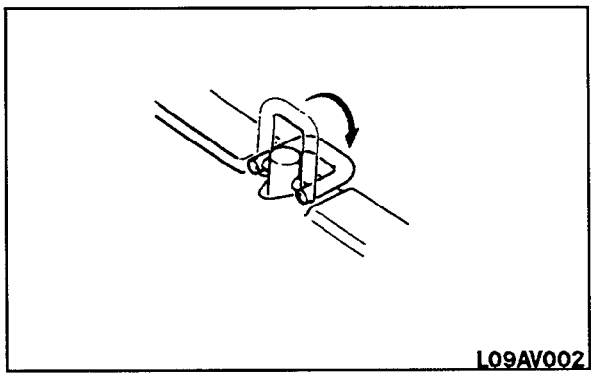
1. Align protrusion (A) of drawbar pin (C) with groove (B) of the counterweight, then insert and rotate 180°.



2. To prevent the drawbar pin from rotating, fold the knob of the drawbar and set in position.

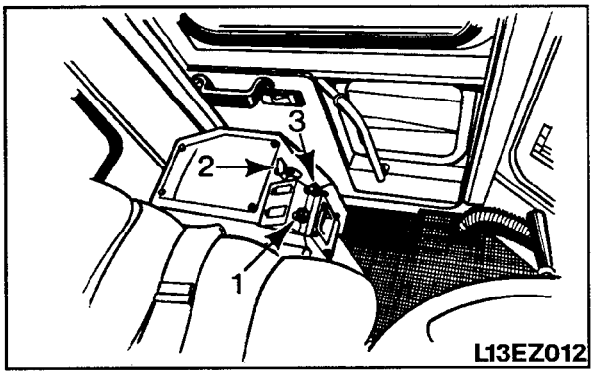
★ When removing, remove in the opposite order.

WARNING! If step 1 and 2 are not carried out properly, the pin may come out and be lost.



CAB HEATER AND DEFROSTER - IF EQUIPPED

CONTROL PANEL



It is possible to use the cab heater to good effect in dusty jobsites. The outside air is passed through the filter and is sent to the operator's cab to increase the pressure inside the cab. In this way, dust is prevented from entering, so comfortable operating conditions are always maintained for the operator.

1. FAN SPEED SWITCH (1)

This switch controls the air flow when the cab heater is used for heating.

★ It has three air flow control levels:
LO (Low), ME (Medium) and HI (High)

★ If the outside air is extremely dusty, set the fan speed switch to the HI position. This will pressurize the cab and prevent the dust from entering.

2. FOOT / DEFROSTER SELECT LEVER (2)

This lever is used to control the air flow to the foot and defroster vents.

3. AIR INTAKE SELECTOR LEVER (3)

This lever switches the air intake port when heating.

★ FRESH: Operate the lever to the right.

Fresh air is taken in from outside in addition to the air inside the compartment. This is used for ordinary heating and when pressurizing the inside of the cab.

★ RECIRC: Operate the lever to the left.

Only the air inside the compartment is used. This is mainly used for quick heating.

1= Lock

2= Free

★ The effectiveness of the heating system can be increased by selecting the most suitable vent.

★ Do not turn the fan speed switch on when all the vents are closed.

CHECK BEFORE STARTING

Pre-operation checks forestall machine trouble. Never neglect them.

WALK-AROUND CHECK

Look around the machine and under the machine to check for loose nut or bolts, collection of dirt, or leakage of oil, fuel, or coolant, and check the condition of the work equipment and hydraulic system. Check also for loose wiring, play, and collection of dust at places which reach high temperatures.

1. Check wear of bucket.
2. Check around transmission case joints for oil leak.
3. Check around brake system for oil leak.
4. Check tightness of air cleaner mounting bolt.
5. Check tightness of battery terminal.
6. Check radiator for water leak.
7. Check around the engine for water and oil leaks.
8. Check around axle for oil leak.
9. Check hydraulic tank joint for oil leak.
10. Check for oil leak at high pressure hose and high pressure hose joints.
11. Check tire for wear and damage.

CHECK AND REFILL COOLANT

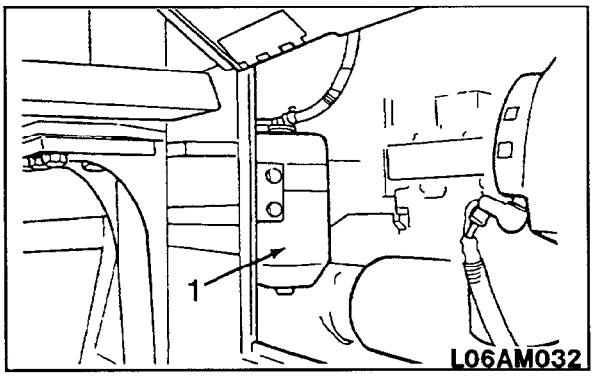
1. Open left engine side cover.
2. Check the level of the coolant. The water level must be between the FULL (A) and LOW (B) marks on sub-tank (1).
3. If the level is too low, add water to sub-tank (1).

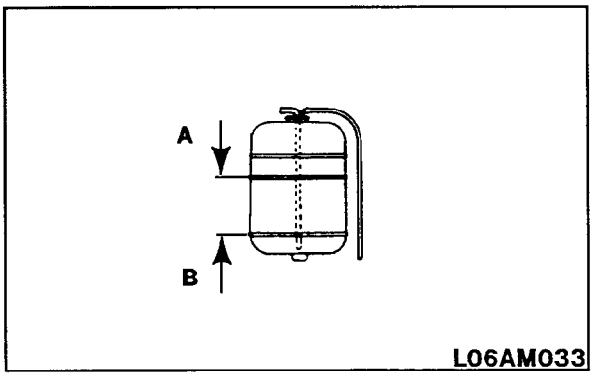
WARNING! Do not open the radiator cap unless necessary. Check always the coolant level of the sub-tank when engine is cold.

★ If the volume of coolant added is more than usual, check for possible water leakage.

★ Confirm that any oil is not in coolant.

★ Use a mixture of 50% water and 50% ethylene glycol base antifreeze.





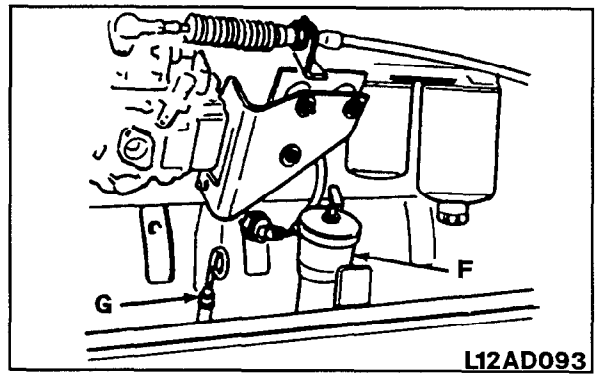
CHECK OIL LEVEL AND REFILL IN ENGINE OIL PAN

1. Open the engine side cover located on the rear right side of the machine.
2. Use dipstick (G) to check the oil level.
3. The oil level should be between mark L and H, if necessary, add oil at oil filler (F).

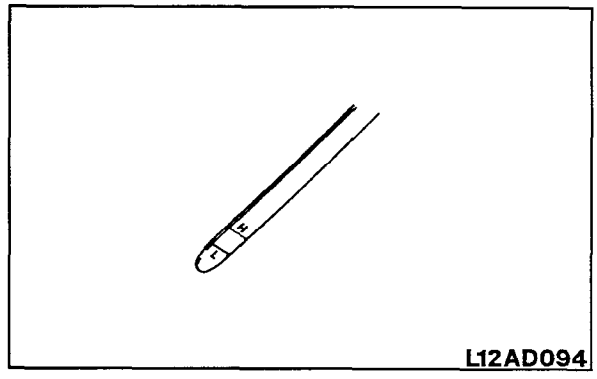
★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS."

★ When checking the oil level, park the machine on a level surface and make an oil level check before starting engine or 5 minutes or more after the engine is stopped.

★ Never operate the engine with the oil level below the L mark or above the H mark.



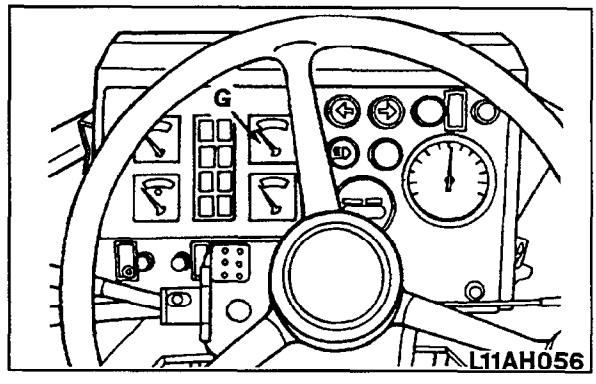
L12AD093



L12AD094

CHECK FUEL LEVEL AND REFILL FUEL

1. Check the fuel level using fuel gauge (G).

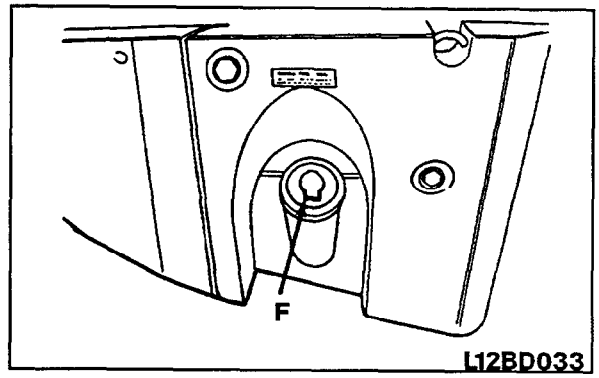


L11AH056

2. Upon completion of work, pour in additional fuel from filler (F) until the fuel tank is full.

★ Fuel capacity: 140ℓ

★ When adding fuel, never let the fuel overflow. This may cause a fire.

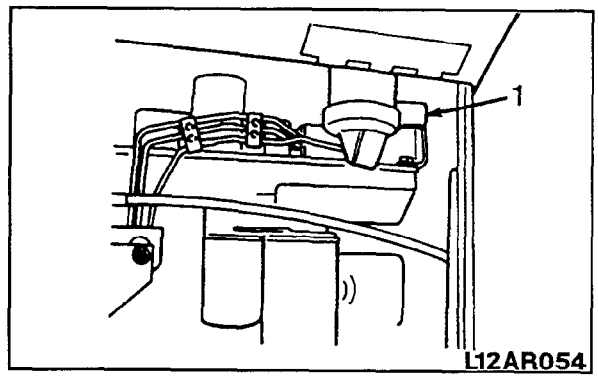


CHECK AIR CLEANER SERVICE INDICATOR

When air cleaner element is clogged, the red piston of service indicator (1) reaches service level and gets locked.

In that case, clean element referring to the section "WHEN REQUIRED."

After cleaning element, push button to return red piston.



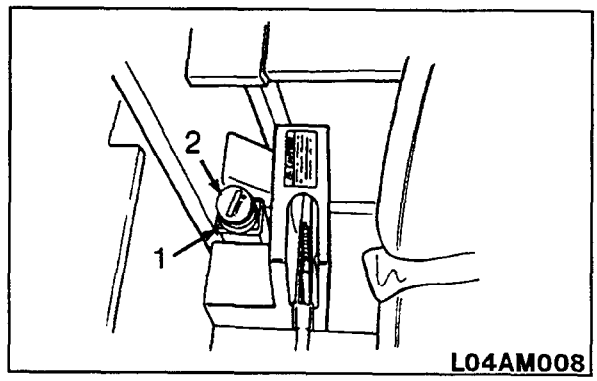
CHECK AND REFILL OF OIL IN BRAKE OIL TANK

1. Check that the oil level in tank (1) at the right side of the operator's seat is between the MAX and MIN marks.

2. Open cap (2) and refill engine oil, if necessary.

★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS."

WARNING! Always use engine oil to refill the brake oil tank.



ADDITIONAL CHECKS

A. Check that parking brake works properly.

B. Check that brakes work properly.

C. Check that horn sounds properly.

D. Check that lamps flash properly; check for dirt or damage.

E. Check direction of rear view mirror; check for dirt or damage.

F. Check that engine exhaust gas color and sound are normal.

G. Check that gauges and instruments work properly.

H. Check steering play; check that steering works properly.

I. Check that back-up buzzer sounds properly.

CHECK ELECTRICAL WIRING

Check for any sign of disconnection or short circuit in the electric wiring. Check also for loose terminals and tighten any loose parts.

Check the following points carefully.
- Battery
- Starting motor
- Alternator

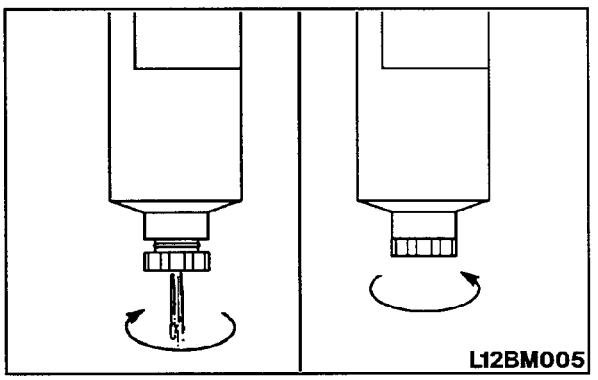
DRAIN THE WATER FROM PRIMARY FUEL FILTER/WATER SEPARATOR

With the engine shut-off, open the drain valve. Turn the valve counterclockwise approximately 1½ to 2 turns until draining occurs. Drain the filter sump of water until clear fuel is visible.

★ Do not over tighten the valve. Over tightening can damage the threads.

★ Turn the valve clockwise approximately 1½ to 2 turns to close the drain valve.

★ Even if a filter/water separator is installed be sure to check the fuel tank to remove water and sediment in the fuel.



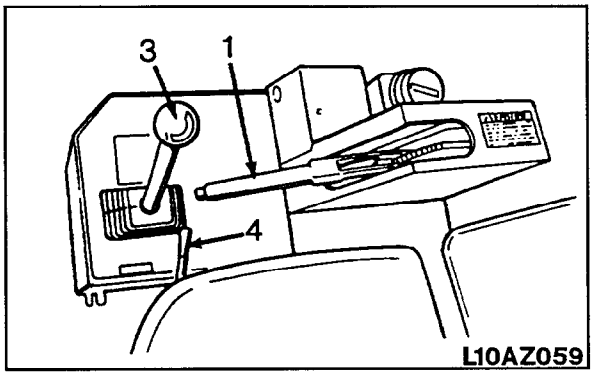
OPERATING YOUR MACHINE

BEFORE STARTING THE ENGINE

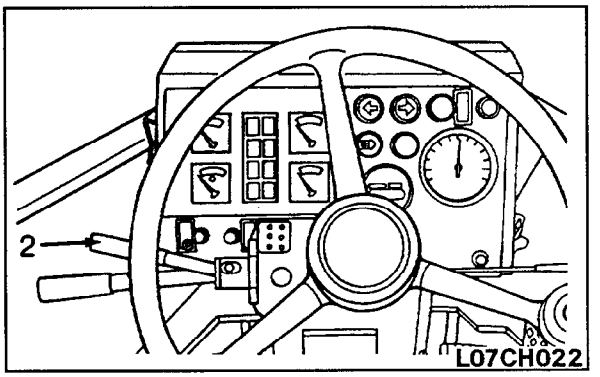
1. Carry out an initial inspection. (For details of the inspection, see CHECK BEFORE STARTING.)
2. With your back against the backrest of the operator's seat, adjust the seat position so that the brake pedal can be easily depressed.
3. Is parking brake lever (1) in lock position?
4. Is directional lever (2) in N (neutral) position?

   ★ The engine will not start while the directional lever (2) is in any position other than N (neutral).

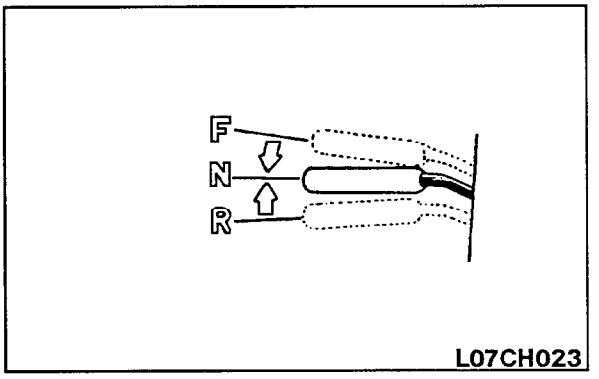
5. Are work equipment control levers (3) locked by safety lock (4)?
6. Turn the starting switch ON and check that the pilot lamp lights up.



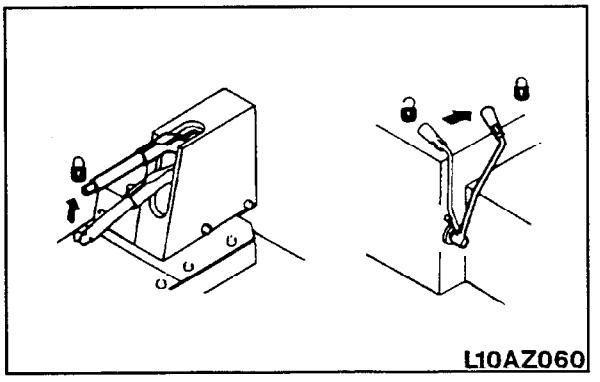
L10AZ059



L07CH022



L07CH023


L10AZ060

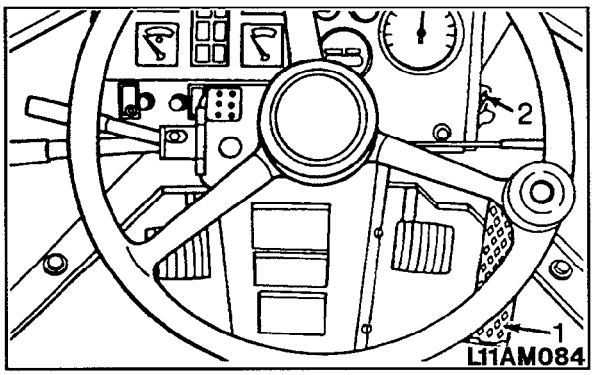
STARTING ENGINE

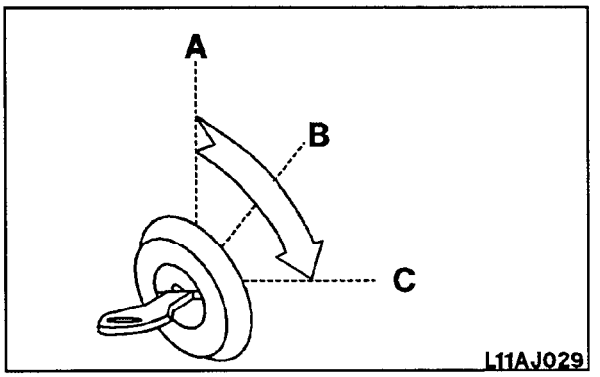
1. Depress accelerator pedal (1) lightly.
2. Turn the key of starting switch (2) to the START position to start engine.
3. When engine is started, release the key of starting switch (2) and the key will return automatically to ON.

★ If engine will not start, repeat the starting procedure after about 2 minutes.

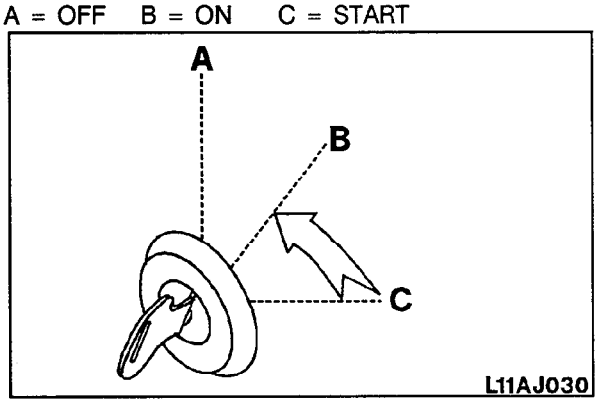
★ Do not leave the key in START for more than 20 seconds.

★ To start engine in cold weather, refer to COLD WEATHER OPERATION.





A = OFF B = ON C = START



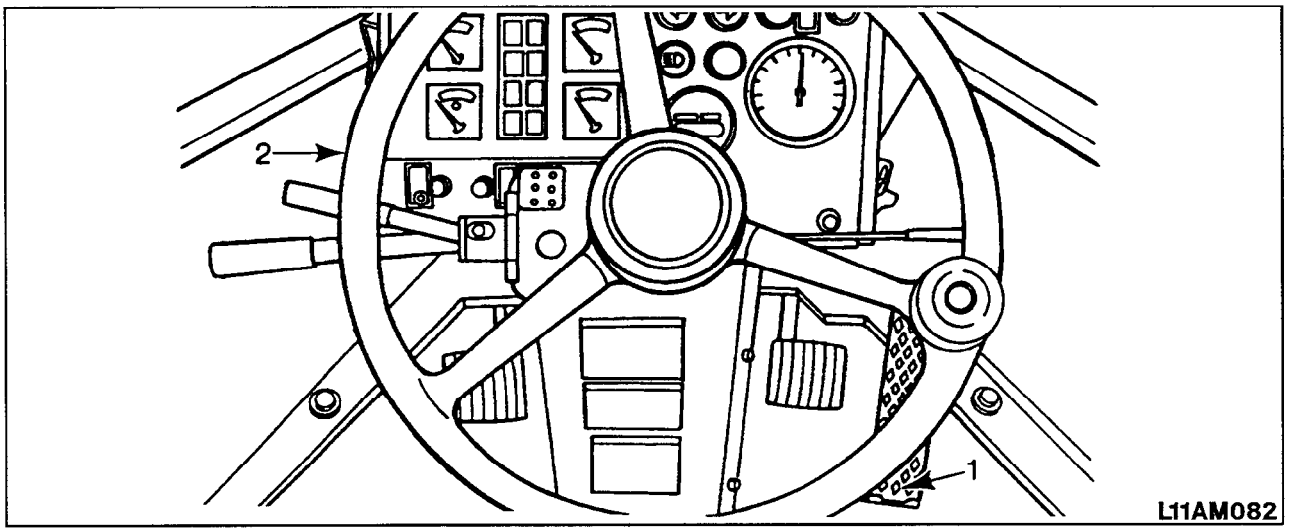
A = OFF B = ON C = START

SPECIAL STARTING

When starting after running out of fuel, fill with fuel, then fill the fuel filter cartridge with fuel and bleed the air from the fuel system before starting.

Refer to FUEL FILTER in every 500 hours services.

COLD WEATHER STARTING

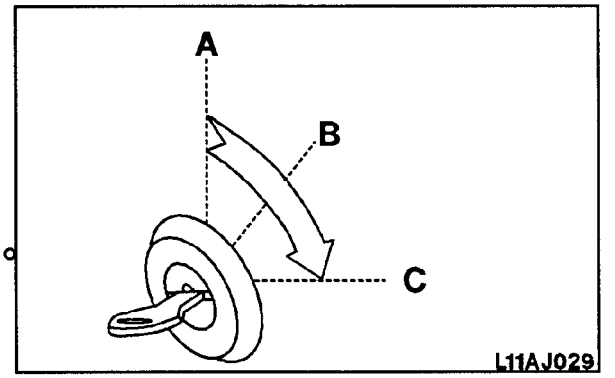


When starting the engine in low temperatures, do as follows.

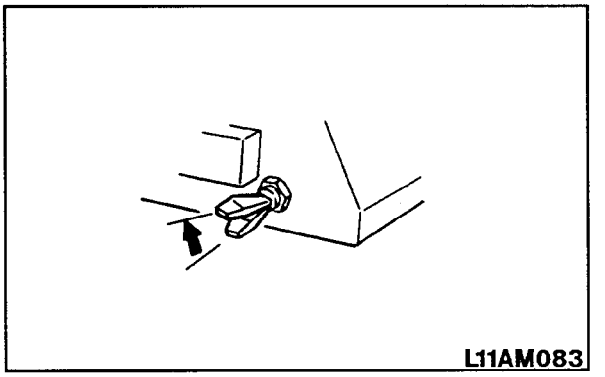
1. Turn the key of starting switch (1) to the ON position.
2. Move ether start switch (2) to the ON position, then release it immediately. Do **NOT** hold it at the ON position for more than 5 seconds. This will cause failure of the ether start valve solenoid.

★ If the engine does not start, repeat this 2-3 times.

★ If the engine does not start, repeat the starting procedure after about 2 minutes.



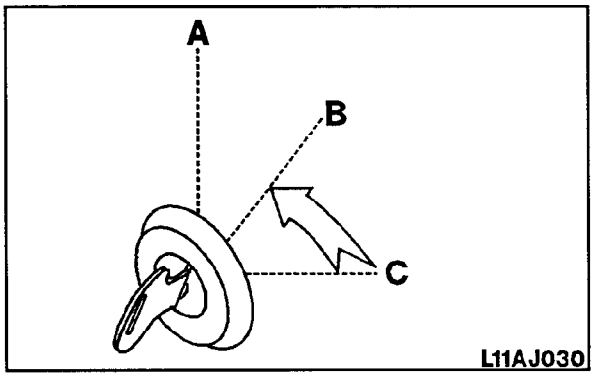
A = OFF B = ON C = START



3. When the engine starts, release the key of starting switch (1), and the key will return automatically to the ON position.

★ Do not leave the key in START for more than 20 seconds.

★ If the engine does not start, repeat the starting procedure after about 2 minutes.



A = OFF B = ON C = START

WARNING! Never operate the ether start switch (2) except when starting the engine.

★ The ether cylinder can be used for about 230 times. (Amount of ether injected: 3 cc, total capacity for one cylinder: 710 cc.)

WARNING! Carefully handle the ether cylinder.

- Never give cylinder access to fire.
- After used, do not throw it in fire nor drill a hole in it.
- Do not store it at places where the temperature may rise over 40°C.
- Never put ether gas on the skin nor breath it in.
- Do not leave it on the operator's seat.
- Do not leave it at places where children can reach or play with it.
- **NEVER** use ether together with a preheating device for the air intake.

★ Remove the ether cylinder when it is unnecessary in summer.

★ When ambient temperature is below -25°C, keep the ether cylinder in a place where the temperature is normal.

★ Before changing the ether cylinder always clean out the valve area where cylinder is installed, and replace the gasket at the same time.

★ The standard specification machine is designed to work in an ambient temperature down to -20°C (-4°F).

★ When operating the machine at temperatures below -20°C, special equipment is needed. Contact your distributor for details.

★ For machines where the air dryer is installed as an option, in cold temperatures below -10°C (+14°F), after the machine has been stopped, operate the machine for at least 10 minutes after starting before moving the machine.

CHECKS AFTER STARTING

After starting make the following checks.

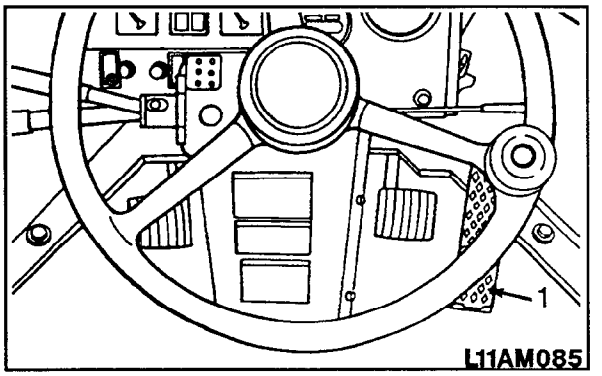
1. Depress accelerator pedal (1) lightly and run the engine with no load at mid-range speed for about 5 minutes.
2. After warm-up run is completed, check monitor lamps for proper operation.

★ Continue to run the engine at light load until the green ranges of the engine water temperature gauge and torque converter oil gauge are indicated.

3. Check if the exhaust color is normal or whether there is any abnormal noise or vibration.

★ Avoid abruptly accelerating the engine until the completion of warm-up.

★ Do not run the engine at low idle continuously for more than 10 minutes.



COLD WEATHER WARM-UP PROCEDURE

When starting the engine the engine in cold weather, do not start operations immediately. First carry out the following.

Ambient temperature	Warm-up time
-20°C (-4°F)	15 minutes
-10°C (14°F)	10 minutes
0°C (32°F)	5 minutes

★ Avoid sudden acceleration of the engine before the warming-up operation is completed.

★ Do not idle the engine continuously for more than 20 minutes.

2. After completing the warming-up operation for the engine, warm up the work equipment circuits.
   1) Move the lift arm control lever slowly to the RAISE position and raise the bucket slightly.
   2) Move the lift arm control lever slowly to the LOWER position and lower the bucket slightly.
   3) Repeat the above operation several times and gradually increase the amount you move the lift cylinders.
   4) Repeat Steps 1) - 3) for the bucket control lever to warm up the work equipment circuit.

★ Run the engine with the throttle at the 1/3 position or below.

   5) Raise the bucket 10 - 30 cm (3.7 - 11.8 in) from the ground, operate the bucket control lever to the tilt position, relieve the circuit for approximately 5 seconds, then return the lever to the neutral position and hold it for approximately 2 seconds. Repeat this operation to warm up the work equipment circuit.

★ Raise the engine speed gradually from the idling speed.

WARNING! If the machine is operated suddenly before the warming-up operation is carried out, the work equipment may be damaged. The warming-up operation is also mandatory for safety reasons.

3. Warm up the steering circuit as follows.

WARNING! If this operation is carried out when the oil temperature is still low, even when the steering wheel is turned and stopped, there may be a time lag before the chassis turns or stops. In such cases, carry out the warming-up operation in a large open area. In addition, use the safety bar to ensure safety. In this case, do not relieve the circuit for more than 5 seconds.

4. Turn the steering wheel slowly to the left and right to warm up the oil inside the steering valve. Repeat this operation about 10 times.

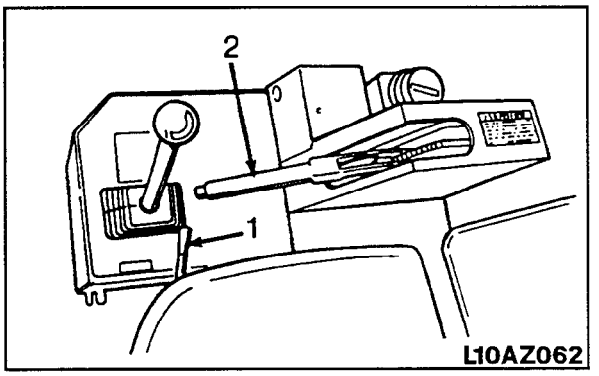
★ Turn the steering wheel a short distance, then stop it, and check that the chassis stops according to the amount the steering wheel is turned.

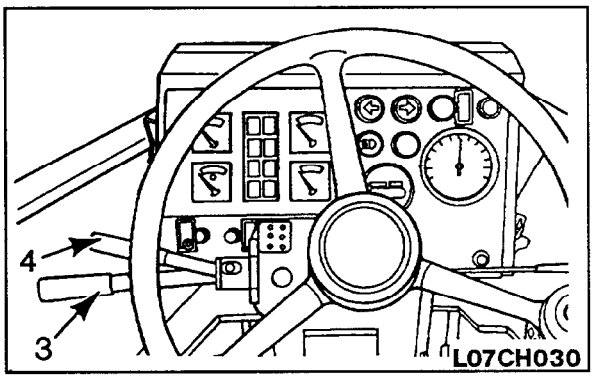
★ The recommended oil for the work equipment hydraulic system depends on the ambient temperature. Select oil according to the table under "LUBRICANTS, FUEL AND COOLANT" in Section 3.

MOVING MACHINE OFF

1. Check that the caution lamps are not lighted.
2. Free the safety lock (1) for work equipment control lever. Bring the work equipment in the traveling posture.
3. Depress right brake pedal, and move parking brake lever (2) to OFF (release) position to release the parking brake.
4. Set speed control lever (3) and directional lever (4) to the desired position.
5. Release right brake pedal, then depress accelerator pedal to move the machine off.

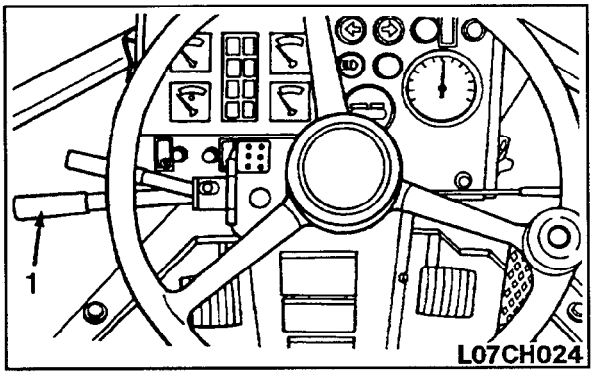
WARNING! If the machine has to be started on a slope, always turn the transmission cut-off selector switch to OFF and depress the left brake pedal. Then depress the accelerator pedal while releasing the left brake pedal to start the machine off slowly.



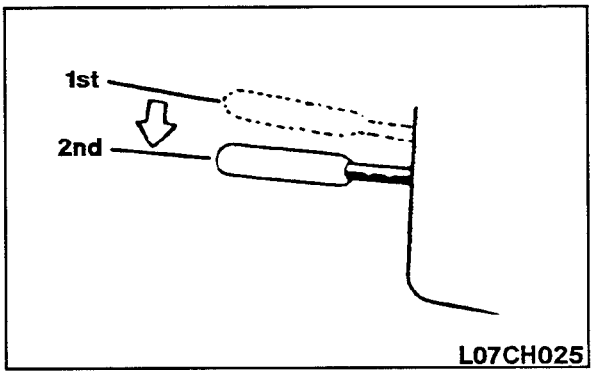


CHANGING GEAR SPEED

Move speed control lever (1) to the desired position.



★ To use 1st or 2nd speeds for digging and loading operations, actuate speed control lever stopper.



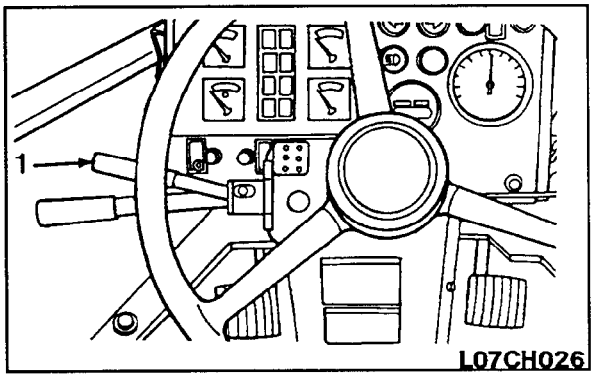
CHANGING DIRECTION

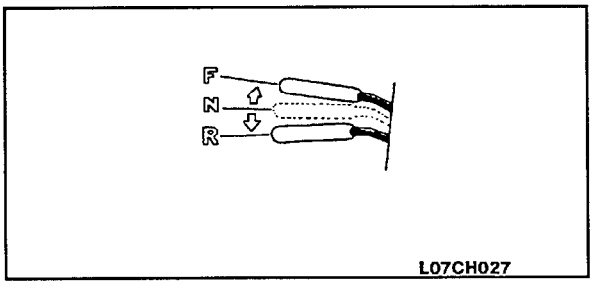
There is no need to stop the machine even when switching between FORWARD and REVERSE.

Place directional lever (1) in the desired position.

WARNING! Before changing direction, check that it is safe.

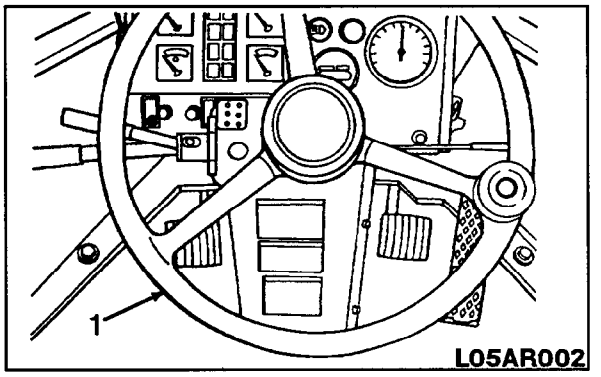
WARNING! Never change between FORWARD and REVERSE at high speed.





TURNING

When traveling, use steering wheel (1) to turn the machine.



★ With this machine, the front frame is joined to the rear frame at the center of the machine by the center pin. The front and rear frames bend at this point, and the rear wheels follow in the same track as the front wheels when turning.

★ Turn the steering wheel lightly to follow the machine as it turns. When turning the steering wheel fully, do not turn it beyond the end of the stroke.

WARNING! It is dangerous to turn the machine suddenly at high speed, or to turn on steep hills.

WARNING! If the engine stops when the machine is traveling, the steering cannot be used.
This is particularly dangerous on slopes, so the engine must never be stoped when traveling on slopes.

If the engine should stop, stop the machine immediately in a safe place.

TO STOP THE MACHINE

1. Release accelerator pedal (1), and depress brake pedal (2) to stop the machine.
2. Place directional lever (3) in N (neutral).
3. Pull parking brake lever (4) to apply the parking brake.

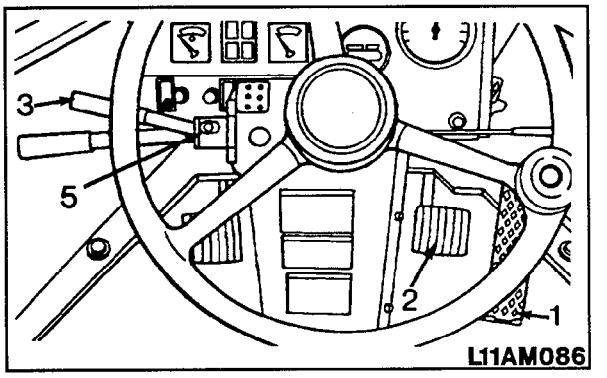
★ When the parking brake is applied, the transmission is automatically returned to neutral.

4. Fit safety lock (5) on the directional lever.
5. Operate work equipment control lever (6) and lower the bucket to the ground, then lock safety lock lever (7) for work equipment control lever.

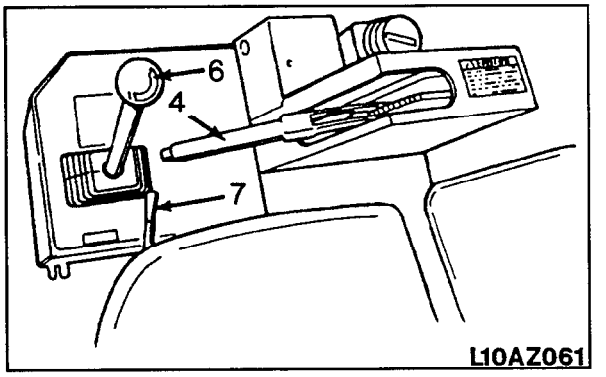
WARNING! Stop the machine in a safe place on firm level ground.

WARNING! If the machine has to be stopped on a slope, put blocks under the wheels.

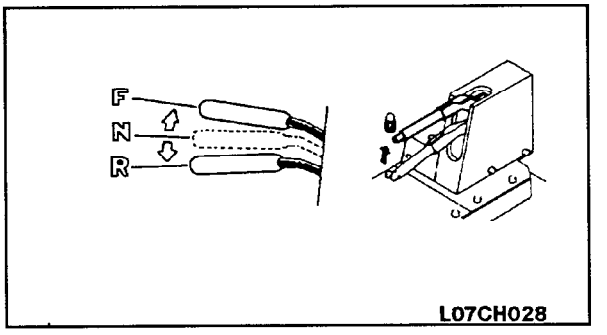
WARNING! In addition, dig the bucket into the ground to increase safety.



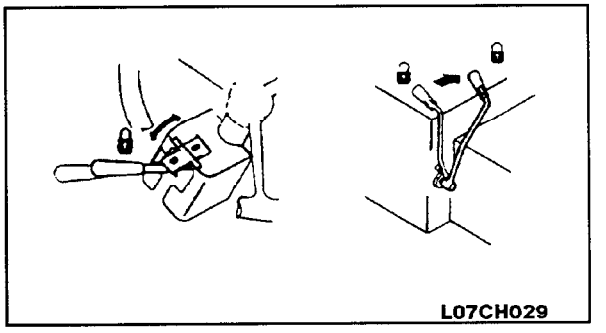
L11AM086



L10AZ061



L07CH028

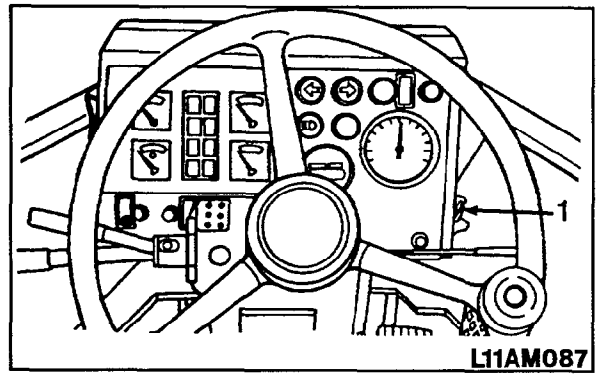

L07CH029

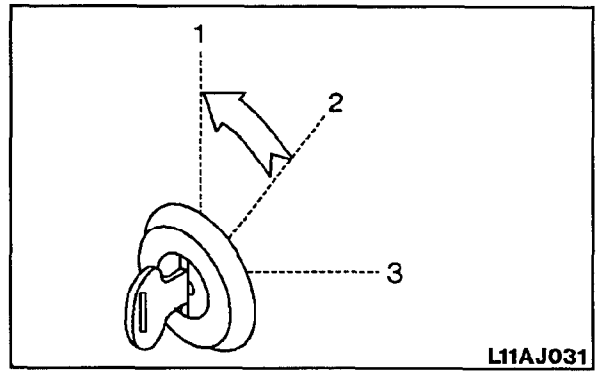
TO STOP THE ENGINE

1. Run the engine at low idling speed for about 5 minutes to allow it to gradually cool down.
2. Return starting switch (1) to the OFF position and remove the key.

★ If the engine is abruptly stopped before it has cooled down, engine life may be greatly shortened. Consequently, do not abruptly stop the engine apart from an emergency.

★ In particular, if the engine has overheated, do not abruptly stop it but run it at medium speed to allow it to cool gradually, then stop it.





1 = OFF 2 = ON 3 = START

OPERATIONS AFTER STOPPING ENGINE

1. Walk around the machine and check the work equipment and tires, also check for oil or coolant leakage. If any abnormalities are found, repair them.
2. Fill the fuel tank.
3. Check the engine compartment for foreign matter and debris. If found, remove the matter and/or debris to avoid a possible fire hazard.
4. Remove any mud stuck to the underside of the machine.

OPERATIONAL PRECAUTIONS

WORKING IN DUSTY LOCATIONS

1. Inspect the dust indicator to se whether the air cleaner is blocked up. Clean the air cleaner as soon as it becomes dirty.
2. Clean the radiator core so that it does not become blocked up.
3. Clean or replace the fuel filter as soon as it becomes dirty.
4. Clean the electrical equipment, particularly the starting motor and alternator, to prevent the accumulation of dust.

- When installing a car radio and a walkie-talkie or citizen band, contact your distributor.
- When washing the machine, take care not to splash water over the electrical equipment. If it is soaked with water, it may not operate normally.
- After disconnecting a connector, cover it with a vinyl bag to prevent oil or dust from sticking to its contact section.
- When welding, be careful of the following:
  1) Turn OFF the power (starting switch).
  2) Do not continuously apply more than 200 V.
  3) Install the ground cable at least 1 m from the range to be welded.
  4) Take care not to install the seals between the grounded point and the range to be welded.

★ Use ordinary automobile washer fluid. Be careful not to let dirt or dust get in.

GREASING THE ROD END

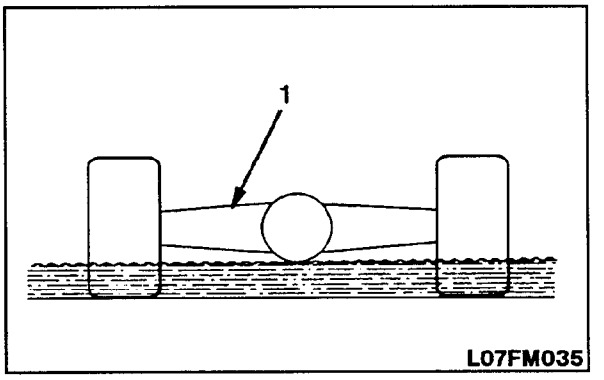
Because the rod end is of the oilless type, no greasing is required, although a grease nipple is fitted to the rod end of the lever linkage.

The rod end should be greased **only** when it becomes stiff after using it for a long span of time.

MAXIMUM DEPTH OF WATER

When working in water or on swampy ground, do not let the water come above the bottom of the axle housing.

★ After finishing the operation, wash and check the lubricating points.



1 = Axle housing

IF WHEEL BRAKE DOES NOT WORK

If the machine is not stopped by depressing brake pedal, use the parking brake to stop the machine.

PRECAUTIONS WHEN DRIVING UP OR DOWN SLOPES

LOWER THE CENTER OF GRAVITY WHEN TURNING

When turning on slopes, lower the work equipment to lower the center of gravity before turning. It is dangerous to turn the machine with the work equipment raised.

BRAKING ON DOWNHILL SLOPES

When going down slopes, put the speed control lever in a low gear position (the same position as when driving up the slope). Make full use of the engine to slow the machine, and use only the right brake pedal.

If the speed control lever is not placed in a proper speed position, the torque converter oil may overheat.

If it overheats, place the speed control lever in the next lower gear speed to lower the oil temperature.

If the temperature gauge does not indicate the green range of the scale even with the lever in the 1st speed position, stop the machine, place the lever in neutral, and run the engine at medium speed until the gauge indicates the green range.

IF ENGINE STOPS

If the engine stops on a slope, depress the right brake pedal fully. Next, lower the work equipment to the ground and apply the parking brake. Then put the directional and speed control levers in neutral, and start the engine again. (If the directional lever is not in neutral, the engine will not start).

POSSIBLE WORK USING LOADER

Various types of attachments are available to extend the range of application beyond the applications described below.

EXCAVATION

- When loading piled soil or blasted rock, drive the machine forward as follows to load. To prevent cutting of the tires caused by the tires slipping, be careful of the following points during the operation.

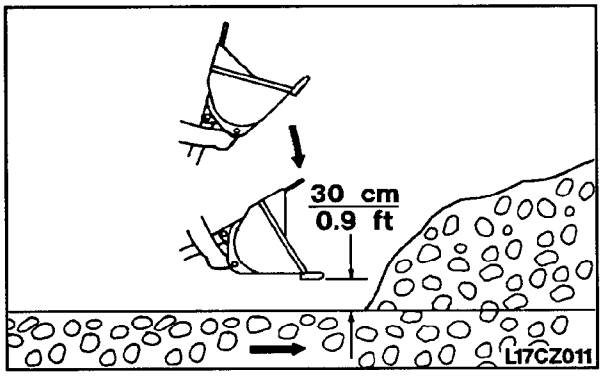
★ Always keep the operating jobsite flat, and remove any fallen rocks.

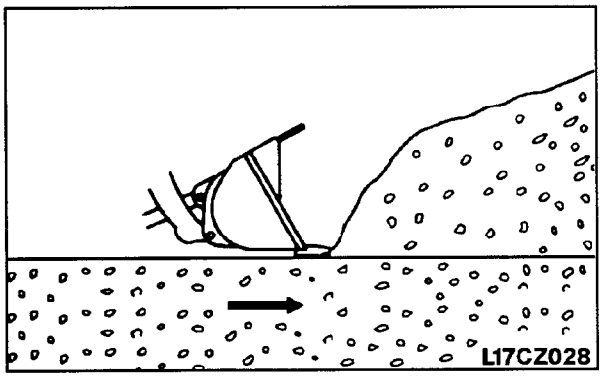
★ When working with stockpiles, operate the machine in 1st or 2nd, operate the machine in 1st when loading blasted rock.

1. When driving the machine forward and lowering the bucket, stop the bucket about 30 cm (0.9 ft) from the ground, then lower it slowly.

★ If the bucket hits the ground, the front tires will come off the ground, and the tires will slip.

2. Shift down immediately in front of the material to be loaded. When completing the shift down, depress the accelerator pedal at the same time and thrust the bucket into the load.



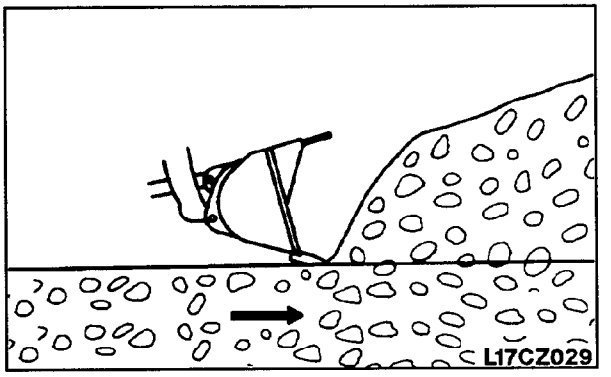


Stockpile

3. When the material is in a stockpile, keep the cutting edge of the bucket horizontal when loading blasted rock, have the bucket tilting slightly down.

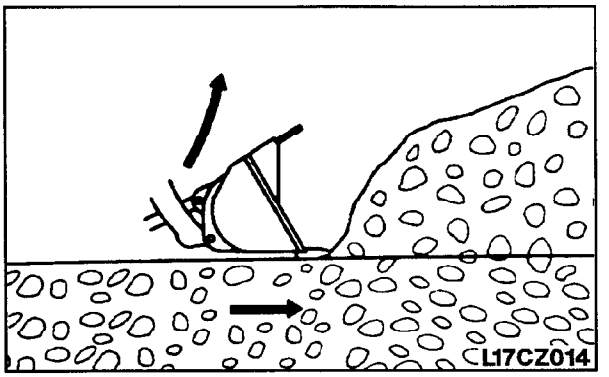
★ Be careful not to get blasted rock under the bucket. This will make the front tires come off the ground and slip.

★ Try to keep the load in the center of the bucket; if the load is on one side of the bucket, the load will be unbalanced.



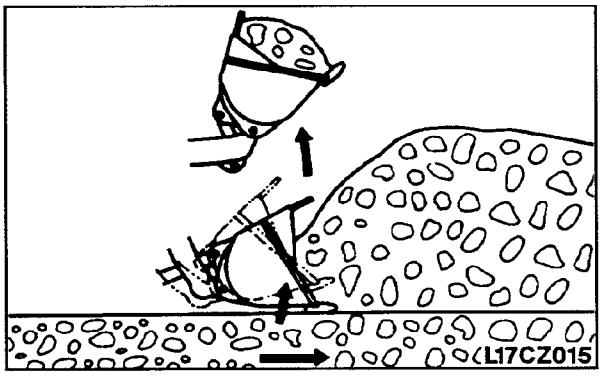
Blasted rock

4. At the same time as thrusting the bucket into the material, raise the lift arm to prevent the bucket from going in too far. By raising the lift arm, ample traction will be produced by the front tires.



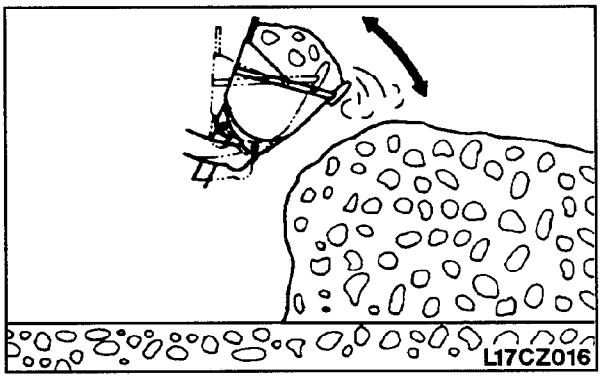
5. Check that there is enough material loaded into the bucket, then operate the bucket control lever to tilt the bucket and load the bucket fully.

★ If the bucket edge is moved up and down while pushing in the bucket and digging, the front tires will come off the ground and this will cause the tires to slip.



6. If there is too much material loaded in the bucket, dump and tilt the bucket quickly to remove the excessive load.

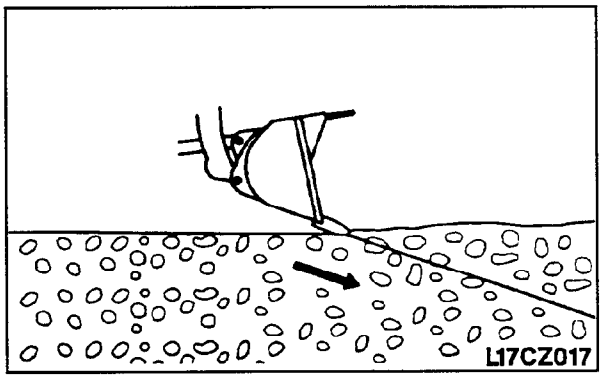
   This prevents spillage of the load during hauling.



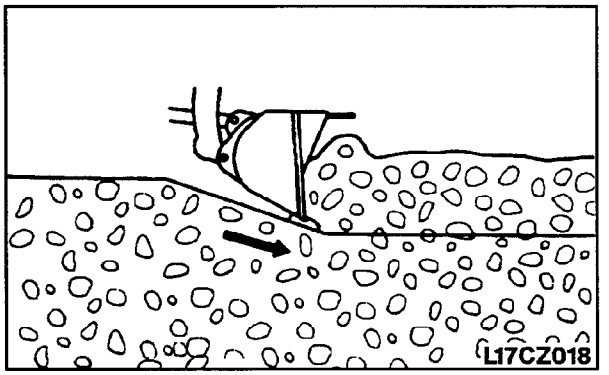
- When digging and loading on level ground, set the bucket edge facing down slightly as follows and drive the machine forward. Always be careful not to load the bucket on one side and cause an unbalanced load.

★ This operation should be carried out in 1st gear.

1. Set the edge of the bucket facing slightly down.



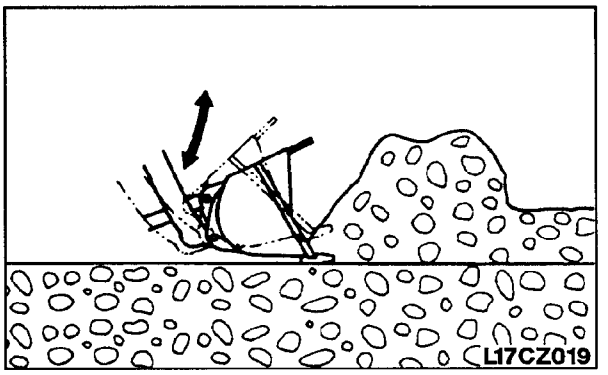
2. Drive the machine forward and operate the lift arm control lever forward to cut a thin layer of the surface each time when excavating the soil.



3. Operate the lift arm control lever slightly up and down to reduce the resistance when driving the machine forward.

★ When digging with the bucket, avoid imposing the digging force onto only one side of the bucket.

WARNING! Never dig or scoop when the machine is articulated.



Precautions when scooping up materials.

When scooping up materials, be careful not to let the counterweight at the rear touch the ground.

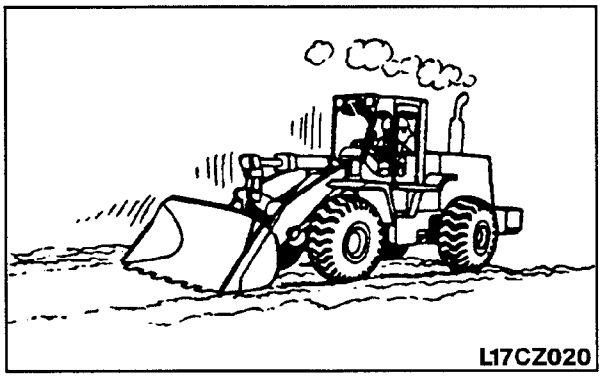
★ Do not allow tires slipping to occur during operation. Tire slippage shortens tire's life.

LEVELING

1. Scoop soil into the bucket. Move the machine backward while spreading soil from the bucket little by little.

2. Go over the spread soil with the bucket teeth touching the ground and level the ground by back-dragging.

3. Scoop some more soil into the bucket, put the lift arm in float, level the bucket at ground level, and smooth the ground by moving backward.



★ Always move the machine backward during leveling operations.

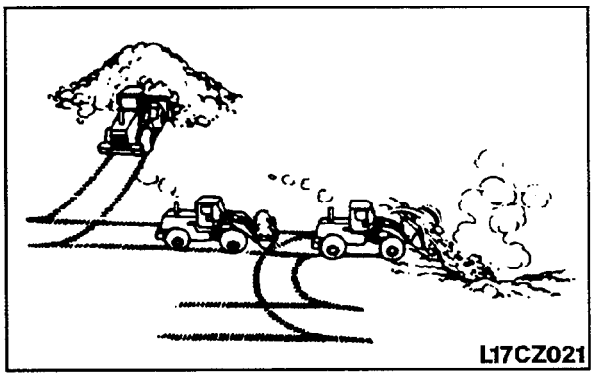
WARNING! If leveling by forward travel can not be avoided, do not dump the bucket beyond 20°. This will prevent quick wear and damage of the work equipment and frame.

LOAD AND CARRY OPERATIONS

Load and carry operation is a series of processes (scooping - carrying - loading to a hopper or glory hole) carried out by the wheel loader.

★ Always maintain the road in good condition.

WARNING! Lower the bucket to bring down the center of gravity when carrying material.


L17CZ021

LOADING

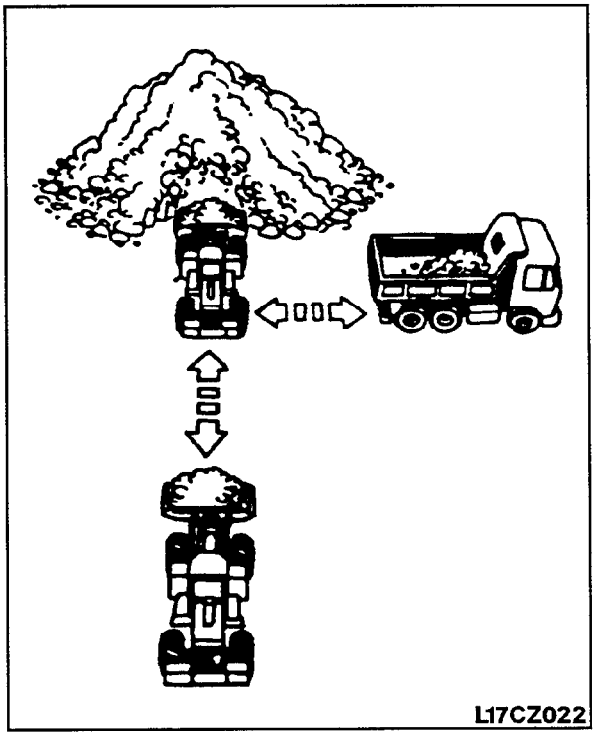
Select and proceed effective operation which avails less turning and the shortest hauling distance according to ground conditions.

Cross Drive Loading

When a wheel loader is operated, the digging should be made at a right angle toward accumulated soil. When the scooping is completed, the machine should be traveled backwards as it is. Then, bring the truck between the accumulated soil and the wheel loader for the purpose of loading upon the dump truck.

WARNING! Provide a flat road free of rocks and hollows. When the boom is raised with the bucket loaded, do not make quick turns or quick braking because it is very dangerous.

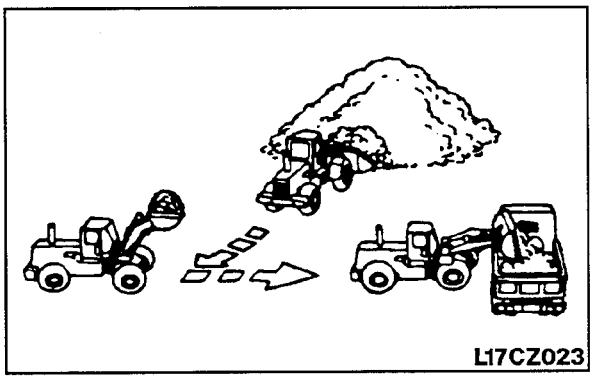
WARNING! Do not load the bucket by thrusting into a pile of soil or gravel at high speed because it is dangerous.


L17CZ022

V-Shape Loading

Stop the truck with the angle of about 60° toward the scooping direction of the wheel loader. After scooping the soil, back the wheel loader in such a way that it makes a right angle to the truck. The loading on the truck is made by the wheel loader going forward.

The smaller the turning angle, the higher the efficiency. However, turning of 90° can be made if necessary.


L17CZ023

PARKING MACHINE

WARNING! Never leave the machine with the engine running or the bucket raised. When parking the machine, stop the engine, lower the bucket to the ground, place the transmission in neutral (N), apply the parking brake, turn off the electrical starting switch, and remove the key.

WARNING! Park the machine in a non-traffic area. If parking in traffic lanes cannot be avoided, provide appropriate flags, barriers, flares and warning signals. Also provide advance warning signals in the traffic lane for approaching traffic.

WARNING! Avoid parking on a slop because unexpected machine movement may occur. If necessary to park on a slope, park at a right angle to the slope and block the tires.

WARNING! Before starting the engine or when the machine is standing with the engine running: Place the transmission in neutral (N), apply the parking brake, and lower all raised work equipment.

Park machine in an area free of grease and fuel puddles which cause tire deterioration.

Lower hydraulically supported equipment to the ground to avoid unexpected movement and damage possibilities.

Park on level ground to obtain accurate coolant, lubricant and fuel level checks.

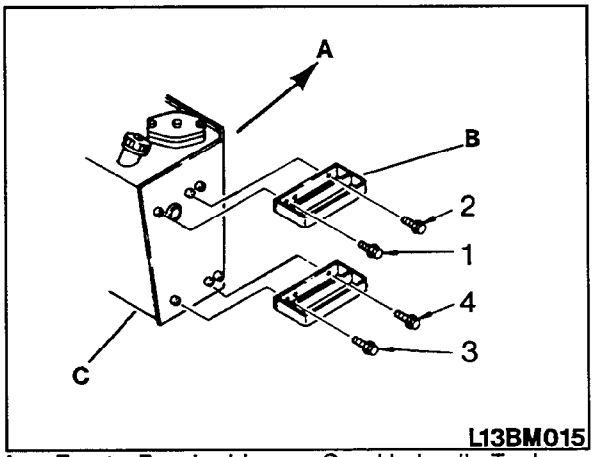
WARNING! Always lock up the machine, including any anti-vandalism attachment, when leaving it unattended.

PRECAUTIONS WHEN TIRE CHAINS ARE FITTED

If the machine is to be driven at high speed with chains fitted, care must be taken to maintain the clearance between the tire chains and the chassis (ladder). To maintain the clearance, move the ladder to the front as follows.

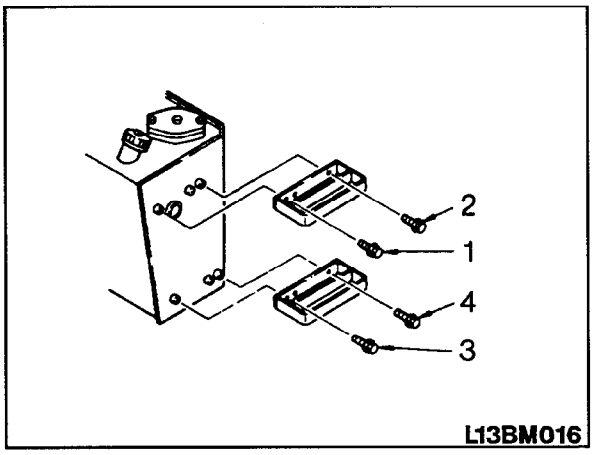
PROCEDURE FOR MOVING R.H. LADDER

1. Remove bolts (1), (2), (3), and (4).



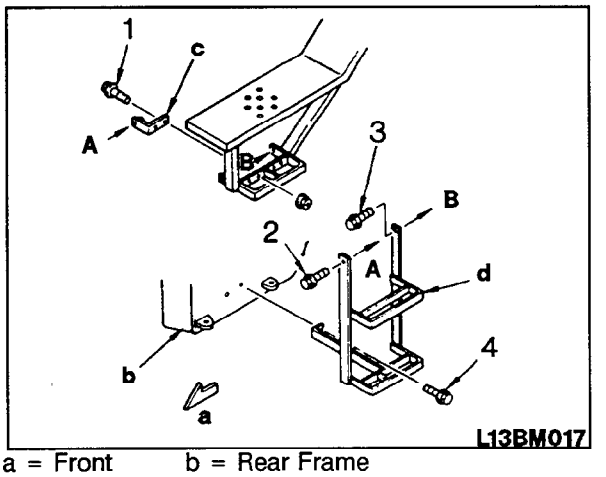
A = Front B = Ladder C = Hydraulic Tank

2. Move both the top and bottom steps of the ladder to the front, and tighten the bolts again.



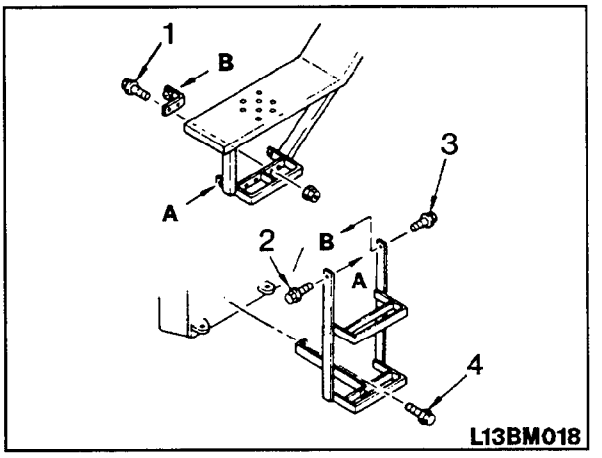
PROCEDURE FOR MOVING L.H. LADDER

1. Remove bolts (1), (2), (3), and (4).



a = Front b = Rear Frame
c = Bracket d = Ladder

2. Move the ladder and the bracket to the front, and tighten the bolts again.

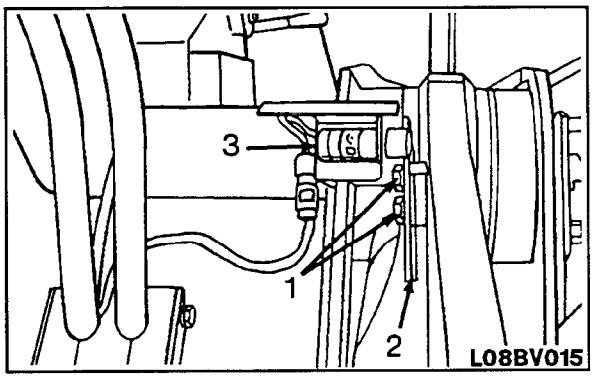


ADJUSTMENT OF WORK EQUIPMENT

The boom kickout makes it possible to set the bucket so that it automatically stops at the desired lifting height (lift arm higher than horizontal) and the bucket positioner makes it possible to set the bucket so that it automatically stops at the desired digging angle. The setting can be adjusted to match the working conditions.

ADJUSTING BOOM KICKOUT

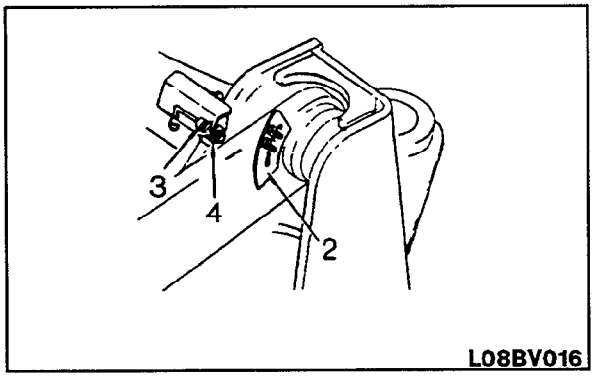
1. Raise the bucket to the desired height, set the work equipment control lever at HOLD and lock the lever in position. Then stop the engine and adjust as follows.
2. Loosen two bolts (1), and adjust plate (2) so that the bottom edge is in line with the center of the sensing surface of proximity switch (3). Then tighten the bolts to hold the plate in position.



3. Loosen two nuts (4) to make a clearance of 3 to 5 mm between plate (2) and the sensing surface of proximity switch (3). Then tighten the nuts to hold in position.

★ Tightening torque: 1.75 ± 0.25 kgm

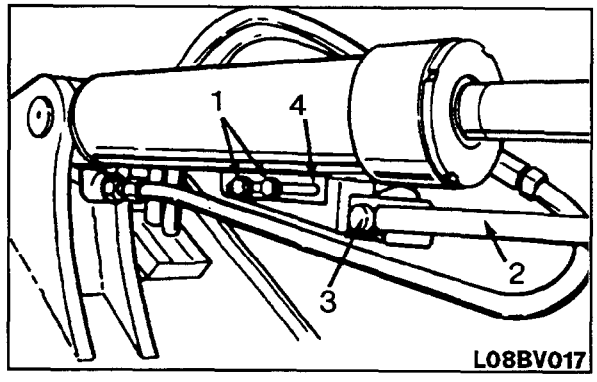
4. After adjusting, start the engine and operate the lift arm control lever. Check that the lever is automatically returned to HOLD when the bucket reaches the desired height.



ADJUSTING BUCKET POSITIONER

1. Lower the bucket to the ground and adjust the bucket to the desired digging angle. Set the bucket control lever at HOLD, stop the engine and adjust as follows.

2. Loosen two bolts (1) and adjust mounting bracket (4) of the proximity switch so that the rear tip of angle (2) is in line with the center of the sensing surface of proximity switch (3). Then tighten the bolts to hold the bracket in position.



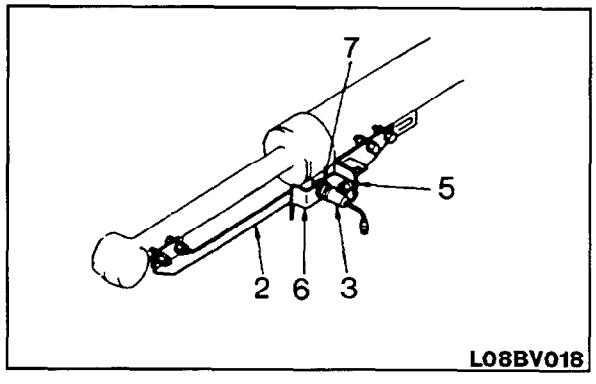
3. Loosen bolt (5) to give a clearance of 0.5 to 2 mm between bar (2) and support (6). Then tighten the nuts to hold in position.

★ Tightening torque: 1.75 ± 0.25 kgm

4. Loosen two nuts (7) to make a clearance of 3 to 5 mm between bar (2) and the sensing surface of proximity switch (3). Then tighten the nuts to hold in position.

★ Tightening torque: 1.75 ±0.25 kgm

5. After adjusting, start the engine and raise the lift arm. Operate the bucket control lever to the DUMP position, then operate it to the TILT position and check that the bucket control lever is automatically returned to HOLD when the bucket reaches the desired angle.

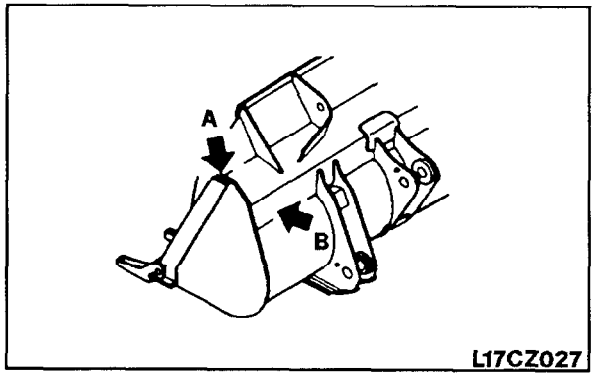


BUCKET LEVEL INDICATOR

(A) and (B) at the top rear of the bucket are the level indicators, so the bucket angle can be checked during operations.

A: Parallel with cutting edge

B: 90° to cutting edge

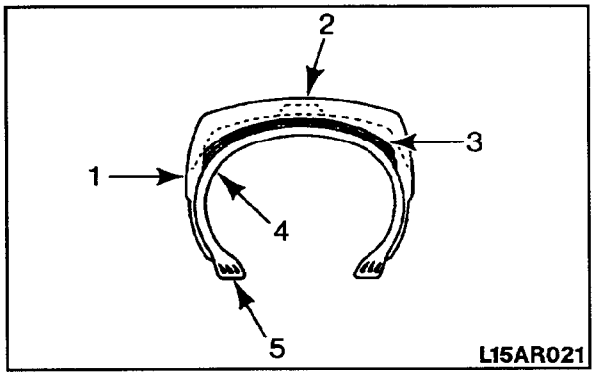


HANDLING TIRES

PRECAUTIONS WHEN HANDLING TIRES

If the following defects are found in tires, for safety reasons the tire should be replaced with a new tire.

- Bead wire is broken or bent, or the tire is greatly deformed.
- Wear is excessive and the carcass ply (excluding breaker) is exposed for more than 1/4 of the circumference.
- Damage to the carcass exceeds 1/3 of the tire width.
- Tire layers are separated.
- Radial cracks reach the carcass.
- Deformation or damage which makes the tire unsuitable for use.



1 = Sidewalls 2 = Tread 3 = Breakers
4 = Carcass 5 = Beads

PRECAUTIONS WHEN DRIVING MACHINE

When the machine travels at high speed for a long distance, the tires become extremely hot. This causes early wear of the tires, so it should be avoided as far as possible. If the machine must be driven for a long distance, take the following precautions.

- Follow the regulations related to this machine, and drive carefully.
- The most suitable tire pressure, travel speed, or tire type differ according to the condition of the travel surface. Contact your distributor or tire dealer for information.
- The following is a guide to suitable tire pressures and speeds when traveling on a paved surface with standard tires.

Tire pressure: Front 2.8 kg/cm^2
Speed: 25 to 30 km/h (16 to 18 MPH)

- Check the tire pressure before starting, when the tire is cool.
- After traveling for 1 hour, stop for 30 minutes. Check the tires and other parts for damage; also check the oil and coolant levels.
- Always travel with the bucket empty.
- Never put calcium chloride or dry ballast in the tires when traveling.

TIRE PRESSURE

Measure the tire pressure before starting operations, when the tires are cool.

If the inflation pressure is too low, it causes overload on the tires; if the inflation pressure is too high, the tire may be cut or may burst under shock. Therefore adjust the inflation pressure to the values in the following table.

Tire size (pattern)	Ply rating	Inflation pressure (kg cm²)			
		Soft ground (sandy ground)	Normal road		When shipped from factory
			Stockpile	Digging	
15.5 - 25 (L-2 Traction)	8	1.8 - 3.0	2.0 - 3.5	2.5 - 3.5	3.0
17.5 - 25 (L-2 Traction Opt.)	12				

- For operations on normal road surfaces, rock digging operations:
  High end of range in air pressure chart.
- Stockpile operations on soft ground:
  Average pressure in air pressure chart.
- Operations on sand (operations not using much digging force):
  Low end of range in air pressure chart.

  If the deflection of the tire is excessive, raise the inflation pressure within the limits given in the table to give a suitable deflection (see deflection ratio).

★ Stockpile operations mean the loading of sand and other loose materials.

As a guide for visual checks, the deflection ratio (deflection/free height) of the front tire should be as follows.

Normal loading and carrying operations (lift arm horizontal): approx. 15-25%

Digging operations (rear wheels off ground): approx. 25 - 35%

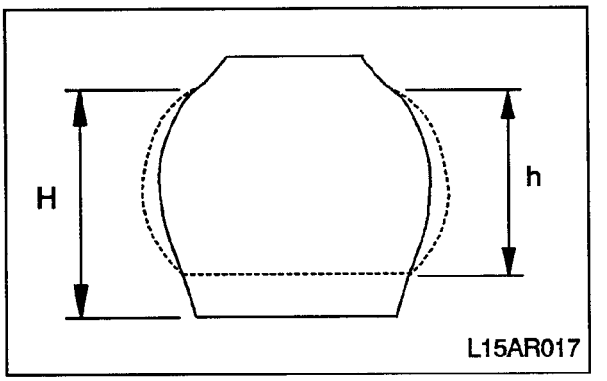
★ When checking the tire pressure, check also for small cracks and damage, and for wire or small pieces of metal which may cause punctures. Check also for abnormal wear.

★ Operating costs can be reduced and tire life increased by keeping the operating area in good condition and free from fallen rocks.

★ Deflection ratio (deflection/free height)

$$= \frac{H - h}{H} \times 100$$

H: Free height
h: Height when loaded



TOWING

TOWING THE MACHINE

This machine must not be towed except in emergencies. When towing the machine, take the following precautions.

WARNING! If there is a failure in the brake line, the brakes cannot be used, so be extremely careful when towing.

WHEN ENGINE CAN BE USED

- Always keep the engine running when towing the machine, so that the steering and braking can be used.

WHEN ENGINE CANNOT BE USED

- No lubrication oil flows in the transmission, so disconnect the front and rear drive shafts before moving the machine.
- The steering cannot be used, so disconnect the steering cylinder and steering linkage.

★ The machine should be towed only to the nearest place for inspection and maintenance. Do not tow the machine for long distances.

TRANSPORTATION

When transporting the machine, observe the various road rules, road transportation vehicle limit ordinances, etc. It is a good idea to obtain a special platform for loading and unloading the machine. When it is unavoidably necessary to use a gangplank, however, at the very least observe the following for the sake of safety.

1. Properly apply the brakes on the trailer and insert blocks beneath the tires to ensure that it does not move. Then fix the gangplank in line with the centers of the trailer and the machine.

   ★ Make sure the gangplank has sufficient width, length and thickness to enable the machine to be safety loaded and unloaded.

   If the gangplank sags appreciably, reinforce it with blocks, etc.

2. Determine the direction of the gangplank, then slowly load or unload the machine.

   ★ When transmission cut-off switch is put in OFF, the left brake pedal and accelerator pedal are operated at the same time.

WARNING! Remove the mud from the undercarriage to prevent the machine from slipping to the side on slopes.

WARNING! Do not on any account change the direction of the machine while it is on the gangplank. To change the direction of the machine, first take it down from the gangplank.

3. Correctly load the machine onto the specified part of the trailer.
4. Lower the bucket and lock each control lever using the safety lock.
5. Lock the front and rear frames with the safety bar.
6. When transporting the machine, place blocks underneath the front and rear wheels to prevent the machine from moving about. Also, hold it down with chains or wire ropes.

   ★ Determine the route for transporting the machine by taking into account the width, height and weight of the machine.

WARNING! When loading the machine, park the trailer on flat roadbed. Keep a fairly long distance between the road shoulder and the machine.

COLD WEATHER OPERATION

PREPARATION FOR LOW TEMPERATURE

If the temperature becomes low, it becomes difficult to start the engine, and the coolant may freeze, so do as follows.

FUEL AND LUBRICANTS

Change to fuel and oil with low viscosity for all components.

For details of the specified viscosity, see the TABLE OF FUEL, COOLANT AND LUBRICANTS.

COOLANT

Use antifreeze during all seasons to protect the cooling system from corrosion as well as freezing damage.

A mixture of 50% water and 50% ethylene-glycol base antifreeze is required for operation of the engine in temperature environments above -37°C. A mixture of 40% water and 60% antifreeze is recommended for temepratures below -37°C.

BATTERY

- As ambient temperature drops, battery capacity will drop, and electrolyte may sometimes freeze if battery charge is low. Maintain battery at a charge level of approx. 100% and insulate it against cold temperature so that machine can be readily started the next morning.

★ When electrolyte level is low, add distilled water in the morning before work instead of after the day's work. This is to prevent fluid from freezing at night.

WARNING! To avoid gas explosions, do not bring fire or sparks near the battery.

WARNING! If the electrolyte gets on your skin or clothes, immediately wash with plenty of clean water.

★ Measure specific gravity of fluid and obtain rate of charge from the following conversion table:

Temp. of fluid / Rate of change	20°C	0°C	-10°C	-20°C	-30°C
100%	1.28	1.29	1.30	1.31	1.32
90%	1.26	1.27	1.28	1.29	1.30
80%	1.24	1.25	1.26	1.27	1.28
75%	1.23	1.24	1.25	1.26	1.27

CAUTIONS AFTER COMPLETION OF WORK

1. Mud and water on the machine body should be completely removed. Park the machine on concrete or hard ground. If this is impossible, park the machine on wooden boards. This will prevent the accessories from freezing to the ground thereby preventing machine movement the next morning.
2. Particular attention should be given to water drops collected on the surface of the hydraulic cylinder piston rods. Such droplets must be fully wiped off because if water is frozen to the rod when the cylinder is utilized, the cylinder oil seals may be damaged.
3. Drain water collected in fuel system so that such water may be frozen at night.
4. As battery capacity drops at low ambient temperature, cover the battery or remove it from the machine to be kept warm at night.

AFTER COLD WEATHER

When weather becomes warm, perform the following without fail:

- Replace lubricating oils for various units with the ones specified for warm-weather use.

LONG TERM STORAGE

BEFORE STORAGE

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

- After every part is washed and dried, the machine shall be housed in a dry building. Never leave it outdoors.

  If it is unavoidable to leave it outdoors, park the machine on flat ground and cover it with canvas, etc.

- Completely fill the fuel tank, lubricate and change oil before storage.

- Apply a thin coat of grease to the metal surfaces of the hydraulic cylinder piston rods and splined shafts.

- Disconnect the negative terminals of the batteries and cover the batteries or remove them from the machine and store them separately.

- When the ambient temperature is anticipated to drop below 0°, always add antifreeze in the cooling water.

- Set each control lever to neutral or hold position, lock them and apply the parking brake.

- Open the air tank drain valves to completely drain the tanks. After draining, close the drain valves.

★ If the engine will be out of service longer than six (6) months, take special precautions to prevent rust. Contact the nearest Distributer for information concerning engine storage procedures.

DURING STORAGE

WARNING! If it is unavoidably necessary to carry out rust-preventive operation while the machine is indoors, open up doors and windows to improve ventilation and prevent the gas poisoning.

- Operate the engine and move the machine for a short distance once a month so the new oil film will be coated over movable parts and component surfaces.

- Before operating the work equipment, wipe off the grease on the hydraulic cylinder piston rods.

AFTER STORAGE

NOTICE:If the machine is stored without carrying out the monthly rust prevention operation, request your distributor for service.

Carry out the following procedure when taking the machine out of long-term storage.

- Wipe off the grease on the hydraulic cylinder piston rods.

- Completely fill the fuel tank, lubricate and add oil.

HANDLING OF BATTERY

PRECAUTIONS FOR CHARGING BATTERY

1. Before charging, disconnect the cable from the negative (-) terminal of the battery. Otherwise, an unusually high voltage will damage the alternator.
2. While charging the battery, remove all battery caps for satisfactory ventilation.

WARNING! To avoid gas explosions, do not bring fire or sparks near the battery.

3. If the electrolyte temperature exceeds 45°C (113°F), stop charging for a while.
4. Turn off the charger as soon as the battery is charged.

   Overcharging the battery may cause the following:

   1) Overheating the battery
   2) Decreasing the quantity of electrolyte.
   3) Damaging the electrode plates.

5. If the electrolyte gets on your skin or clothes, immediately wash with plenty of clean water.
6. Do not mix up battery cables; positive (+) to negative (-) or negative (-) to positive (+), as this will damage the alternator.
7. When inspecting or servicing a battery, be sure to stop the engine and turn the starting switch key to "OFF" position.
8. When performing any service to battery besides checking the electrolyte level or measuring the specific gravity or voltage reading, disconnect the cables from the battery.

REMOVAL AND INSTALLATION OF BATTERY

- When removing the battery, first disconnect the cable from the ground; normally, from the negative (-) terminal.

WARNING! If a tool touches a connected positive (+) cable terminal and the chassis, there is danger that it will cause sparks.

- When installing the battery, connect the positive (+) cable first and connect the negative (-) or ground cable to the ground terminal last.
- Batteries are mounted on both sides of the machine, just in front of the counterweight. The ground cable is connected to the battery, located on the right side.

STARTING ENGINE WITH BOOSTER CABLES

When starting the engine with booster cables, do as follows:

WARNING! Be sure to follow all related safety precautions listed in Section 1.

BEFORE CONNECTING BOOSTER CABLES

1. The size of the booster cable and clamp should be suitable for the battery size.
2. Check booster cables and clamps for damage or corrosion.
3. Make sure that the cables and clamps are firmly connected.
4. Keep the starting switch in the "OFF" position.
5. The battery of the normal machine must be the same capacity as that of the engine to be started.

CONNECTING BOOSTER CABLES

Connect the booster cables in the following manner.

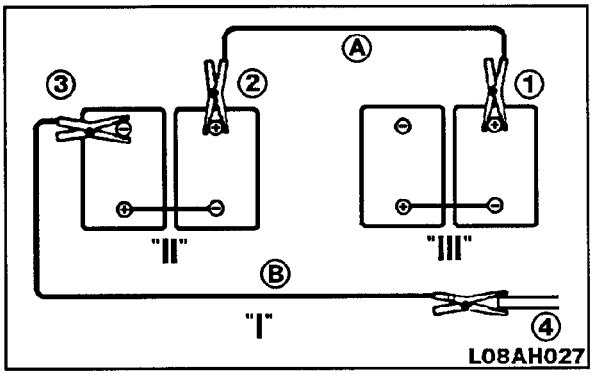
WARNING! When connecting the cables, never contact the positive (+) and negative (-) terminals.

WARNING! Make sure that the booster cable connections are correct. Connect the booster cable to the engine block as far as possible from the battery.

1. Connect one clamp of booster cable (A) to the positive (+) battery terminal of the engine to be started.
2. Connect the opposite clamp of booster cable (A) to the positive (+) battery terminal of the normal machine.
3. Connect one clamp of booster cable (B) to the negative (-) battery terminal of the normal machine.
4. Connect the other clamp of booster cable (B) to the engine block of the problem machine.

★ Make sure the cable clamps are firmly connected to the battery terminals.

"I" = Engine block of problem machine
"II" = Booster batteries
"III" = Batteries of problem machine



STARTING ENGINE

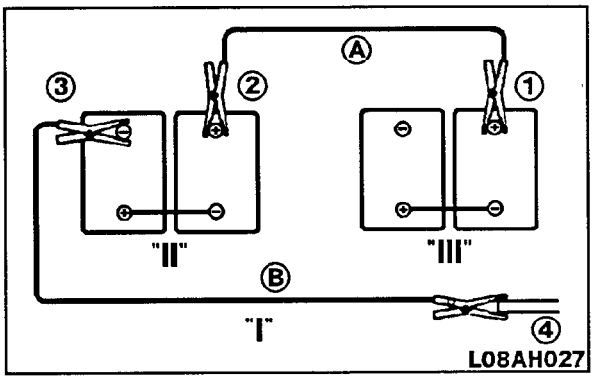
1. Start the engine of the normal machine and run the engine above low idle speed.
2. Start the engine of the problem machine as outlined under "STARTING ENGINE".

DISCONNECTING BOOSTER CABLES

After the engine has started, disconnect the booster cables in the reverse order in which they were connected.

1. Disconnect the clamp of booster cable (B) from the engine block of the problem machine.
2. Disconnect the other clamp of booster cable (B) from the negative (-) battery terminal of the normal machine.
3. Disconnect the clamp of booster cable (A) from the positive (+) battery terminal of the normal machine.
4. Disconnect the other clamp of booster cable (A) from the positive (+) battery terminal of the problem machine.

"I" = Engine block of problem machine
"II" = Booster batteries
"III" = Batteries of problem machine



TROUBLESHOOTING

This guide is not intended to cover all conditions, however many of the more common possibilities are listed.

- In cases of abnormalities or causes which are not listed below, contact your distributor.

ELECTRICAL SYSTEM

Lamp does not glow brightly even when engine runs at high speed.

Lamp flickers while engine runs.
- Check for loose terminals and open-circuit wiring.
- Adjust belt tension.

Charge monitor does not go out even when engine runs at high speed.
- Repair or place the alternator.
- Inspect and repair wiring.

Unusual noise is emitted from the alternator.
- Repair or replace the alternator.

Cranking motor does not turn when starting switch is turned on.
- Inspect and repair the wiring.
- Charge the batteries.

The pinion of the cranking motor keeps going in and out.
- Charge the batteries.

Cranking motor turns the engine sluggishly.
- Charge the batteries.
- Replace the cranking motor.

The cranking motor disengages before the engine starts up
- Check and repair the wiring.
- Charge the batteries.

The engine pre-heating monitor does not flash.
- Check and repair wiring.
- Replace the heater relay.
- Replace the monitor.

The engine oil pressure monitor does not light up when engine is stationary and when the starting switch is in ON position.
- Replace the monitor.
- Replace the monitor sensor.
- Inspect and repair the wiring.

Charge monitor does not light up when the engine is stationary and when the starting switch is in ON position.
- Replace the monitor.
- Inspect and repair the wiring.

Outside the electrical intake air heater is not warm when touched with the hand.
- Check and repair wiring.
- Replace the electrical intake air heater.
- Check and repair the heater switch.

ENGINE

The engine oil pressure monitor flashes when engine speed is raised after completion of warm-up.
- Add the oil to the specified level.
- Replace the oil filters.
- Check oil leakage from the pipe or the joint.
- Replace the monitor.

Steam is emitted from the top of the radiator at the pressure valve.
The engine coolant temperature monitor flashes.
- Supply the coolant and check for leakage.
- Adjust fan belt tension.
- Clean and flush inside of cooling system.
- Clean or repair radiator core fins.
- Replace engine thermostat.
- Tighten the radiator cap firmly or replace the cap if it has a faulty gasket.
- Replace the monitor.

The engine does not start when the cranking motor is turned over.
- Add fuel.
- Repair where air is leaking into fuel system.
- Replace the injection pump or the nozzle.
- Check engine valve clearance.
- Check engine compression pressure.
- Refer to section for ELECTRICAL SYSTEM.

Exhaust gas is white or blue.
- Adjust to specified oil quantity.
- Replace with specified fuel.

Exhaust gas occasionally turns black.
- Clean or replace the air cleaner element.
- Replace the nozzle.
- Check engine compression pressure.
- Clean and replace turbocharger.

Combustion noise occasionally changes to breathing sound.
- Replace the nozzle.

Unusual combustion noise or mechanical noise.
- Replace with specified fuel.
- Check over-heating.
- Replace the muffler.
- Adjust valve clearance.

CHASSIS

TRANSMISSION

Engine is running but machine will not move.
- Release parking brake.
- Put directional lever in position properly.
- Add oil to transmission case to the specified level.

Even at full throttle, machine moves slowly and lacks power.
- Add oil to transmission case to the specified level.
- Disassemble transmission strainer and clean.

Oil overheats.
- Add oil to transmission case to the specified level or drain oil.
- Use a suitable gear speed.
- Reduce time using torque converter at stall speed.
- Check engine.

Abnormal noise is produced.
- Add oil to transmission case to the specified level.

DRIVE AXLES

Abnormal noise is produced.
- Add oil to axle housing up to proper level.

WHEEL BRAKES

Brakes do not work when pedal is depressed.
- Replace discs.
- Add brake oil to the specified level.
- Bleed air from brake system.

Brake drags or stays applied.
- Clean exhaust hole of treadle valve.
- Clean breather of power cluster.
- Check and repair slack adjuster.

Brake slips.
- Replace discs.

PARKING BRAKE

Brake does not work properly.
- Adjust linkage.
- Clean brake pad.
- Adjust or replace brake pad.

STEERING

Steering wheel is heavy.
- Adjust steering gear.
- Check linkage, replace parts.

EQUIPMENT HYDRAULIC SYSTEM

Bucket lacks lifting power.
Bucket lifting speed is slow.
- Add oil.
- Replace filter in hydraulic tank.

Many bubbles form in oil.
- Replace with specified oil.
- Add oil.
- Bleed air from oil line.

Oil pressure is too low.
- Add oil and bleed air.

Cylinder vibrates when operating.
- Add oil.

SECTION 3
MAINTENANCE

WARNING ! REFER TO AND READ ALL SAFETY PRECAUTIONS IN SECTION 1.

PERIODIC MAINTENANCE

Proper lubrication and maintenance assure trouble-free operation and long machine life. Time and money spent for scheduled periodic maintenance will be amply compensated by prolonged machine operation and reduced operating cost.

All hourly figures given in the following descriptions are based on service meter readings. In practice, however, it is recommended to rearrange all of them into units of days, weeks and months, to make the maintenance schedule more convenient. Under rough jobsite or operating conditions, it is necessary to somewhat shorten the maintenance intervals stated in this manual.

MAINTENANCE GUIDELINES

Perform maintenance work on a hard, flat surface.

Use genuine parts specified in the Parts Book as replacement parts.

Use genuine oils and grease. Choose oils and grease with proper viscosities specified for the ambient temperature.

Use clean oil and grease. Also, keep containers of the oil and grease clean. Keep foreign materials away from oil and grease.

Always keep the machine clean. This makes is easier to find parts causing problems. Keep in particular grease fittings, breathers and oil level gauges clean and avoid foreign matters from getting in them.

Be careful of hot coolant and oil:
Draining hot oils and coolants and removing their filters immediately after the engine stops are hazardous. Allow the engine to cool. If the oil has to be drained when it is cold, warm up the oil to a suitable temperature (approx. 20°-40°C [68°-104°F]) before draining it.

Check for foreign materials in drained oil:
After oil is changed or filters are replaced, check the oil and filters for metallic particles and foreign materials. If large quantities of metallic particles or foreign materials are found, consult your distributor.

Fuel strainer:
Do not remove the fuel strainer while fueling.

Oil changes:
Check or change oils in the places where dust is scarce to keep foreign materials away from oils.

Warning tag:
Attach the warning tag to the starting switch or other appropriate control lever to avoid someone who is not aware of the circumstances from starting the engine.

Obey precautions:
During operation, always obey the precautions on the safety product graphics located on the machine.

Welding instructions:
- Turn off the engine starting switch.
- Do not apply more than 200 V continuously.
- Connect grounding cable within 1 m (3.3 ft) from the area to be welded.
- Avoid seals or bearings from being between the area to be welded and the position of the grounding point.

Fire prevention:
Use a nonflammable cleaner or light oil for cleaning parts. Keep flame or cigarette light away from cleaning fluid.

Clamping faces:
When O-rings or gaskets are removed, clean the clamping faces and replace the O-rings and gaskets with new ones. Be sure to properly fit the O-rings and gaskets when assembling.

Objects in your pockets:
Keep your pockets free of loose objects which can fall out and drop into the machinery; especially when you work on the machinery while bending over it.

Cleaning machine:
- Do not direct a high-pressure jet directly at the radiator.
- Do not splash water on the electrical components.

Pre- and post-work checks:
Before starting work in mud, rain, snow or at the seashore, check plugs and drain valves for tightness. Wash the machine immediately after the work to protect components from rusting. Lubricate components more frequently than usual. Be sure to

lubricate work equipment pins daily if they are submerged in water.

Dusty worksites:

When working at dusty worksites, do as follows:

- Check the air cleaner for clogging more frequently. Clean the air cleaner at shorter intervals than specified.
- Clean the radiator core frequently to avoid clogging.
- Replace the fuel filter(s) frequently.
- Clean electrical components, especially the cranking motor and alternator, to avoid accumulation of dust.

Avoid mixing oils:

Never mix oils of different brands. If you have only oil which is a different brand from the one that is used in the machine, do not add it but replace all the oil.

OUTLINES OF SERVICE

LUBRICATION WHEN SHIPPED

- Use genuine oils and grease. Choose oils and grease with proper viscosities specified for the ambient temperature.
- When changing or adding oil, do not use a different type of oil.
- Unless otherwise specified, the oils, grease, fuel and coolant used at the time of shipment from the factory are as shown in the table below.

COMPARTMENT	LUBRICANT
Engine	Engine oil SAE 15W-40 API classification CE
Torque converter, Transmission, Transfer case & Oil cooler	Engine oil SAE 30W API classification CE
Service brakes	Engine oil SAE 10W API classification CE
Hydraulic system	Engine oil SAE 10W API classification CE
Drive axles - Front & rear	Axle oil - See NOTE
Lubrication fittings	No. 2 multi-purpose lithium grease with 3% molybdenum disulfide
Fuel tank	Diesel fuel ASTM D975 Grade No. 2-D
Cooling system	Coolant mixture of water, antifreeze, & supplemental coolant additives

NOTE: For axle oil, one of the following oils was used:

SHELL:	DONAX TT or TD
CALTEX:	RPM TRACTOR HYDRAULIC FLUID
CHEVRON:	TRACTOR HYDRAULIC FLUID
TEXACO:	TDH OIL
MOBIL:	MOBIL AND SUPER UNIVERSAL

RELATING TO ENGINE

ENGINE OIL

- Engine oil is critical because it lubricates the engine, the heart of the machine.
- Main services relating to engine oil are: 1) daily check of oil level, 2) check for contamination and 3) periodic replacement.

COOLANT

- Coolant is used to cool the engine and to keep it in good working condition.
- Check coolant level in the radiator daily and maintain it at the proper level.
- For coolant recommendations/specifications, refer to "COOLANT" under "LUBRICANTS, FUEL AND COOLANT".

DIESEL FUEL

- Always use the fuel specified for the engine. Fuels other than the specifications can damage the engine or reduce the engine output.
- Always fill the fuel tank at the end of the day's operation.
- When adding fuel, be careful not to let any water on top of the drum or at the bottom of the drum get into the fuel.
- After the machine has run out of fuel or after the fuel filter has been replaced, bleed the air from the fuel line.

RELATING TO HYDRAULIC SYSTEM

- Use extreme caution when servicing the hydraulic system, because oil in the system soon after the operation is very hot. Also, high pressure is applied in the system not only during but also after the operation.
- Services relating to the hydraulic system are: 1) weekly check of oil level, 2) periodic filter replacement and 3) periodic oil replacement.
- Always bleed the air from the circuit after replacing the filter or changing the hydraulic oil.
- When a item, such as a hose, in the line is disconnected, check O-rings for damage and replace them if necessary.
- If a hydraulic component has been removed or any hydraulic line has been disconnected or removed, bleed the air from the hydraulic tank and system after completion of assembly. Bleed the air from the tank and system as described under "HYDRAULIC TANK" and/or "PPC (PROPORTIONAL PRESSURE CONTROL) CIRCUIT" in the section.

RELATING TO ELECTRICAL SYSTEM

- If the wiring gets wet or the insulation is damaged, the electrical system leaks and this could result in hazardous malfunction of the machine.
- Services relating to the electrical system are: 1) check fan belt tension, 2) check for damage or wear of the fan belt and 3) check the battery electrolyte level.
- Never remove or disassemble any electrical components installed on the machine.
- Never install any electrical components other than those specified by Komatsu Dresser Company.
- Be careful to keep the electrical system free of water when washing the machine or when it rains.
- When working on the seashore, carefully clean the electrical system to prevent corrosion.
- Never connect any optional power source to the fuse, starting switch, battery relay, etc.

RELATING TO LUBRICATION

- Lubrication is to help smooth operation of the machine and work equipment. It prevents the machinery from being subjected to excessive load and from getting caught or generating noise. There are two lubricating methods; using oil and using grease.
- Services relating to lubrication are: 1) check of oil levels, 2) periodic changing of oil and 3) adding grease for proper lubrication.
- The machine has grease fittings in various places. Some of the fittings may not be mentioned in this manual. These fittings are equipped for the overhaul purpose, and no greasing is required for them.
- Always use only the lubricants specified under "LUBRICANTS, FUEL AND COOLANT".
- After adding new grease, wipe off old grease that was forced out, especially on rotating parts that could be worn by sand and dirt adhering to them.
- Maintain oil at the proper level. Both too high and too low oil levels are not good for the machine.

BLEEDING AIR

BLEEDING AIR FROM HYDRAULIC TANK

The hydraulic tank and system should be bleed free of air after the following:

- Replacing the hydraulic oil and filter elements or cleaning the oil strainer.
- Removing a hydraulic component or disconnecting hydraulic piping.

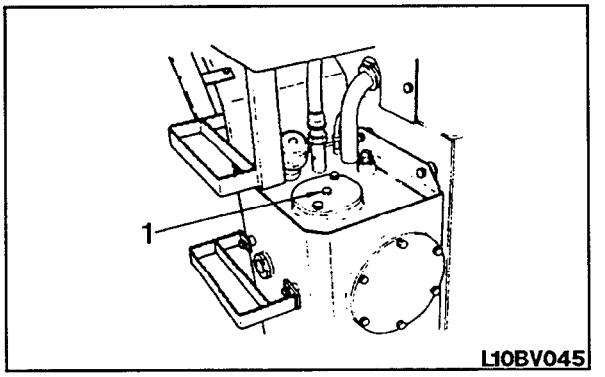
After reassembly, bleed the air from the hydraulic tank and system as follows:

1. Check and if necessary refill the hydraulic tank with oil up to the specified oil level of the sight gauge.

NOTICE: Check the hydraulic tank oil level and refill with oil frequently when bleeding the system.

WARNING! At first, if the engine is operated at high speed or if the hydraulic cylinder is moved to the end of its stroke, the air in the cylinder may damage the cylinder piston packing, etc.

2. Run the engine at low idle. One at a time, operate the hydraulic steering, bucket and lift arm cylinders four (4) to five (5) times, stopping 100 mm (3.9 in) from the end of its full stroke.
3. Next, operate each hydraulic cylinder three (3) to four (4) times, to the end of its stroke, then stop the engine.
4. Loosen the air bleed plug (1) on the hydraulic tank to bleed the air. After bleeding the air, tighten the air bleed plug (1).



5. Recheck the hydraulic tank oil level and add oil as necessary.
6. Start the engine, increase the engine speed and repeat Steps 3 and 4 to bleed the air until no more bubbles come out from the bleed plug ports.
7. After bleeding the air, tighten the air bleed plug (1).

★ Tightening torque of bleed plug: 1.15 ± 0.15 kgm (8.3 ± 1.0 lbf ft / 11.3 ± 1.4 N•m)

8. Recheck the oil level in the hydraulic tank and add oil as necessary. After adding oil, tighten the oil filler cap securely.

BLEEDING AIR FROM THE WHEEL BRAKE HYDRAULIC CIRCUIT

The wheel brake hydraulic circuit should be bleed free of air after the following:

- Removing a brake hydraulic component or disconnecting brake hydraulic piping.

After reassembly, bleed the air from within the brake hydraulic circuit as follows:

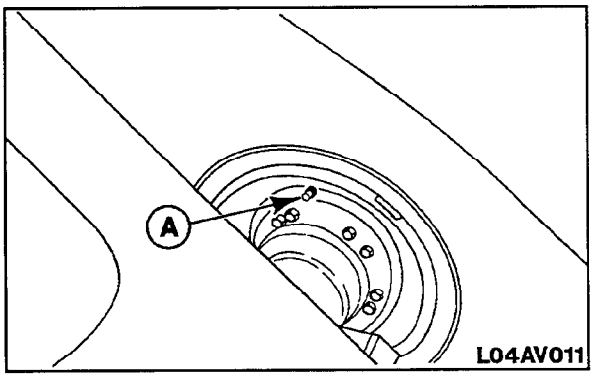
WARNING! When bleeding air from within the brake hydraulic circuit, always place blocks or chocks under the tires to prevent the machine from moving.

1. Check and if necessary refill the brake oil tank with oil up to the specified oil level of the sight gauge.

NOTICE: Check the brake oil level and refill with oil frequently when bleeding the system.

2. Run the engine at low idle. Remove the protective cap of air bleed plug (A).
3. Depress and hold the brake pedal and loosen air bleed plug (A) about 3/4 of a turn at one of the wheel brakes to bleed the air. After bleeding the air, tighten the air bleed plug and release the brake pedal.
4. Repeat the previous step to bleed the air until air bubbles stop coming out from the bleed plug port. After bleeding the air, tighten air bleed plug (A) and install the protective cap.
5. Recheck the brake oil level and add oil as necessary.
6. Repeat Steps 2 thru 5 to bleed the air at the remaining three (3) brakes.
7. Stop the engine.
8. Recheck the oil level in the brake oil tank and add oil as necessary. After adding oil, tighten the oil filler cap securely.

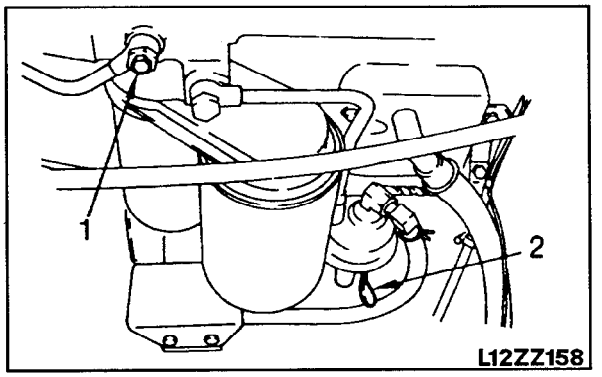
★ For further details, contact your distributor.



BLEEDING AIR FROM FUEL SYSTEM

Manual bleeding will be required if:

- The fuel filter is not filled prior to installation.
- Injection pump is replaced.
- High pressure fuel lines are replaced.



Venting the low pressure lines and fuel filter

1. Loosen bleed screw (1).
2. Operate hand lever (2) until the fuel flowing from the fitting is free of air.

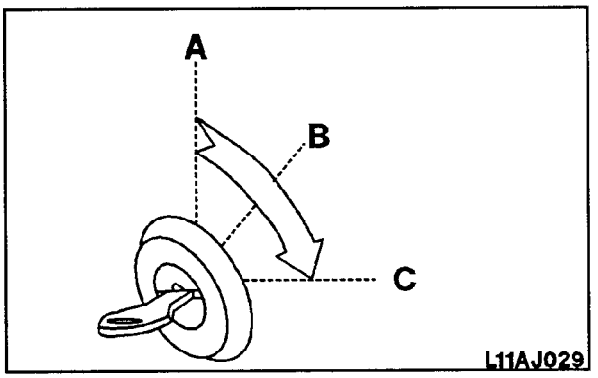
   Tighten bleed screw (1) to 0.82 kgm.

Venting at the injection pump

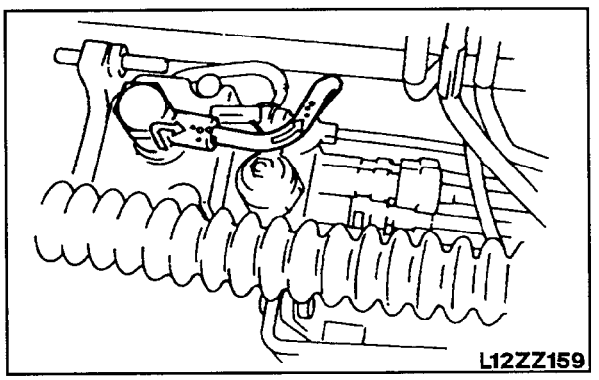
1. Air can be vented from the injection pump through the fuel drain manifold line by operating the starting motor.

★ When using the starting motor to vent the system, do not engage it for more than 30 seconds at a time: wait two minutes between engagements.

WARNING! It is necessary to put the engine in the "RUN" position. Because the engine may start, be sure to follow all the safety precautions. Use the normal engine starting procedure.



A = OFF B = ON C = START



Venting the high pressure lines

★ When using the starting motor to vent the system, do not engage it for more than 30 seconds at a time: wait two minutes between engagements.

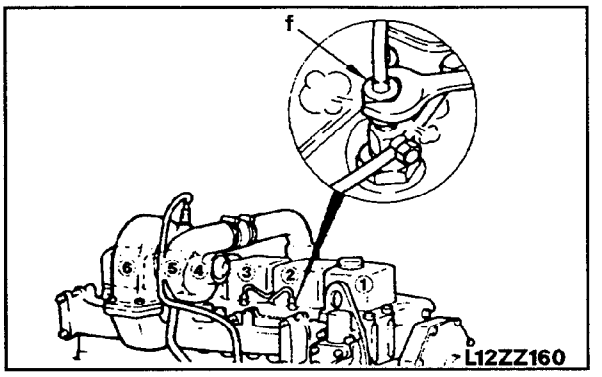
WARNING! It is necessary to put the engine in the "RUN" position. Because the engine may start, be sure to follow all the safety precautions. Use the normal engine starting procedure.

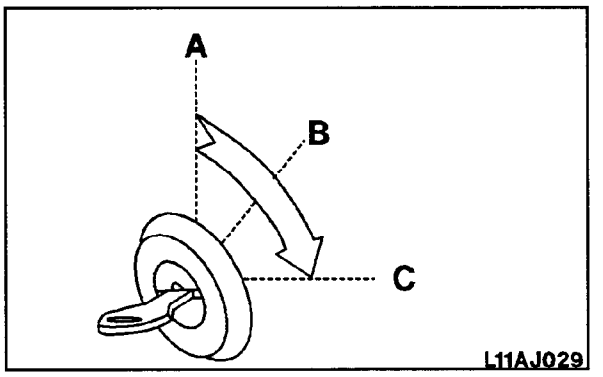
1. Loosen fittings (f) at the injectors, and crank the engine to allow entrapped air to bleed from the lines. Tighten the fittings.

WARNING! High pressure could cause penetration of the skin.

WARNING! Do not bleed a hot engine as this could cause the fuel to spill onto a hot exhaust manifold creating a danger of fire.

2. Start the engine and vent one line at a time until the engine runs smoothly (at 700 rpm).





A = OFF B = ON C = START

WEAR PARTS REPLACEMENT

Wear parts such as filters, filter elements, cutting edge, etc. are to be replaced at the time of scheduled maintenance or before their functional and serviceable limits.

The wear parts should be changed correctly in order to use the machine economically.

Use genuine parts specified in the Parts Book as replacement parts.

Part Description	Quantity	Replacement Interval
Engine oil filter	2	Every 250 hours service
Fuel filter	1	Every 500 hours service
Transmission oil filter element	1	Every 500 hours service
Hydraulic tank oil filter element	1	Every 1000 hours service
Hydraulic tank breather element	1	Every 1000 hours service
Air cleaner element	2	When required
Engine fan drive belt	1	When required
Bucket teeth - if equipped	8	When required
Bucket bolt-on cutting edge	3	When required

PERIODICAL PART REPLACEMENT

The users of the machine should carry out periodical maintenance in order to ensure proper and safe operation. The parts, listed below, should be replaced periodically so that the highest safety standard can be maintained.

These parts with the passage of time may have a tendency to deteriorate in quality and to wear or deform. These parts must be replaced with new ones after a predetermined replacement interval even though there is no apparent abnormality.

If any abnormality should be found, these parts must be replaced or repaired even before the predetermined period expires.

Periodical part replacement cost does not imply reimbursement under the manufacture's warranty policy. Refer to the warranty manual for further details.

Part description	Replacement interval	Remarks
Brake hoses	Every year	
Piston and packing of service brake master cylinder	Every year	Replace with repair kit
Packings, seals, O-ring of steering cylinders	Every 2 years	
Rubber hoses for steering cylinders	Every 2 years	
Fuel hoses	Every 2 years	

LUBRICANTS, FUEL AND COOLANT

PROPER SELECTION TABLE

RESERVOIR	FLUID TYPE	AMBIENT TEMPERATURE -22 -4 14 32 50 68 86 104 122°F -30 -20 -10 0 10 20 30 40 50°C	CAPACITY Specified	 Refill
Engine with filters	Engine oil See NOTE 1	SAE 15W-40 SAE 10W-30 Synthetic SAE 5W-30	11 ℓ 2.9 gal	9.5 ℓ 2.5 gal
Torque converter, Transmission, Transfer case & Oil cooler	Engine oil See NOTE 2	SAE 30W SAE 10W	23 ℓ 6.0 gal	18.5 ℓ 4.9 gal
Hydraulic system		SAE 10W SAE 5W-20	54 ℓ 14.3 gal	38 ℓ 10.0 gal
Service brakes		SAE 10W	1 ℓ 1.0 qt.	1 ℓ 1.0 qt
Drive axles - Front & rear	Axle oil	See NOTE 3	14 ℓ 3.7 gal each	14 ℓ 3.7 gal each
All lubrication fittings	Grease	See NOTE 4	Fill as instructed	--
Fuel tank	Diesel fuel	See NOTE 5	120 ℓ 31.7 gal	--
Cooling system	Coolant	See NOTE 6	17 ℓ 4.5 gal	--

API: American Petroleum Institute
ASTM: American Society of Testing and Material
SAE: Society of Automotive Engineers

Specified capacity: Total amount of oil including oil for components and oil in piping.
Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

NOTES:

1. ENGINE OIL

Normal Operation

Oil performance recommendations are as follows:

The use of a quality engine lubricating oil combined with appropriate oil and filter change intervals are critical factors in maintaining engine performance and durability.

SAE 15W-40 multi-viscosity oil meeting the American Petroleum Institute (API) performance classification of CE or CF-4 is recommended.

NOTE: CD or CD/SF oils may be used in areas where CE or CF-4 oil is not yet available.

A sulfated ash limit of 1.0 mass percent is suggested for optimum valve and piston deposit and oil consumption control. The sulfated ash **must not** exceed 1.85 mass percent. The sulfated ash limit of 1.85 mass percent has been placed on all engine lubricating oils recommended for use in the engine. Higher ash oils can cause valve and/or piston damage and lead to excessive oil consumption.

The API service symbol displays the following information. The upper half of the symbol displays the appropriate oil categories; the lower half may contain words to describe oil energy conserving features. The center section identifies the SAE oil viscosity grade.

Oil viscosity recommendations are as follows:

The use of a multi-graded lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures.

While SAE 15W-40 multi-viscosity oil is recommended for most operating climates, refer to the previous chart for oil viscosity recommendations for extreme climates.

Limited use of low viscosity oils, such as SAE 10W-30 may be used for easier starting and providing sufficient oil flow at ambient temperatures below -5°C (+23°F). However, continuous use of low viscosity oils can decrease engine life due to wear.

Special "break-in" lubricating oils are **not** recommended for a new or rebuilt engine. Use the same type of oil during the "break-in" as specified for normal operation.

Additional information regarding lubricating oil availability throughout the world is available in the "E.M.A. Lubricating Oils Data Book for Heavy Duty Automotive and Industrial Engines." The data book may be ordered from the Engine Manufacturers Association, 401 North Michigan Avenue, Chicago, IL U.S.A. 60611. The telephone number is (312) 644-6610.

Arctic Operation

If an engine is operated in ambient temperatures consistently below -23°C (-10°F) and there are no provisions to keep the engine warm when it is **not** in operation, use a synthetic API performance classification CE or CF-4 engine oil with adequate low temperature properties such as SAE 5W-20 or 5W-30.

The oil supplier **must** be responsible for meeting the performance service specifications.

IMPORTANT: The use of a synthetic base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as; corrosion, deposits and wear.

2. ENGINE OIL

Use API performance classification CE engine oil.

When using SAE 5W-20 engine oil in the work equipment hydraulic system in cold areas, return to SAE 10W when the cold season ends.

3. AXLE OIL

For axle oil, use only the recommended oil as follows:

SHELL: DONAX TT or TD
CALTEX: RPM TRACTOR HYDRAULIC FLUID
CHEVRON: TRACTOR HYDRAULIC FLUID
TEXACO: TDH OIL
MOBIL: MOBIL AND SUPER UNIVERSAL

★ It is possible to substitute engine oil SAE 30W API classification CD for axle oil. Although increased brake noise may result, durability should not be affected.

4. GREASE

The recommended lubricating grease is No. 2 multi-purpose lithium grease with 3% molybdenum disulfide.

5. DIESEL FUEL

WARNING! Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.

IMPORTANT: Due to the precise tolerances of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the injection pump and nozzles.

For normal service above -12°C (+10°F), the use of ASTM Grade No. 2-D diesel fuel with a minimum Cetane number of 40 is recommended. The use of No. 2-D diesel fuel will result in optimum engine performance under most operating conditions. Fuels with Cetane numbers higher than 40 may be needed in high altitudes or extremely low ambient temperatures to prevent misfires and excessive smoke.

At operating temperatures below -12°C (+10°F), use ASTM Grade No. 1-D diesel fuel. The use of lighter fuels can reduce fuel economy.

Where a winterized blend of Grade No. 2-D and No. 1-D fuels is available, it may be substituted for Grade No. 1-D fuel. However, it is the supplier's responsibilty to provide the fuel for the anticipated ambient temperature.

Use a low sulfur content fuel having a cloud point that is at least 10 degrees below the lowest expected fuel temperature. Cloud point is the temperature at which crystals begin to form in the fuel.

The viscosity of the fuel **must** be kept above 1.3 cSt to provide adequate fuel system lubrication.

6. COOLANT

General

Selection and maintenance of the engine coolant is important to long engine life. The following information provides recommendations for selecting the engine coolant and maintaining the coolant inhibitors.

Heavy duty diesel engines require a balanced coolant mixture of water, antifreeze, and supplemental coolant additives. Supplemental coolant additive recommendations are included in the section entitled "Inhibitors/Conditioners". The coolant mixture **must** be drained and replaced at the specified service interval shown in the "SCHEDULED MAINTENANCE GUIDE" or every two years of operation, whichever comes first.

Water

Use water which has a low mineral content. Water used in conjunction with antifreeze, coolant filters and inhibited water must meet the following standards:

Total Hardness - Not to exceed 170 parts per million (10 grains/gallon maximum) to prevent scale deposits. Water containing dissolved magnesium and calcium (the usual reason for water hardness) above the specified amount will cause scale deposits to develop in the engine.

Chlorides - Not to exceed 40 parts per million (2.5 grains/gallon maximum) to prevent corrosion.

Sulfites - Not to exceed 100 parts per million (5.8 grains/gallon maximum) to prevent corrosion.

Dissolved Solids - Not to exceed 340 parts per million (20 grains/gallon maximum) to minimize sludge deposits, scale deposits, corrosion or a combination of these.

If any of the above requirements cannot be met, use distilled, de-ionized, or de-mineralized water. To

determine if local water supplies meet these standards, water samples can be tested by water treatment laboratories. "Softened" water that is prepared using common salt (sodium chloride) contains excessive amounts of chlorides and should not be used.

NOTE: Never use water alone in the cooling system because corrosion will occur.

Antifreeze

In climates where the temperature is above -37°C (-34°F), use a coolant mixture that contains 50 percent antifreeze. **Antifreeze is essential in any climate.** It broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point. Do **not** use more than 50 percent antifreeze in the mixture unless additional freeze protection is required. **Never** use more than 68 percent antifreeze under any condition.

An antifreeze concentration greater than 68% will adversely affect freeze protection and heat transfer rates. Antifreeze concentrations between 68% and 100% actually have a higher freezing point than a 68% antifreeze concentration and should not be used due to reduced heat transfer rates.

Low silicate ethylene glycol antifreeze is recommended. The antifreeze should contain no more than 0.1% anhydrous alkali metasilicate. Low silicate antifreeze is recommended to avoid the formation of silica-gel (hydro-gel). This gel formation can occur when the cooling system contains an over concentration of high silicate antifreeze and/or supplemental coolant additive. DO NOT use methanol or alcohol as an antifreeze because of its low boiling point.

Antifreeze may retain its freeze protection for more than one season but coolant conditioners must be added to maintain corrosion protection.

Antifreeze formulated with methoxy propanol, or propylene glycol, is not recommended for this system.

NOTE: Do not mix types of antifreeze solutions. Mixed solutions make it impossible to determine the protection against freezing. Antifreeze containing sealer or anti-leak additives should NOT be used in this system. Sealer or anti-leak additives will cause plugging problems in the cooling system.

Check the solution periodically and at normal operating temperature, to be sure the cooling system has sufficient protection against freezing.

The following table shows the approximate percentage of antifreeze solution required for various temperatures.

Approximate Freezing Point		Percentage of Antifreeze Concentration by Volume	Specific Gravity at 60°F (16°C)
+32°F	(0°C)	0	1.000
+20°F	(-7°C)	15	1.025
+10°F	(-12°C)	25	1.040
0°F	(-18°C)	33	1.053
-10°F	(-23°C)	40	1.062
-20°F	(-29°C)	45	1.070
-30°F	(-34°C)	48	1.074
-40°F	(-40°C)	53	1.080
-50°F	(-46°C)	56	1.083
-60°F	(-51°C)	59	1.088
-70°F	(-57°C)	62	1.092
-80°F	(-62°C)	65	1.095
-90°F	(-68°C)	67	1.097
-92°F	(-96°C)	68	1.098

In tropical climates where antifreeze availability may be limited, use a corrosion inhibitor DCA4, to protect the engine cooling system.

Inhibitors/Conditioners

1. All cooling system inhibitors, including those in antifreeze solutions, become depleted through normal operation. If the inhibitors in antifreeze are allowed to become depleted, the antifreeze becomes corrosive and attacks and coats the metallic surfaces of the cooling system which reduces heat transfer. Cooling system conditioners which contain these inhibitors must be added to maintain corrosion protection.

2. SOLUBLE OIL IS NOT RECOMMENDED for use in this engine as its use will reduce heat transfer.

3. There are no miracle additives that will increase heat transfer or prevent overheating. Conditioned water is still the best coolant.

4. DCA4 is recommended to inhibit corrosion in the cooling system for the following reasons:

   - Improved compatibility with high silicate antifreezes to minimize hydro-gel formation if over concentration occurs.

   - Provides engine protection in the following areas:
     - Solder corrosion/bloom
     - Copper corrosion/erosion/stress cracking
     - Oil fouling
     - Cylinder liner cavitation corrosion
     - Aluminum cavitation corrosion
     - Seal and gasket degradation

MAINTENANCE OF COOLING SYSTEM INHIBITORS

Keeping the engine coolant properly inhibited will keep the engine and radiator free of rust, scale deposits and corrosion.

New machines are delivered with antifreeze protection. Service at regular scheduled interval specified in the "SCHEDULED MAINTENANCE GUIDE" with a "service" DCA4 filter. Each time the coolant is drained and replaced, the coolant must be recharged with DCA4. New coolant can be correctly charged with supplemental coolant additives by using DCA4 filters or DCA4 concentrate listed in the table entitled, "DCA4 Unit Guide".

If coolant is added between drain intervals, additional DCA4 will be required.

COOLANT TESTING FOR CONDITIONER CONCENTRATION

When the cooling system is maintained as recommended, the conditioner concentration should be satisfactory. The DCA4 concentration must not fall below 1.0 unit per 3.8 ℓ (1 US gal) or exceed 2 units per 3.8 ℓ (1 US gal) of coolant. The only accurate method for testing chemical concentrations in coolant with mixed chemical compounds is a laboratory analysis. For this reason, the coolant inhibitor should be maintained as shown in the "SCHEDULED MAINTENANCE GUIDE".

NOTE: *Inadequate concentration of the coolant additive can result in major corrosive damage to cooling system components. Over concentration can cause formation of "gel" that can cause restriction, plugging of passages and overheating.*

REPLENISHING COOLANT CONDITIONER

Install a "precharge" DCA4 filter when the coolant is changed or a significant (more than 50%) coolant loss occurs. Install a "service" DCA4 filter as specified in the "SCHEDULED MAINTENANCE GUIDE". When antifreeze is added, add coolant conditioner equal to 1.0 unit per 3.8 ℓ (1 US gal) of antifreeze.

NOTE: *Mixing of DCA4 and other supplemental coolant additives is not recommended because there is currently no test kit available to measure concentration levels with mixed chemical solutions.*

DCA4 UNIT MAINTENANCE GUIDE

Use supplemental coolant additives (corrosion inhibitors) to protect the engine cooling system from corrosion. Antifreeze alone does **not** provide enough corrosion protection for a heavy duty diesel engine. Supplemental corrosion protection **must** be supplied through periodic additions of supplemental coolant additives to the coolant.

To protect against corrosion, a new coolant charge **must** be brought up to 0.26 DCA4 unit per liter [one unit per U.S. gallon] of coolant (initial charge). Maintain the correct DCA4 concentration by changing the service coolant filter at each engine oil and filter change interval.

Each time the coolant is drained and replace, the coolant **must** be recharged with supplemental coolant additives. Use the appropriate DCA4 spin-on filter listed in following table. The coolant mixture **must** be drained and replaced as defined under "General".

The amount of replacement inhibitor is determined by the length of the service interval and the cooling system capacity. Refer to the DCA4 Unit Guide for the selection of the correct filter to replenish the DCA4.

If coolant is added between drain intervals, additional DCA4 will be required. Check the coolant DCA concentration level anytime make-up coolant is added to the system. The DCA4 concentration **must not** fall below 0.13 units per liter or exceed 0.5 units per liter [0.5 units per U.S. gallon or exceed 2 units per U.S. gallon].

DCA4 Unit Guide

Fleetguard Part No.	DCA4 Units
DCA4 Coolant Filter	
WF-2070	2
WF-2071	4
WF-2072	6
WF-2073	8
WF-2074	12
WF-2075	15
WF-2076	23
WF-2077	0
DCA4 Liquid	
DCA60L	4 (1 Pint)
DCA80L	1760 (55 US gal)
DCA4 Powder	
DCA95	20

DCA4 Precharge and Service Filters

System Capacity		Precharge Filter (See NOTE 1)	Service Filter (See NOTE 3)
Liters	Gallons		
19-26	5-7	WF-2072	WF-2070
30-38	8-10	WF-2073	WF-2071
42-57	11-15	WF-2074	WF-2071
61-76	16-20	WF-2075	WF-2071
80-114	21-30	WF-2076	WF-2072
118-190	31-50	(See NOTE 2)	WF-2073

NOTE 1 - After draining and replacing coolant, always precharge the cooling system to maintain the DCA4 concentration between 1.0 and 2.0 units per 3.8 ℓ (1 US gal).

NOTE: ***When performing service which requires draining the cooling system, discard the coolant. Reusing coolant can introduce contaminates or over concentrated chemicals, resulting in premature failure of cooling system components.***

NOTE 2 - To precharge cooling systems larger than 114 ℓ (30 gal) do the following:

- Install appropriate service filter listed in the above table based on cooling system capacity.

  Example: 95 gal (360 ℓ) cooling system capacity
  -15 Units (1) WF-2075 Filter
  80 Units

- The answer represents the additional units required to precharge the cooling system. Four bottles of powder, part number DCA95, will provide a sufficient amount of DCA4 units (80) to precharge the example cooling system.
- Install the appropriate service filter at the next and subsequent maintenance intervals.

NOTE 3 - Change the coolant filter at every engine oil and filter change interval to protect the cooling system.

Maintain a nominal concentration of 1.0 DCA4 unit per 3.8 ℓ (1 US gal) of coolant in the system. Less than 0.5 unit per 3.8 ℓ (1 US gal) indicates an under-concentrated coolant solution. More than 2.0 units per 3.8 ℓ (1 US gal) indicates an over-concentrated coolant solution.

To check the DCA4 concentration level, use the Fleetguard coolant test kit, CC2626. Instructions are included with the test kit.

DCA4 Unit Concentration Guide

Number of Solution A Drops to Cause Color Change	Coolant Condition	Action Required
0 - 10 Drops	Extremely under-concentrated - less than 0.4 DCA4 units per 3.8 ℓ (1 US gal)	Initially charge the system to a minimum of 1.0 DCA4 unit per 3.8 ℓ (1 US gal).
11 - 16 Drops	Marginally under-concentrated - 0.45 to 0.8 DCA4 units per 3.8 ℓ (1 US gal)	Add DCA4 liquid units to maintain 1.0 DCA4 unit per 3.8 ℓ (1 US gal) minimum or change the DCA 4 coolant filter.
17 - 25 Drops	Acceptable - 0.85 to 1.3 DCA4 units per 3.8 ℓ (1 US gal)	None.
26 - 35 Drops	Highly acceptable - 1.35 to 2.0 DCA4 units per 3.8 ℓ (1 US gal)	None.
36 - 55 Drops	Marginally over-concentrated - 2.1 to 3.3 DCA4 units per 3.8 ℓ (1 US gal)	Review maintenance practice.
Over 55 Drops	Extremely over-concentrated	Drain 50% of the coolant and replace with water antifreeze mixture. Retest the system for correct DCA4 unit concentration.

MEMORANDUM

SCHEDULED MAINTENANCE GUIDE

Scheduled maintenance is the normal maintenance necessary to provide proper and efficient equipment operation. To protect your investment and prolong the service life of your equipment, follow the scheduled maintenance listed below.

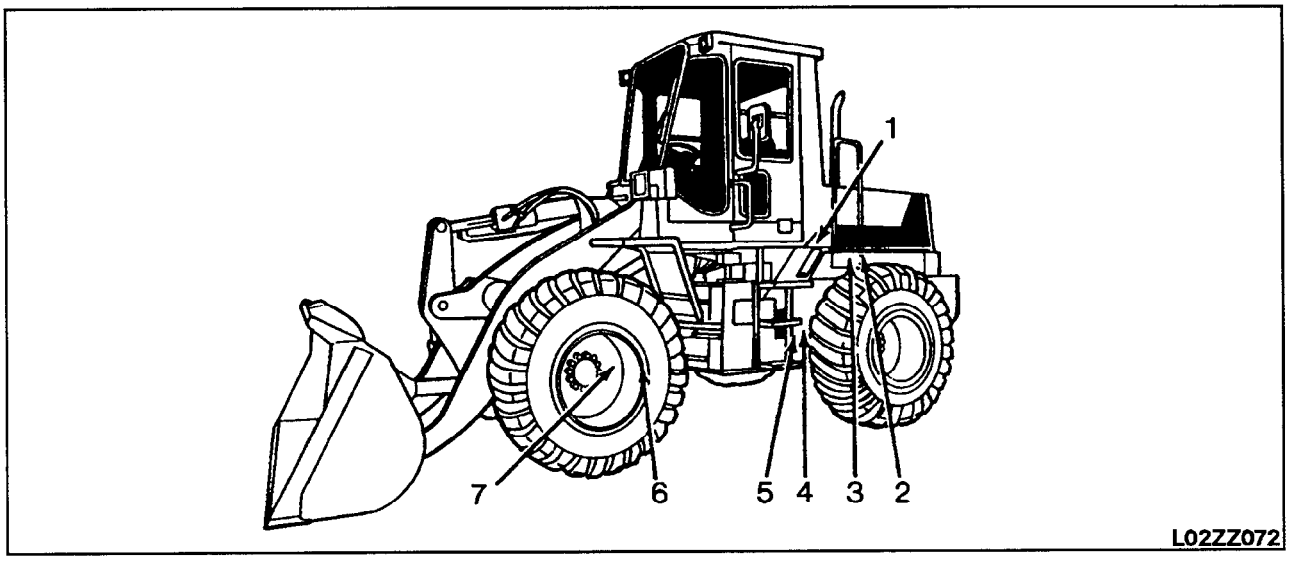
ITEM	SERVICE	PAGE
INITIAL 250 HOURS SERVICE ONLY		
Transmission oil filter	Replace elements	3-24
Normal 250 hour scheduled maintenance	Refer to "EVERY 500 HOURS SERVICE"	
WHEN REQUIRED		
Coolant additive concentration - DCA4	Check and supply	3-24
Air cleaner element	Check, clean or replace	3-24
Transmission oil level	Check and refill	3-27
Radiator core	Clean	3-27
Windshield washer tanks	Check and refill	3-28
Drive axle oil level	Check and refill	3-28
Drive axle housing breathers	Clean	3-29
Lubrication: Work equipment control valve linkage Accelerator pedal linkage Transmission control linkage Brake control linkage	 Lubricate 5 points Lubricate 1 point Lubricate 6 points Lubricate 3 points	 3-29 3-30 3-30 3-30
Bucket bolt-on cutting edge - if equipped	Reverse or replace	3-31
Bucket teeth - if equipped	Replace	3-31
Parking brake	Check and adjust	3-33
CHECKS BEFORE STARTING ENGINE		
Walk around check		2-26
Coolant level	Check and refill	2-26
Engine oil level	Check and refill	2-27
Fuel level	Check and refill	2-27

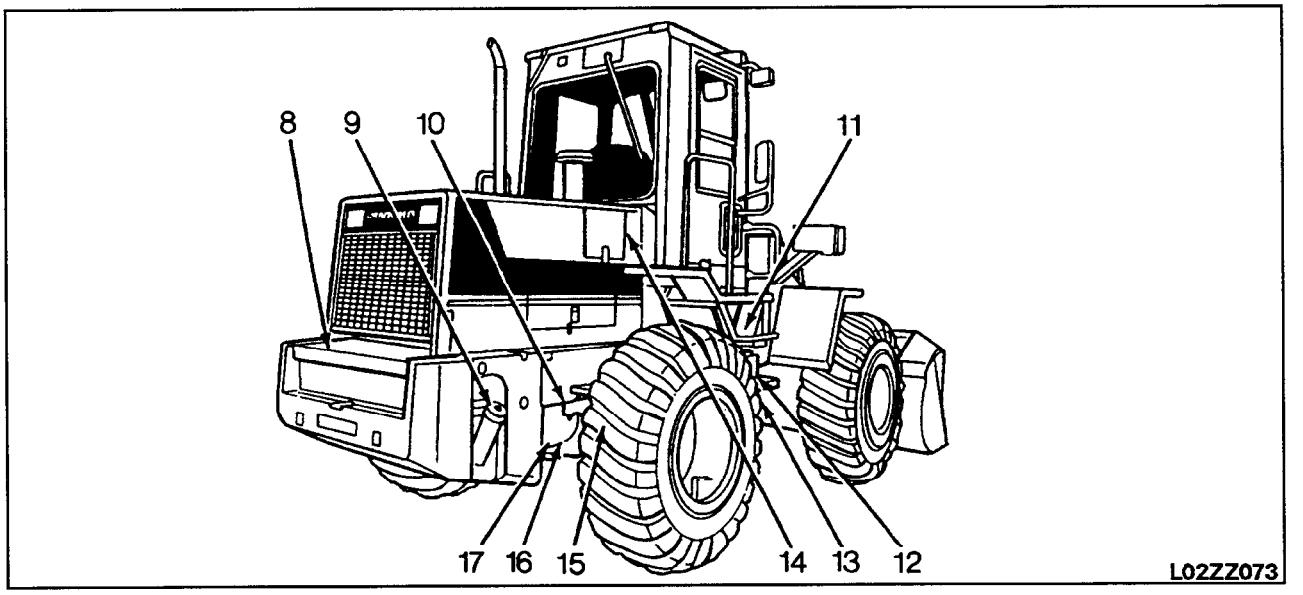
ITEM	SERVICE	PAGE
Air cleaner service indicator	Check	2-28
Brake oil level	Check and refill	2-28
Fuel filter/water separator	Drain water	2-29
Parking brake	Check function	2-29
Wheel brakes	Check function	2-29
Horn	Check function	2-29
Lamps	Check function	2-29
Rear view mirrors	Check	2-29
Engine exhaust gas color and sound	Check	2-29
Instruments and gauges	Check function	2-29
Steering wheel	Check play	2-29
Back-up alarm	Check function	2-29
Electrical wiring	Check	2-29
EVERY 50 HOURS SERVICE		
Fuel tank	Drain water and sediment	3-34
Tires	Check air pressure and for damage	3-34
EVERY 100 HOURS SERVICE		
Hydraulic tank oil level	Check and refill	3-34
Lubrication: Bucket pins Bucket link pins Rear axle pivot pins	 Lubricate 2 points Lubricate 2 points Lubricate 2 points	 3-35 3-36 3-36

ITEM	SERVICE	PAGE
EVERY 250 HOURS SERVICE		
Lubricating: Tilt lever pin Dump cylinder pin Lift cylinder pin Lift arm pivot pin Steering cylinder pin	 Lubricate 1 points Lubricate 2 points Lubricate 4 points Lubricate 2 points Lubricate 4 points	 3-38 3-38 3-39 3-39 3-39
Wheel hub bolts	Check and re-tighten	3-39
Engine oil pan and filter	Change oil and replace filter element	3-40
Battery electrolyte	Check fluid level	3-41
Air intake system	Check	3-42
EVERY 500 HOURS SERVICE		
Lubrication: Center drive shaft spline Center hinge pin	 Lubricate 1 point Lubricate 2 point	 3-42 3-43
Fuel filter	Replace cartridge	3-43
Transmission oil filter	Replace elements	3-45
Antifreeze concentration	Check	3-45
EVERY 1000 HOURS SERVICE		
Lubrication: Front drive shaft Drive shaft center support Center drive shaft Rear drive shaft	 Lubricate 2 points Lubricate 1 point Lubricate 2 points Lubricate 2 points	 3-46 3-46 3-47 3-47
Hydraulic tank and filter	Change oil and replace element	3-48
Transmission case breather	Clean	3-49
Transmission oil and strainer	Change oil and clean strainer	3-49
Engine valves	Check and adjust clearance	3-50
Drive belt	Check tension	3-53
Drive belt tensioner bearing and hub bearing	Check	3-53

ITEM	SERVICE	PAGE
EVERY 2000 HOURS SERVICE		
Drive axles	Change oil	3-54
Hydraulic tank breather	Replace element	3-56
Brake disc	Check	3-56
Vibration damper	Check	3-56
Cooling system	Check coolant and flush the system	3-57

OIL FILLER AND LEVEL GAUGE POSITIONS





1. Cooling water sub-tank inlet
2. Engine oil pan oil filler
3. Engine oil pan level gauge
4. Transmission case level gauge and oil filler
5. Transmission case drain plug
6. Front axle drain plug
7. Front axle level plug and oil filler
8. Cooling water drain valve
9. Fuel tank oil filler
10. Engine oil pan drain plug
11. Hydraulic tank oil filler
12. Hydraulic tank level gauge
13. Hydraulic tank drain plug
14. Brake oil tank oil filler
15. Rear axle level plug and oil filler
16. Rear axle drain plug
17. Fuel tank drain valve

INITIAL 250 HOURS SERVICE ONLY

Perform the following maintenance only after the first 250 hours.

TRANSMISSION OIL FILTER

For details of the method of replacing or maintaining, see the section on "EVERY 500 HOURS SERVICE".

WHEN REQUIRED

COOLANT ADDITIVE CONCENTRATION - DCA4

★ **Inadequate** concentration of the coolant additive can result in major corrosive damage to cooling system components. **Over** concentration can cause restriction, plugging of passages, and overheating.

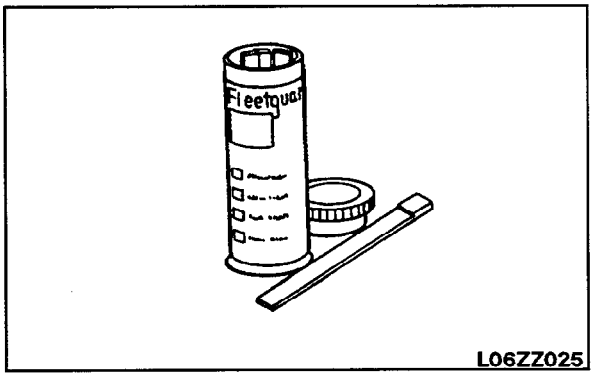
The cooling system must contain the proper coolant additive units to provide the best chemical protection.

DCA4 Test Kit: use only DCA4 Coolant Test Kit, Fleetguard Part No. CC-2600 to check the coolant additive concentration in the cooling system.

★ Check once every 6 months, regardless of the number of hours operated.

Check and service. For the detailed procedure, refer to the Engine Operation and Maintenance Manual.

L06ZZ024

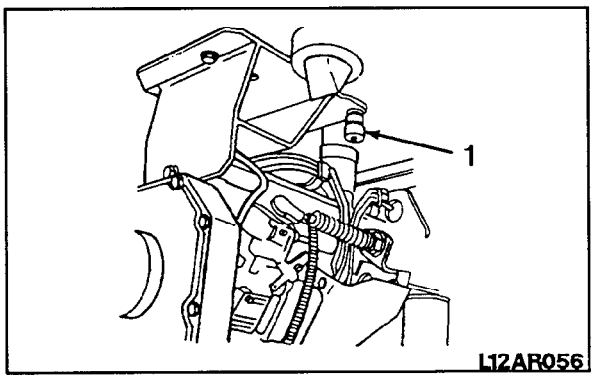


L06ZZ025

AIR CLEANER ELEMENT

CHECKING

Whenever the red piston in service indicator (1) appears, clean the air cleaner outer element. Stop the engine when cleaning the element.



L12AR056

CLEANING OR REPLACING OUTER ELEMENT

WARNING! Do not clean or replace the air cleaner element with the engine running.

1. Remove cover wing nut (2) and remove cover (3).
2. Remove wing nut (4) and remove outer element.
3. Clean the air cleaner body interior and the removed cover.
4. Clean and inspect the element. (See the item "Cleaning outer element" for cleaning procedure.)
5. Install the cleaned element.
6. Push the service indicator reset button to return the red piston to the original position.

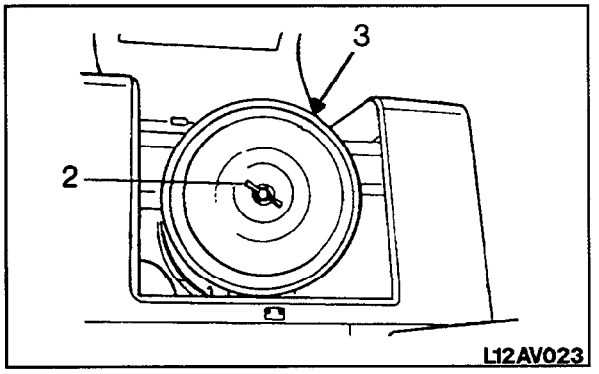
★ Replace the outer element which has been cleaned six times repeatedly or used throughout a year. Replace the inner element at the same time.

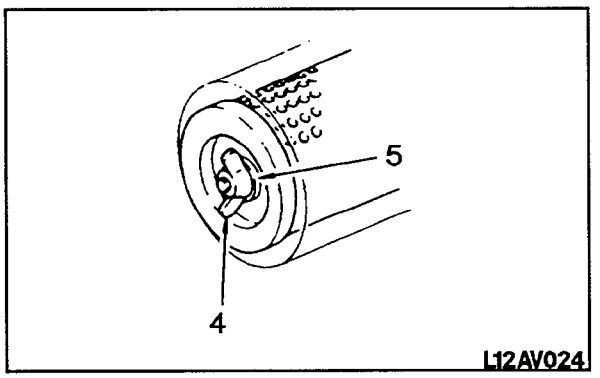
★ Replace both inner and outer elements when the service indicator red piston appears soon after installing the cleaned outer element even though it has not been cleaned six times.

★ Remove one seal from the outer element. The number of times the outer element has been cleaned can be seen by the number of removed seals.

★ Check inner element mounting nuts for looseness and, if necessary, re-tighten.

★ Replace seal washer (5) or wing nut (4) if they are damaged.





REPLACING INNER ELEMENT

WARNING! Do not clean or replace the air cleaner element with the engine running.

1. First remove the end cover and the outer element, and then remove the inner element.
2. Place a protective cover over the air intake part to prevent dust from entering.
3. Clean the air cleaner body interior, then remove the cover from the air intake port.

WARNING! Do not attempt to reinstall a cleaned inner element.

4. Install a new inner element and tighten it with nuts.
5. Install the outer element and the end cover. Push the service indicator reset button.

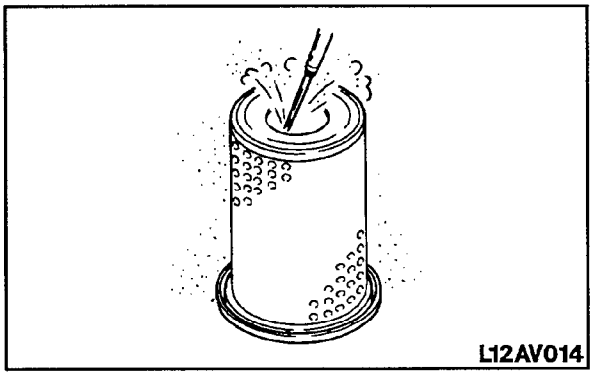
CLEANING OUTER ELEMENT

Using compressed air

WARNING! Do not clean or replace the air cleaner element with the engine running.

WARNING! When using compressed air, wear safety glasses and other things required to maintain safety.

Direct dry compressed air, less than 7 kg/cm^2 (100 PSI / 689 KpA), to element from inside along its folds, then direct it from outside along its folds and again from inside. Check element as follows.



Using water

NOTICE: The following method requires a spare element.

Wash the element with city water at less then 3 kg/cm^2 (43 psi / 296 kPa) of pressure, from the inside along the folds, then from the outside and again from the inside. Dry the element and check it as follows.

Using water with cleaning agent

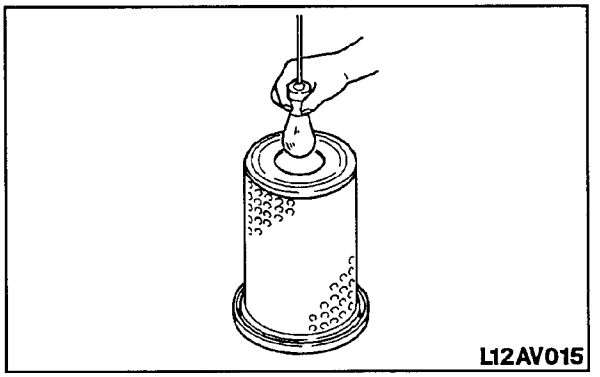
NOTICE: The following method requires a spare element.

For removing oil and grease as carbon etc. on the element, the element may be cleaned in a lukewarm solution of mild detergent, then rinsed in clean water and left to air dry.

★ Using warm water at about 40°C (104°F) instead of soapy water may also be effective.

★ The drying process can be speeded up by applying dry compressed air, at less than 7 kg/cm^2 (100 PSI / 689 KpA), to the element from the inside to the outside of the element.

NOTICE: Never attempt to heat the element.



★ If small holes or thinner parts are found on element when it is checked with an electric bulb after cleaning and drying, replace the element.

★ If element is usable, wrap it and store it in dry place.

★ Do not use element whose folds or gasket or seal are damaged.

★ When cleaning element, do not hit it or beat it against something.

TRANSMISSION OIL

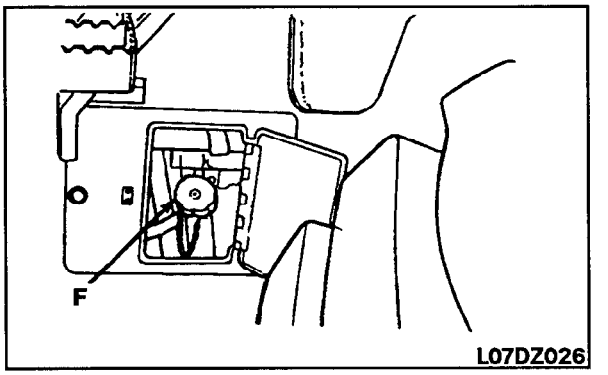
Carry out this procedure if there is any sign of oil on the transmission case, or if there is oil mixed with the cooling water.

WARNING! When checking the oil level, apply the parking brake, and lock the front and rear frames with the safety bar and pin.

★ After the engine is operated for 5 minutes, check the oil level of the transmission in neutral position at the engine low idling.

1. Start the engine and remove the cap of oil filler (F).
2. Use the oil level gauge marked on dipstick to check the oil level.
3. The oil level should be between mark L and H, if necessary, add oil at the oil filler tube (F).

★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS."



RADIATOR CORE

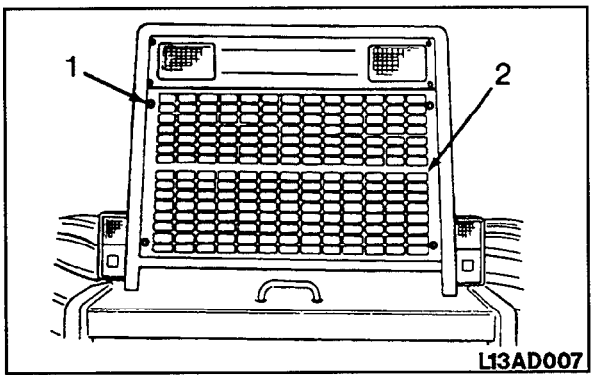
Carry out this procedure if there is any mud or dirt stuck to the radiator and/or oil cooler.

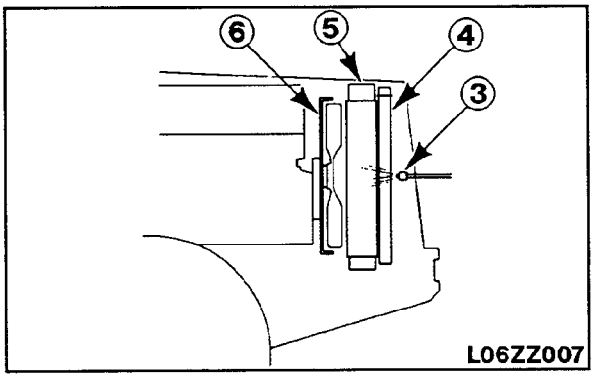
1. Loosen the four mounting bolts (1) and remove radiator grille (2).
2. Clean the radiator core and oil cooler that are clogged with mud, dirt, etc., with compressed air. Steam or water may be used instead of compressed air.

★ When cleaning the radiator core and oil cooler, choose a 2 mm (0.07 in) diameter nozzle (3) and use high pressure water at a pressure less than 40 kg/cm^2 (569 psi / 3923 kPa).

★ If it is impossible to remove all mud and dirt when cleaning from the radiator grille side of oil cooler (4), remove engine fan guard (6) and clean from the front side of radiator (5).

★ Hydraulic oil hoses should be checked at the same time. If a hose is found to have cracks or to be hardened by aging, such a hose should be replaced by new one. Furthermore, check for loosened hose clamps.





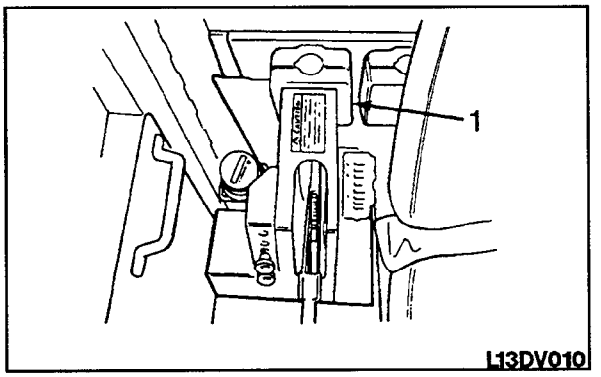
WINDSHIELD WASHER TANKS

Check the liquid level in washer tank (1).

Add automobile window washer liquid if necessary.

★ Be careful not to let dirt get in the tank when adding the liquid.

NOTE: Be careful not to spill liquid on the auxiliary cab fuse box.



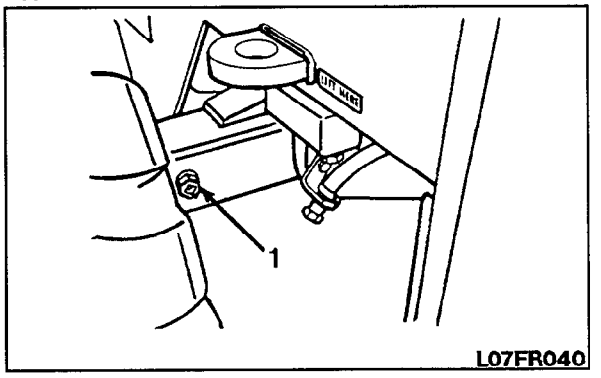
DRIVE AXLE OIL

Carry out this procedure if there is any sign of oil on the axle housing.

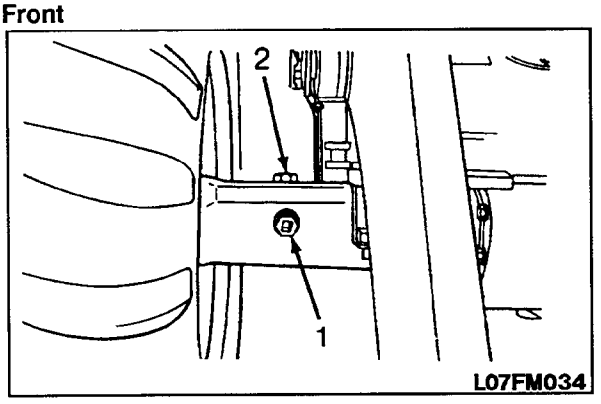
Remove oil level plug (1), and check that the oil level reaches the bottom of the plug hole. If necessary, add oil through the hole of plug (2).

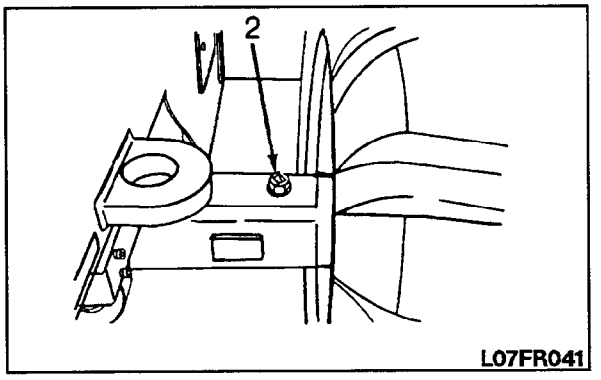
★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS".

Rear



Front



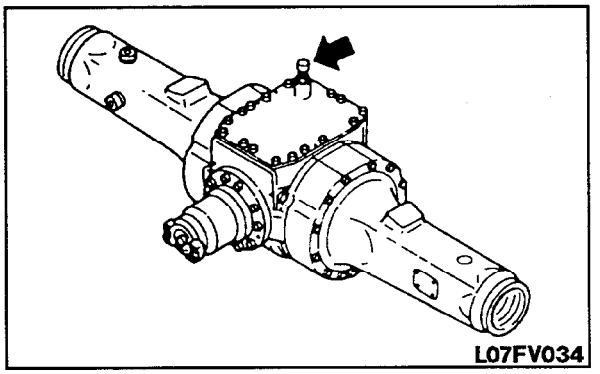


DRIVE AXLE HOUSING BREATHERS

Carry out this procedure if there is any mud or dirt stuck around the breather.

Remove all mud and dirt from around the breather with brush.

★ Clean the breathers of the front and rear drive axles in the same way.

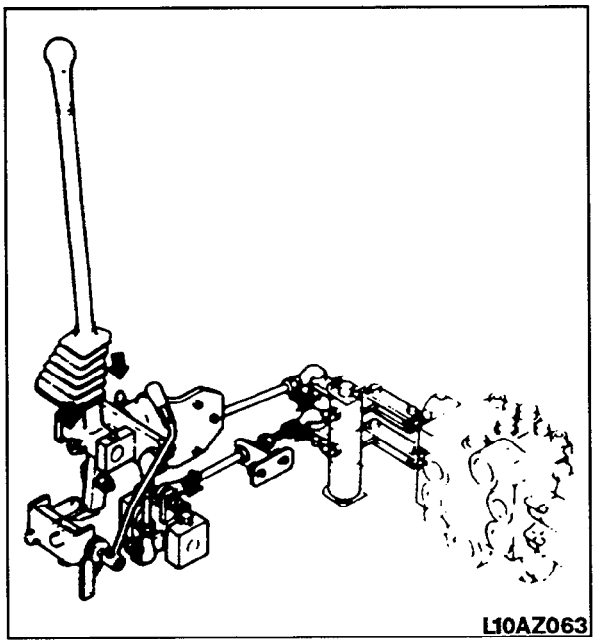


LUBRICATING

Apply grease to the grease fittings shown by arrows.

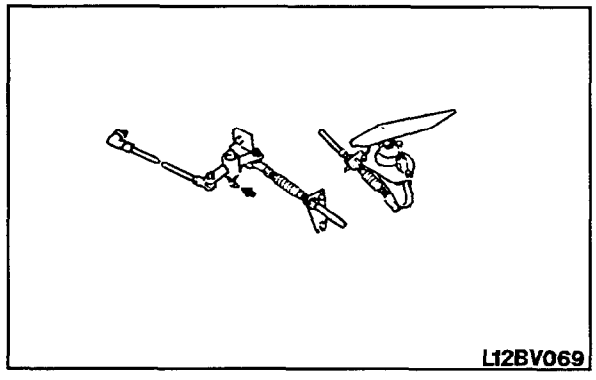
1. Work equipment control valve linkage (5 points)

If the work equipment control lever is heavy or does not move smoothly, apply grease.



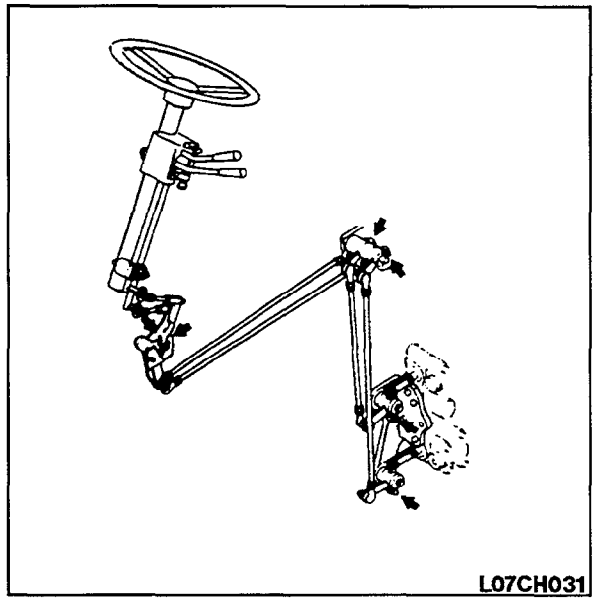
2. Accelerator pedal linkage (1 point)

If the accelerator pedal is heavy or does not return properly, apply grease.



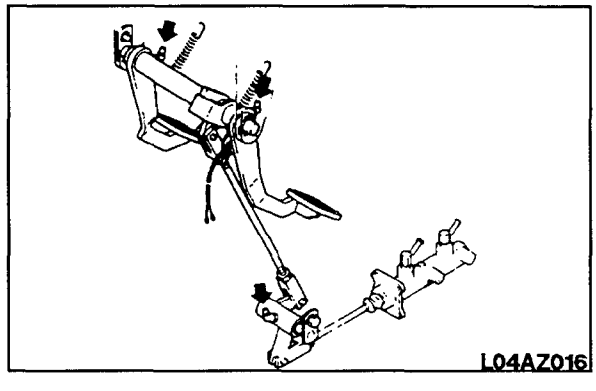
3. Transmission control linkage (6 points)

If the lever is heavy or does not move smoothly, apply grease.



4. Brake control linkage (3 points)

If the brake pedal is heavy or does not return properly, apply grease.



BUCKET BOLT-ON CUTTING EDGE - IF EQUIPPED

If the bolt-on cutting edge is worn, turn the edge.

1. Raise the bucket to a convenient height, and put blocks under the bucket to prevent it from coming down.

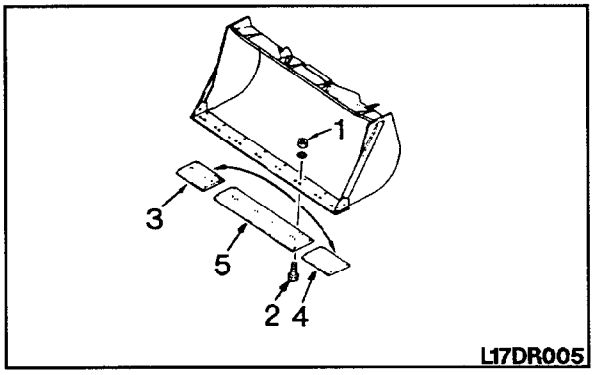
★ Raise the bucket so that the bottom is horizontal.

2. Loosen nut (1) and remove bolt (2). Then, turn the cutting edge.

3. Exchange cutting edges (3) and (4), and install edge (5) in the opposite direction.

4. After exchanging, tighten with bolts (2) and nuts (1).

★ Tightening torque: 40 - 54 kgm
★ When installing the edge to the bucket, clean the mounting surface.
★ After the edge has been turned once, replace it with a new part.



BUCKET TEETH - IF EQUIPPED

BUCKET IS EQUIPPED WITH BOLT-ON TEETH

When the bucket teeth are worn, replace them as follows.

1. Raise the bucket to a convenient height, and put blocks (A) under the bucket to prevent it from coming down.

★ Position the bucket so that the bottom is horizontal.

2. Remove the mount bolts and nuts (1) and bucket teeth (2).

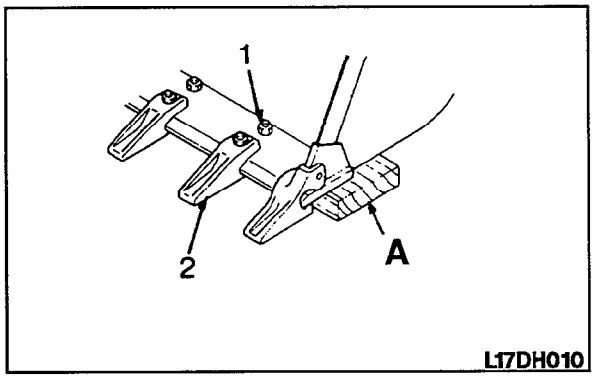
3. Install the new teeth on the bucket. When installing each tooth, insert a shim(s) so that there is no clearance between the tooth and the top surface of the bucket.

★ Continue to adjust with shims until it becomes impossible to insert a shim of thickness 0.5 mm.

4. To prevent any clearance between the tooth and the edge of the bucket, tighten the mount nut partially, then hit the tip of the tooth with a hammer.

★ Tightening torque of mounting bolts: 64 ± 3 kgm

★ After operating the machine for a few hours, tighten the mounting bolts again.



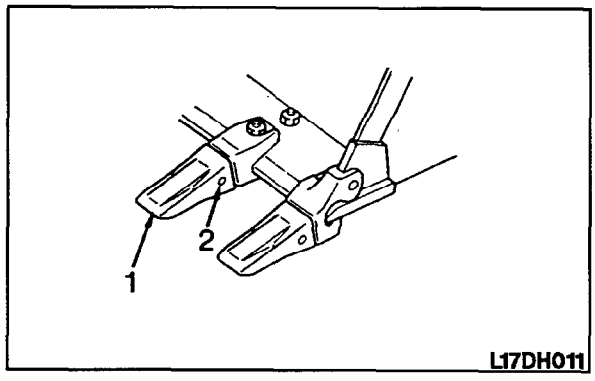
BUCKET IS EQUIPPED WITH WELDED ON OR REPLACEABLE TIP TEETH

Replace the teeth before they wear down as far as the adaptor.

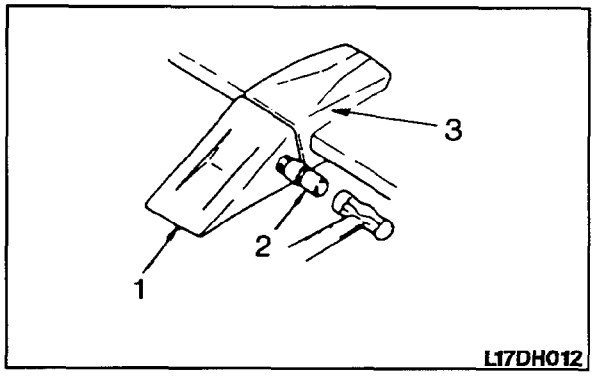
1. Extract pin (2) fitted to the bucket and then remove tooth (1).

★ When extracting pin (2), strike the part (either the left or right part) with a sharp object. This will enable the pin to be extracted from the opposite side.

2. Insert the new tooth (1) onto the adaptor (3), and insert pin (2) partway as shown in the diagram. Then drive it home by means of a hammer.



L17DH011

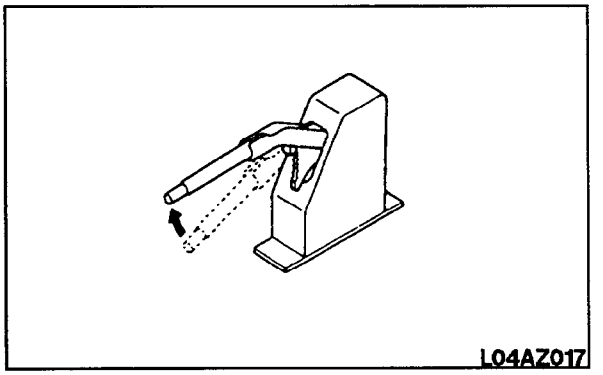


L17DH012

PARKING BRAKE

INSPECTION

If 12 or more ratchets are counted before the parking brake comes into effect, perform the following adjustment.


L04AZ017

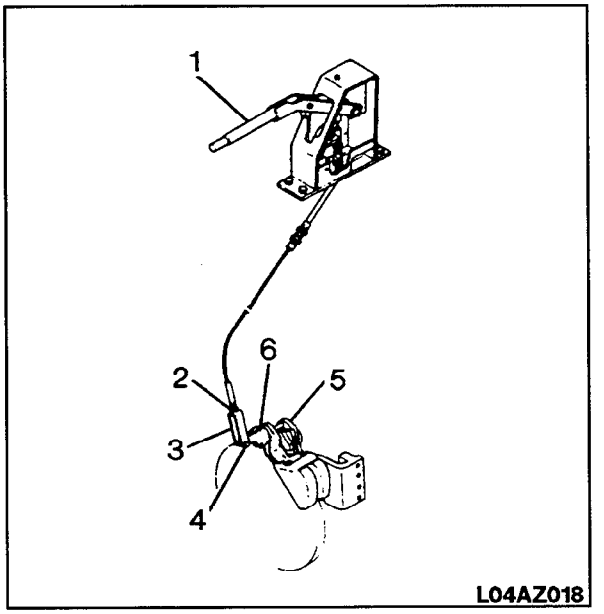
ADJUSTMENT

1. Move lever (1) back fully to release caliper (5).
2. Loosen lock nut (2) and remove clevis pin (4).
3. Adjust with adjustment bolt (7) so that clearances (A) and (B) between the disc and pad are 0.05 - 0.2 mm.
4. Push up by an amount equal to clearance of the caliper lever, and screw in clevis (3). Align the pin hole of caliper lever (6), then assemble clevis pin (4) and tighten locknut (2).

★ Don't tighten adjusting bolt (7) too much.

★ After adjusting, make sure that there is no play of adjustment bolt (7) in the axial direction.

★ After adjustment, check the stroke when the lever is pulled (approx. 5 kg) three or four clicks from released position.



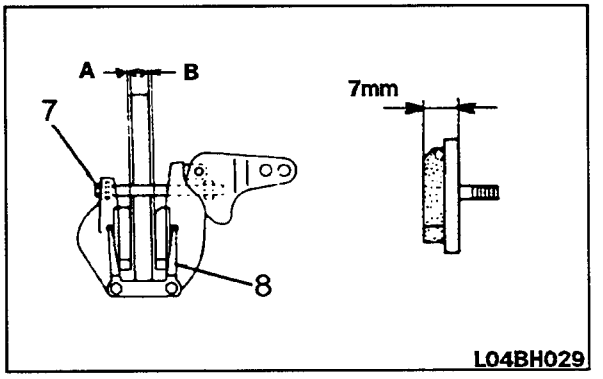
L04AZ018

WARNING! Install blocking in front of and behind the wheels before adjusting the parking brake.

NOTICE: When the thickness (including lining) of a pad wears out to 7 mm or less, replace the pad.

★ Replace two pads as one set, and replace the retraction plate (8) at the same time.

★ Have the pads replaced by your distributor.



L04BH029

WARNING! Do not get any oil or grease on the surface of the brake pad or disc.

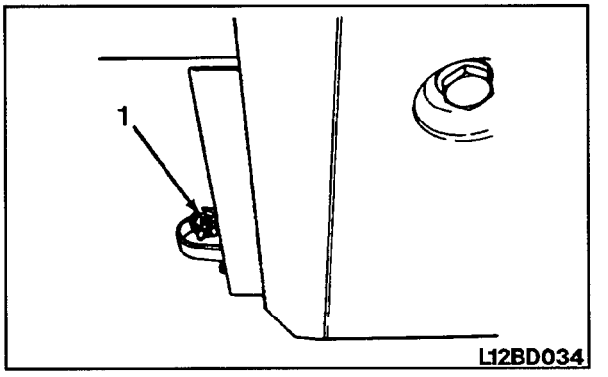
CHECK BEFORE STARTING

See the section on CHECK BEFORE STARTING aforementioned in SECTION 2.

EVERY 50 HOURS SERVICE

FUEL TANK

Loosen valve (1) on the bottom of the tank so that the precipitation and mixed water will be drained in accompaniment with fuel.



TIRES

Measure the inflation pressure before operations when the tires are cool. Refer to HANDLING TIRES.

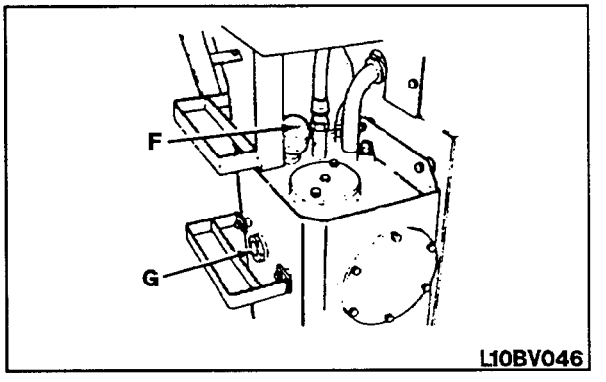
Also, at this time, check for tire damage.

EVERY 100 HOURS SERVICE

★ **Maintenance for every 50 hours should be carried out at the same time.**

HYDRAULIC TANK

1. Lower the bucket horizontally to the ground and stop the engine. Wait for 5 minutes, then check sight gauge (G). The oil should be visible in sight gauge (G).
2. Add engine oil at the oil filler (F), if necessary.



WARNING! When removing the cap, turn it slowly to relieve inner pressure.

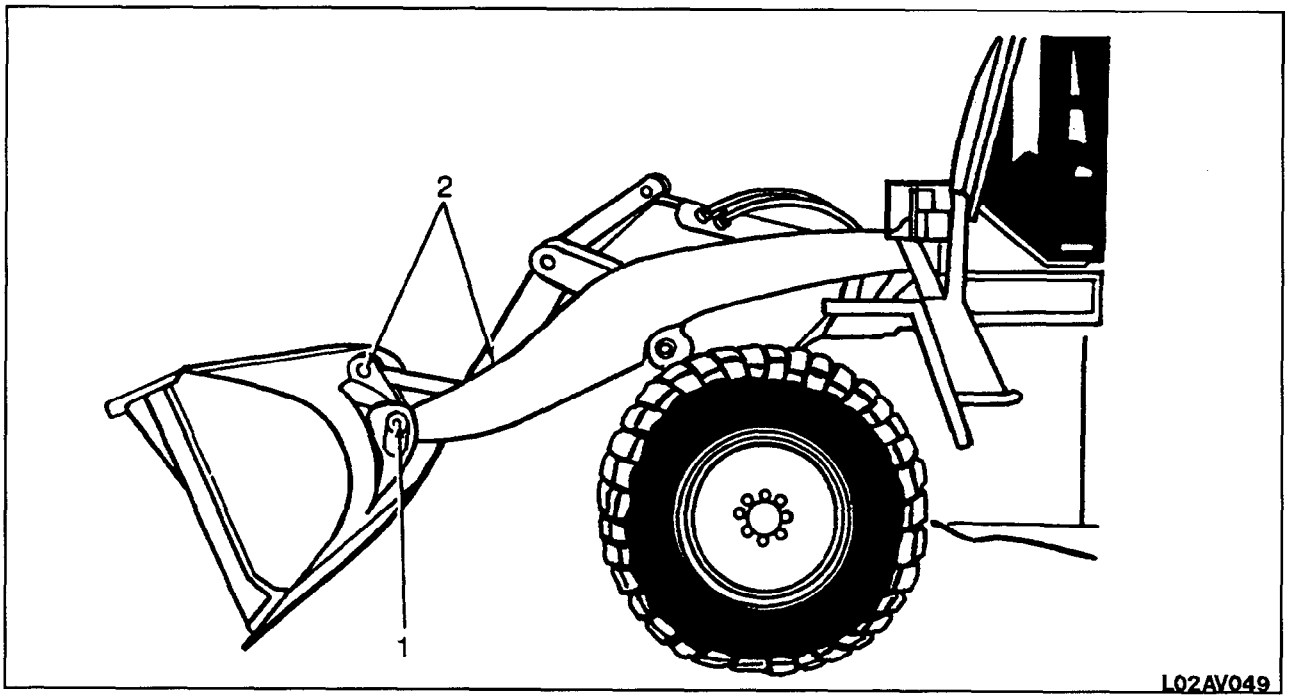
★ Turn wrench clockwise and hold it, then remove the filler cap by turning it counter-clockwise.

★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS."

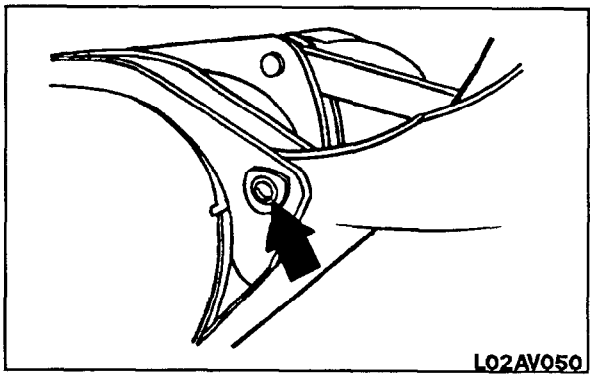
LUBRICATING

Apply grease fittings shown by arrows.

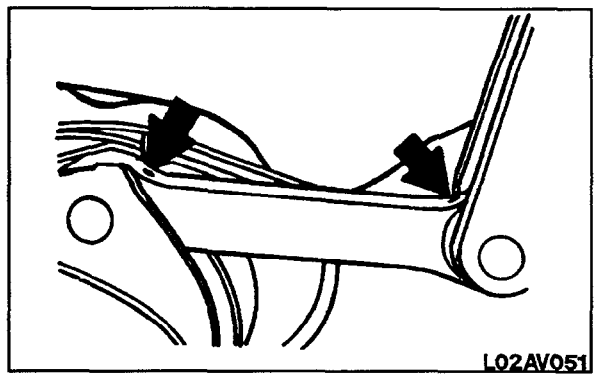
WARNING! Before starting the greasing service, fully dump the bucket, lower it to the ground, lock the work equipment control lever, apply the parking brake, and stop the engine.



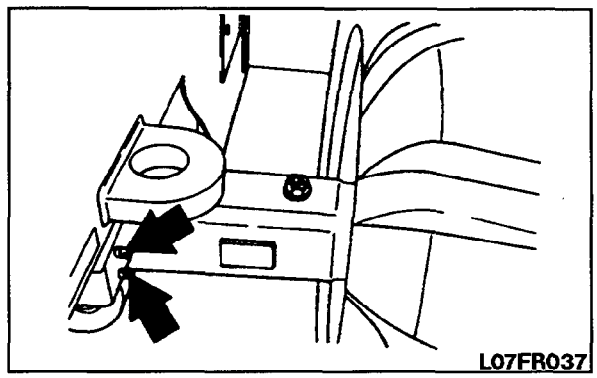
1. Bucket pin (2 points)



2. Bucket link pin (2 points)



3. Rear axle pivot pin (2 points)



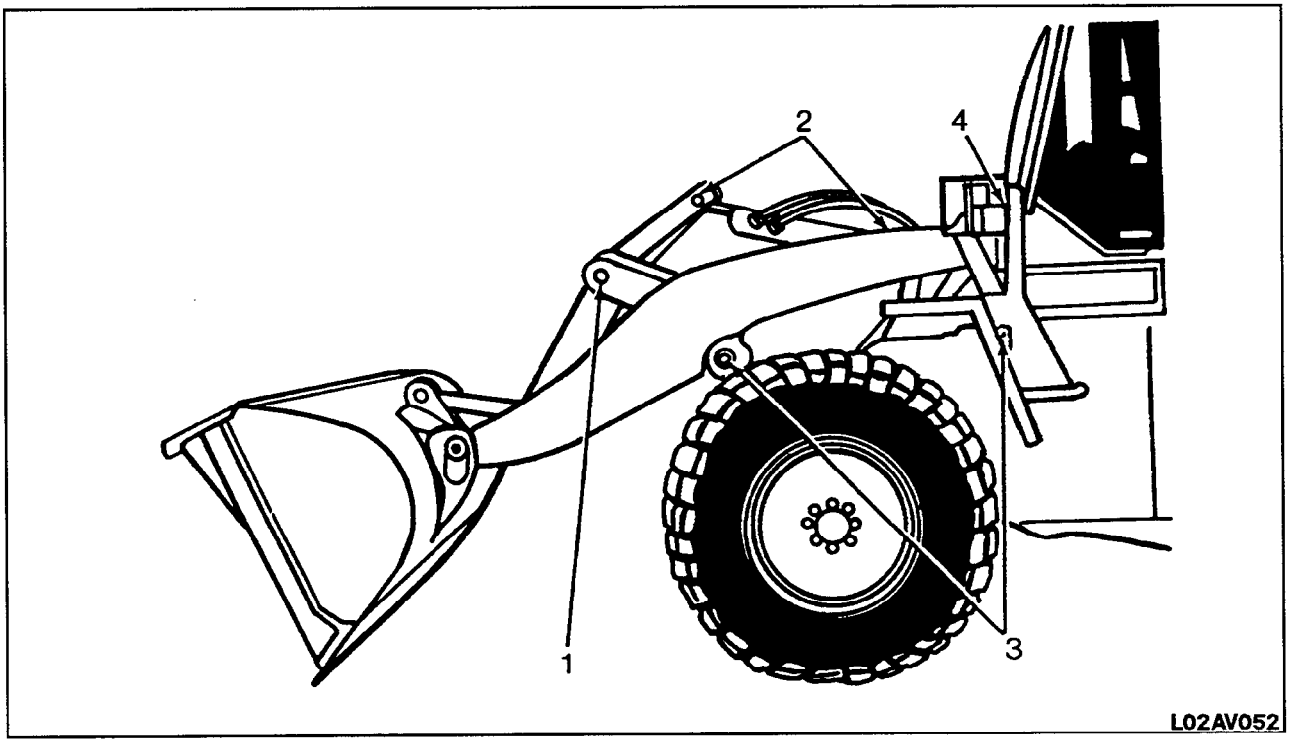
EVERY 250 HOURS SERVICE

★ **Maintenance for every 50 hours should be carried out at the same time.**

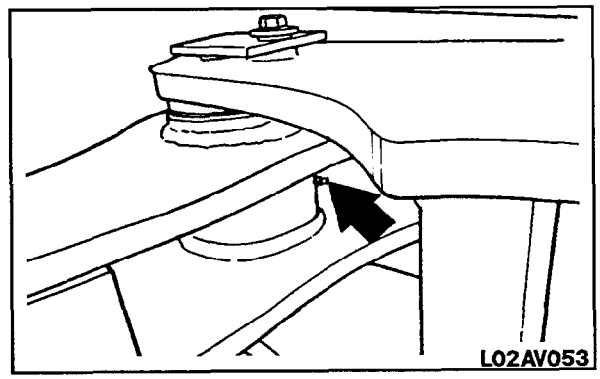
LUBRICATING

Apply grease to the grease fittings shown by arrows.

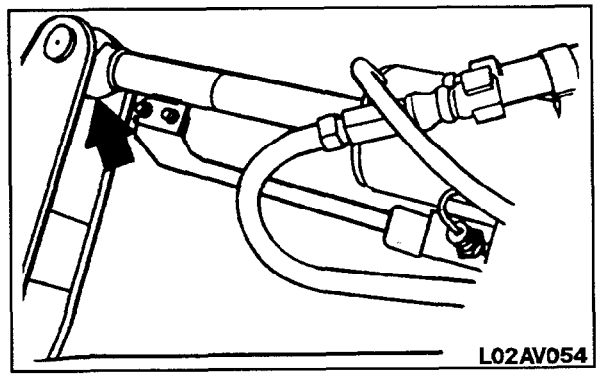
WARNING! Before starting the greasing service, fully dump the bucket, lower it to the ground, lock the work equipment control lever, apply the parking brake, and stop the engine.

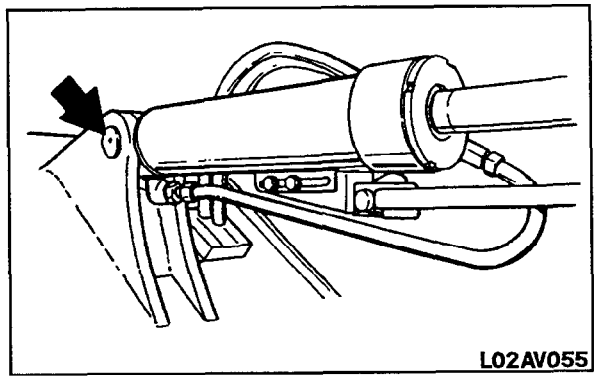


1. Tilt lever pin (1 point)

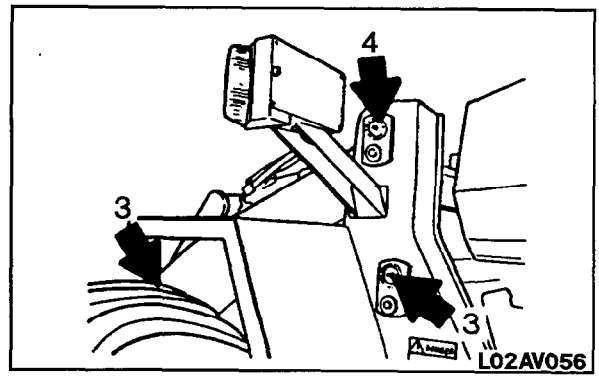


2. Dump cylinder pin (2 points)

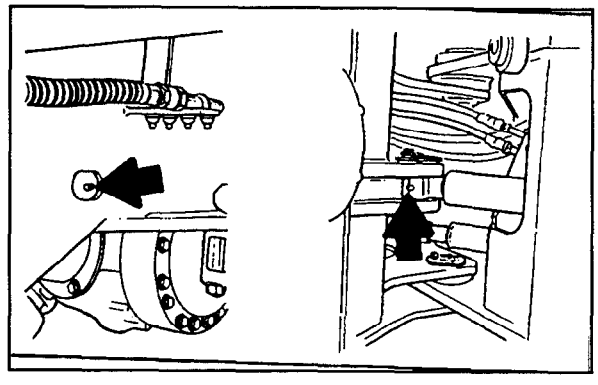




3. Lift cylinder pin (4 points)
4. Lift arm pivot pin (2 points)



5. Steering cylinder pin (4 points)



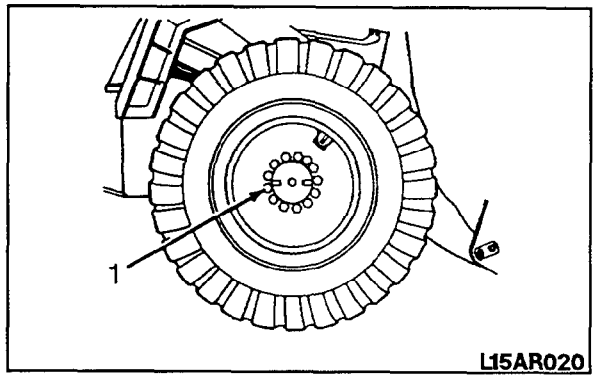
WHEEL HUB BOLTS

If wheel hub bolts (1) are loose, tire wear will be increased and accidents may be caused. If any hub nuts are loose, tighten them to the specified tightening torque.

★ Tightening torque: 94.5 ± 10.5 kgm

★ If any wheel bolt is broken, replace all bolts for that wheel.

★ Always rotate in the direction of tightening when checking for loose bolts.

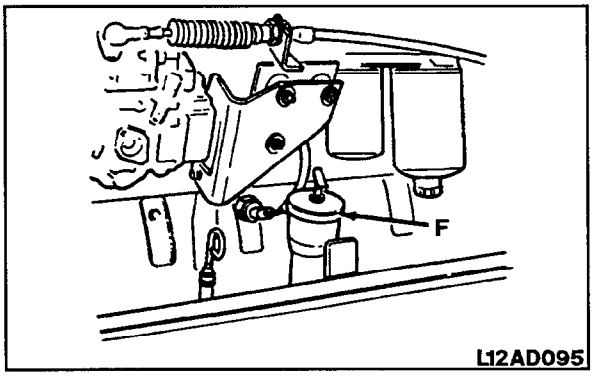


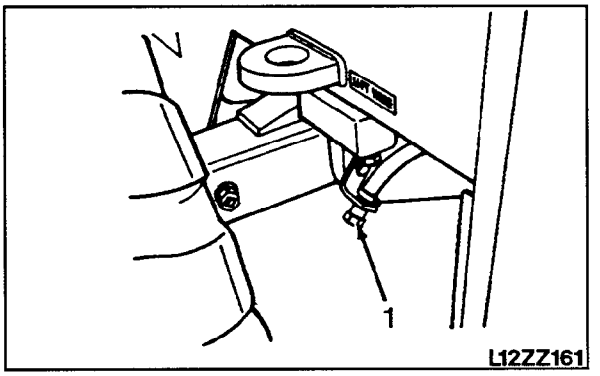
ENGINE OIL PAN AND FILTER

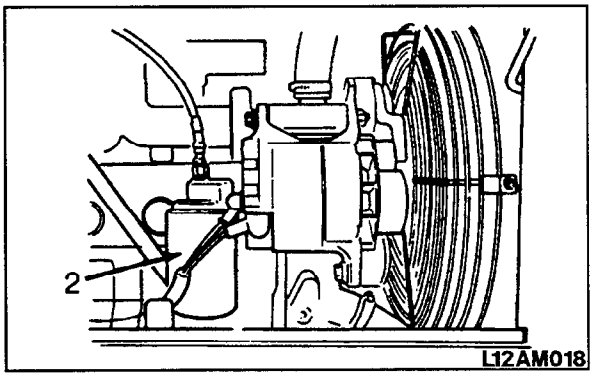
1. Warm up the engine to operating temperature and the trun the engine off.

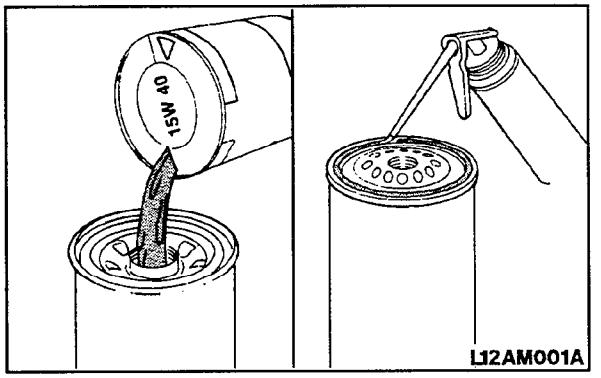
WARNING! If oil filter (2) is removed immediately after stopping the engine, oil will spill. Wait at least 10 minutes after stopping the engine before replacing the filter.

2. Open the engine side covers located on the left and right of the engine hood.
3. Open oil filler (F) and remove drain plug (1) to drain oil. After draining, tighten the drain plug.
4. Clean the area around the oil filter.
5. Using a filter wrench, remove oil filter (2) by turning it counterclockwise.
6. Clean the filter gasket surface of the filter header.
7. Fill a new oil filter with engine oil. Then, apply engine oil or a thin coat of grease to the seal.
8. To install filter, bring its seal surface into contact with sealing surface of filter base and then tighten the filter 1/2 to 3/4 turn by hand.
   - ★ Be careful not to tighten it up excessively.
   - ★ Be sure to use a genuine filter.
9. After replacing the filter, pour in the specified quantity of engine oil at oil filler (F).
   - ★ Refill capacity is 9.5 ℓ (2.5 US gal).
   - ★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS."
   - ★ Replace once every 3 months, regardless of the number of hours operated.







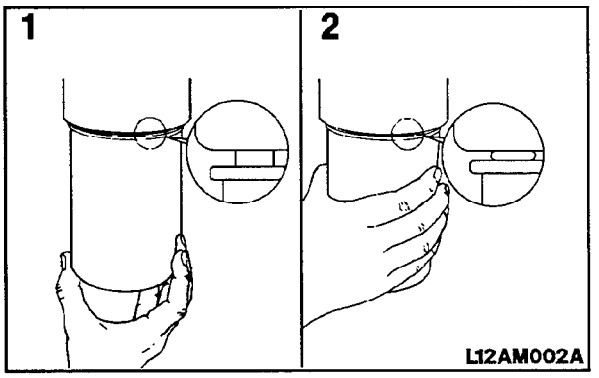


10. After refilling with oil, start the engine and idle it for a while. Inspect for oil leaks at the filter and drain plug. Then stop the engine and check the oil level. Wait for 5 minutes before checking.

11. Close the engine side covers.

★ Diluted oil can cause severe damage to the engine. Check the condition of the used oil.

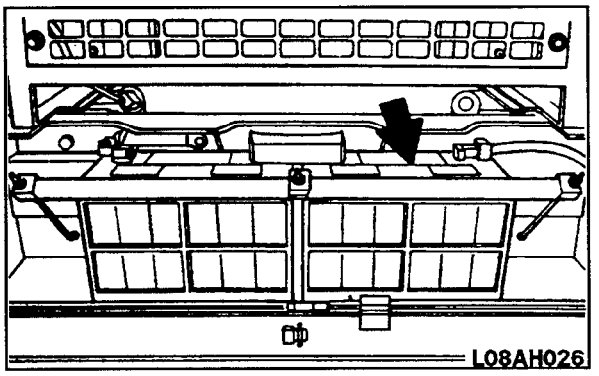
- Thin, black oil indicates fuel dilution.
- Milky discoloration indicates coolant dilution.



BATTERY ELECTROLYTE

WARNING! If the electrolyte gets on your skin or clothes, immediately wash with plenty of clean water.

WARNING! To avoid gas explosions, do not bring fire or sparks near the battery.



1. Open the battery box covers and remove the battery caps.

2. If the electrolyte level is lower than the prescribed level (10 to 12 mm above the plate), add distilled water.

   ★ Should any of the acid be split, have it replenished by the nearest battery shop with acid of the correct specific gravity.

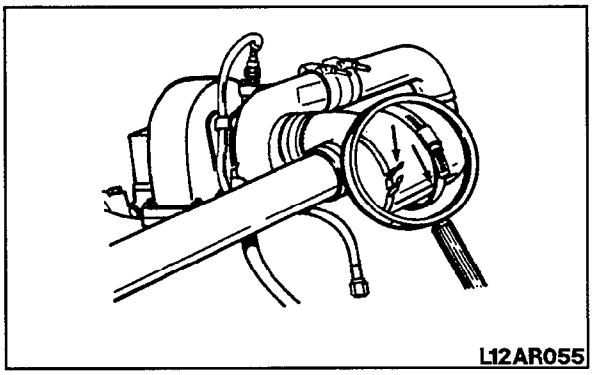
   ★ When checking electrolyte level, clean the vent hole of the battery caps.

3. Reinstall the battery caps and close the battery box covers.

AIR INTAKE SYSTEM

Inspect the intake piping for damage, cracked hoses, loose clamps, etc.

★ Never operate the engine without an air cleaner.



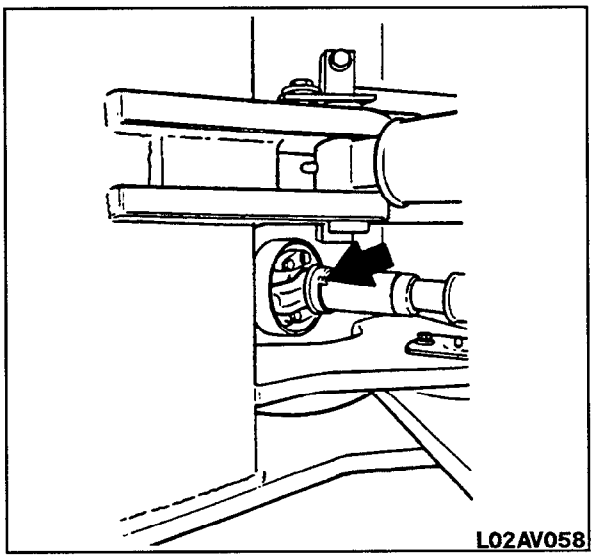
EVERY 500 HOURS SERVICE

★ **Maintenance for every 50, 100 and 250 hours should be carried out at the same time.**

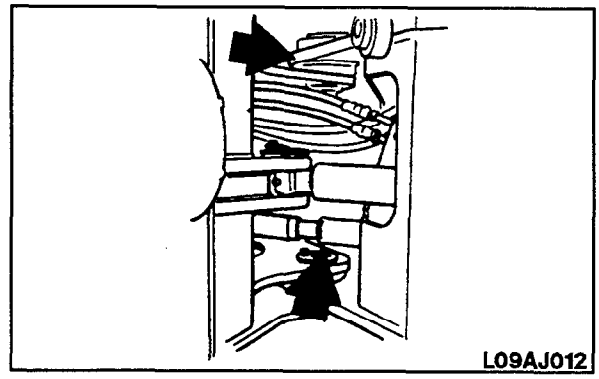
LUBRICATING

Apply grease to the grease fitting shown by an arrow.

1. Center drive shaft spline (1 point)



2. Center hinge pin (2 points)



FUEL FILTERS

GENERAL

The fuel filters are spin-on type filters. These filters cannot be cleaned and should not be disturbed except when it becomes necessary to replace them.

Change the fuel filters as listed on the SCHEDULED MAINTENANCE GUIDE or sooner if a power loss is evident. If a power loss persists, consult your distributor.

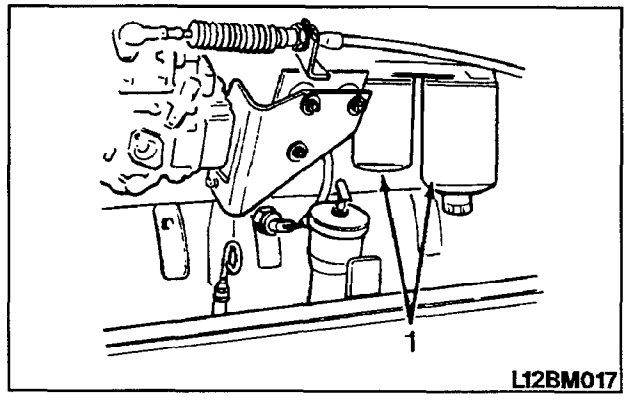
NOTE: Fuel with more than the average impurities may require changing filters at shorter intervals.

The fuel filters are located on the right side of the engine.

Be careful not to allow dirt, water or other foreign material to get in the new filter. Keep new filters in the original package until ready for installation.

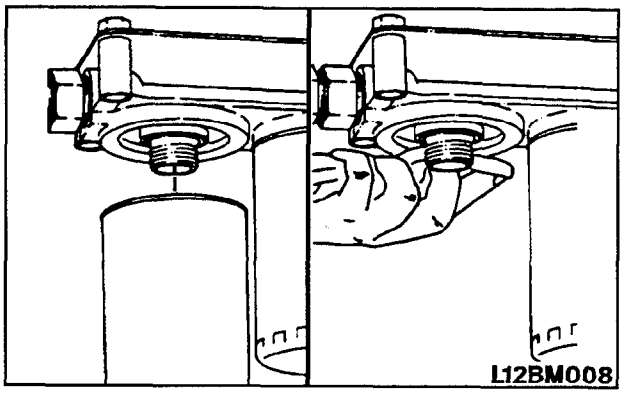
REPLACEMENT

1. Open the engine side access cover on the right side of the machine.
2. Clean the area around the fuel filters (1).

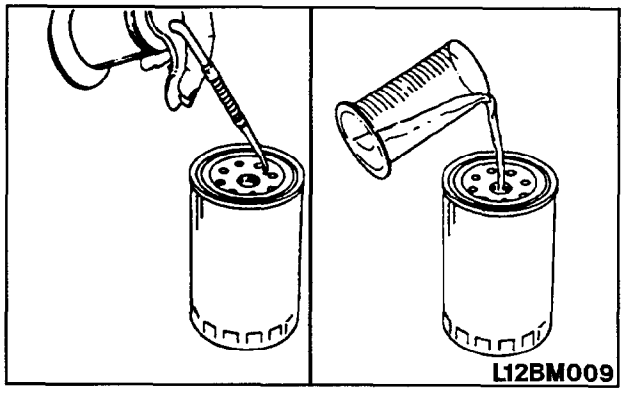


3. Using a filter wrench, remove the fuel filters by turning them counterclockwise. Discard the filters in a suitable manner if they are **not** needed for any reason.

4. Clean the filter gasket surfaces of the filter header for each filter. Replace the filter O-rings.



5. Fill the new filters with clean diesel fuel. Then, apply a thin coat of clean engine oil to the seal of the filter.



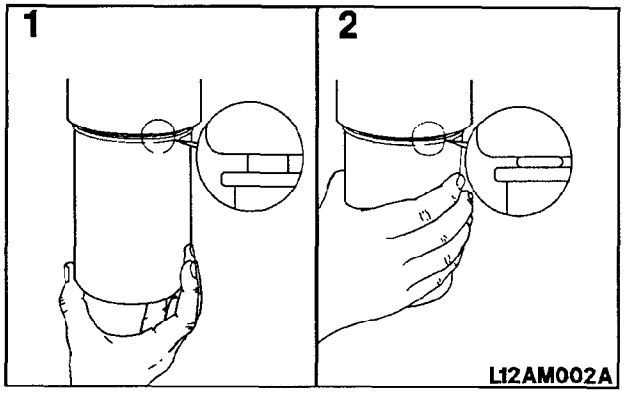
6. Install the filters on the filter header until the filter seal contacts the seal surface of the filter header and then, turn the filter an additional 1/2 to 3/4 turn by hand.

★ Do not over tighten the filter or damage may result to the filter seal or threads.

★ Use a genuine filter.

7. After replacing the filters, start the engine and idle it for a few minutes. Check the filters for possible fuel leakage.

8. Close the engine side access cover.



TRANSMISSION OIL FILTER

1. Remove drain plug (1) at the bottom of the filter case, and drain the oil. After draining the oil, tighten the plug.
2. Hold case (2) and loosen center bolt (3), then remove case (2).

★ Be sure to use a genuine filter element.

★ Replace the filter gasket and O-rings with new parts. Coat the gasket and O-rings with clean engine oil before installing.

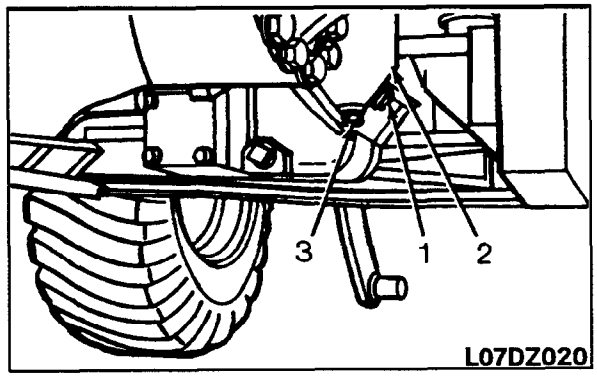
3. Remove the element, and clean the inside of the case. Assemble a new element, then install the case.

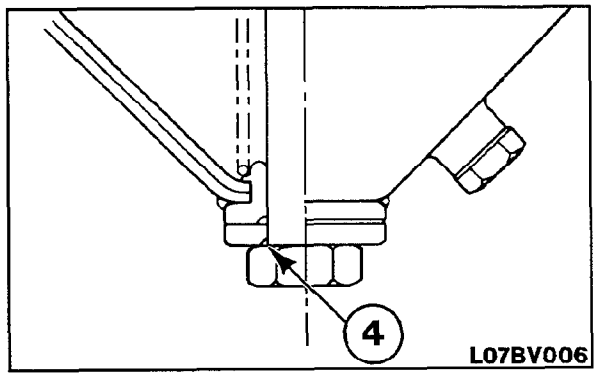
★ Before tightening center bolt (3), install bolt washer (4) so that its chamfered surfaces faces the hexagonal head of the center bolt.

★ Be careful not to apply excessive torque to center bolt (3).

★ Torque center bolt (3).
Tightening torque: 7.8 ± 1.2 kgm.

4. Run the engine for a short time at idling speed, then stop the engine. Check that the oil is at the specified level (for details, see WHEN REQUIRED).





ANTIFREEZE CONCENTRATION

Check the antifreeze concentration. Use ethylene-glycol base antifreeze to protect the engine to -37°C year round. See SECTION 2.

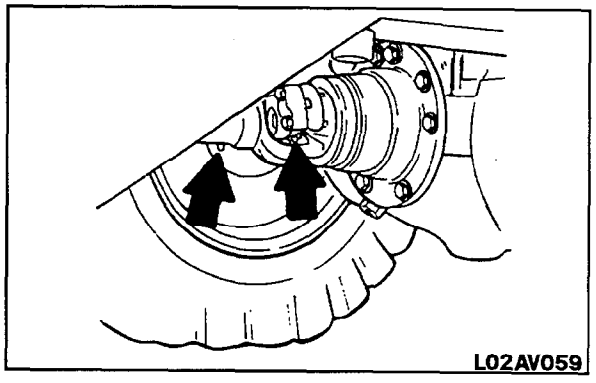
EVERY 1000 HOURS SERVICE

★ **Maintenance done for every 50, 100, 250 and 500 hours should be carried out at the same time.**

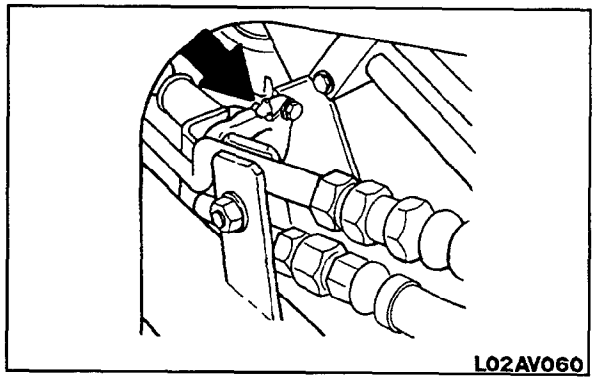
LUBRICATING

Apply grease to the grease fittings shown by arrows.

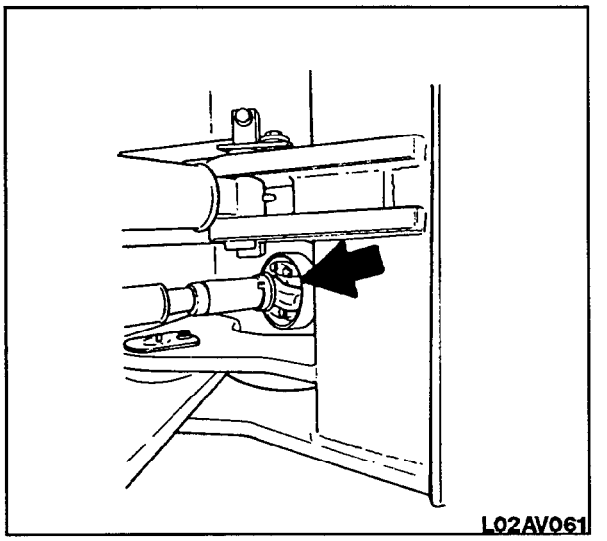
1. Front drive shaft (2 points)

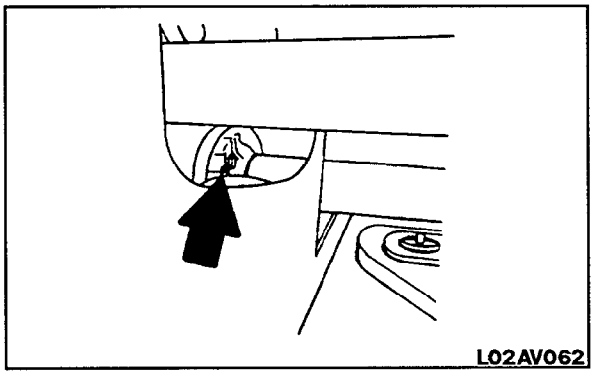


2. Drive shaft center support (1 point)

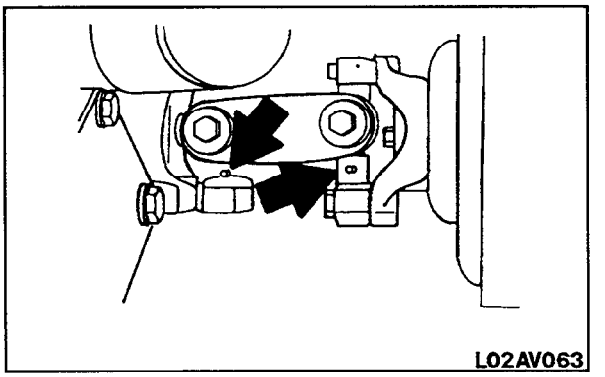


3. Center drive shaft (2 points)





4. Rear drive shaft (2 points)



HYDRAULIC TANK AND FILTER

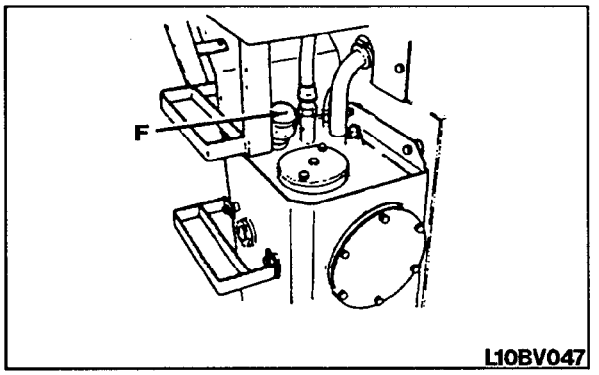
1. Lower the bucket horizontally to the ground and apply the parking brake, then stop the engine.
2. Remove the cap of oil filler (F).
   - ★ Turn wrench clockwise and hold it, then remove the filler cap by turning it counter-clockwise.

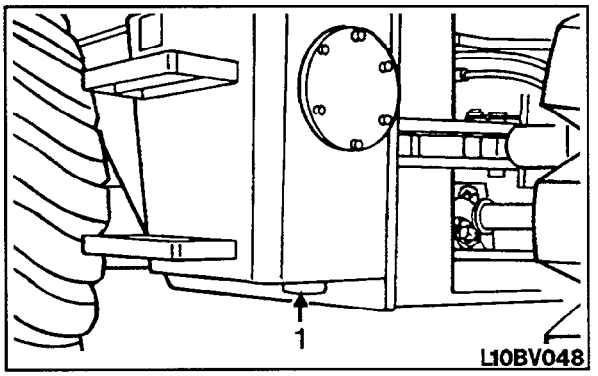
WARNING! When removing the cap, turn it slowly to relieve inner pressure.

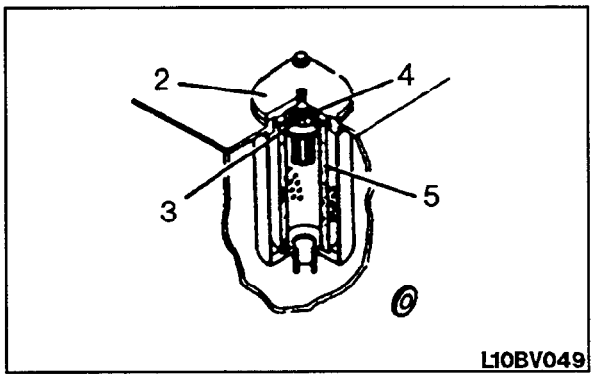
3. Loosen drain plug (1) to drain oil. After draining, tighten the drain plug.

WARNING! The filter cover is pushed up by spring tension, so hold the cover down when removing the bolts.

4. Remove the mounting bolt of filter cover (2), then remove the cover.
5. Remove spring (3) and bypass valve (4), then remove element (5).
   - ★ Check that there is no foreign matter inside the tank before cleaning it.
6. Install a new element, then install bypass valve (4), spring (3), and cover (2).
   - ★ If the o-ring of the cover is damaged or deteriorated, replace it with a new part.
   - ★ When installing the cover bolts, push down the cover and tighten the bolts evenly.
7. Pour the specified quantity of engine oil from filler (F).
8. Bleed the air from the hydraulic circuit, lower the bucket horizontally to the ground, and stop the engine. See "BLEEDING AIR FROM CIRCUIT" for the air bleeding procedure.
9. Check the oil level and ensure that is correct. (Refer to EVERY 100 HOURS SERVICE.)
   - ★ Refill capacity: 38 ℓ
   - ★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS".
   - ★ Check that there is no oil leaking from the filter cover mount.

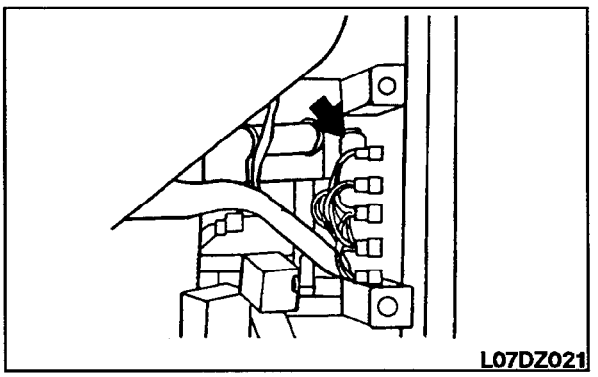






TRANSMISSION CASE BREATHER

Remove all mud and dirt from around the breather, then remove the breather. Put in cleaning fluid and clean the breather.



TRANSMISSION OIL AND STRAINER

1. Loosen drain plug (P) to drain oil. After draining off the oil, tighten up drain plug (P).

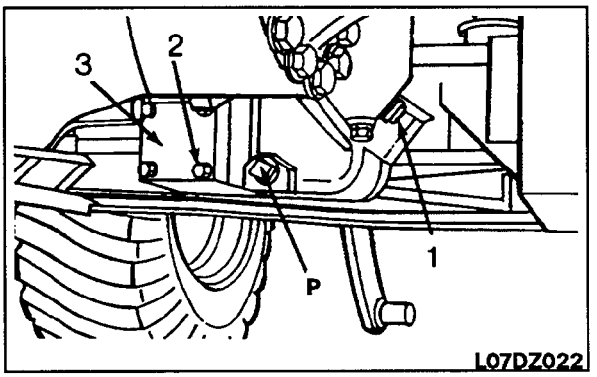
   ★ After loosening drain plug (P), pull out the plug slowly to prevent the oil spouting out.

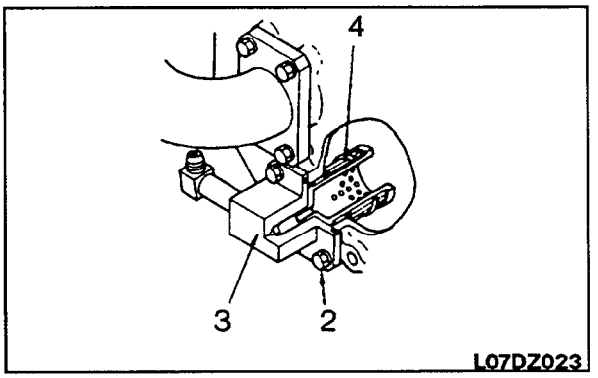
2. Loosen drain plug (1) of transmission oil filter to drain oil. After draining off the oil, tighten up drain plug (1).

3. Remove bolt (2) and cover (3), then remove strainer (4).

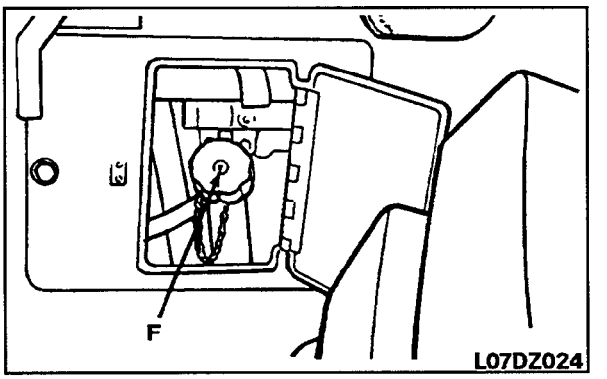
4. Remove all dirt from the surface of strainer (4), then wash in clean light oil. If strainer (4) is damaged, replace with a new part.

5. Install strainer (4) in cover (3). Replace the O-ring of the cover with a new part, then install the cover.



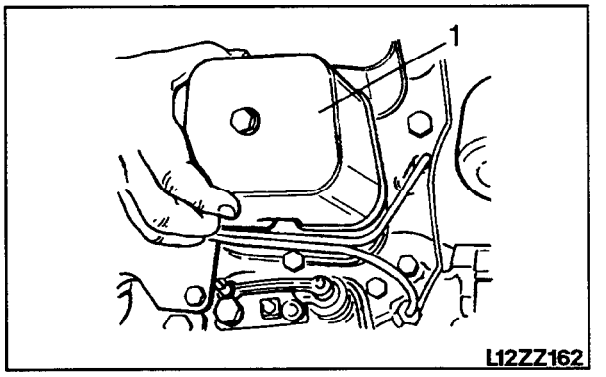


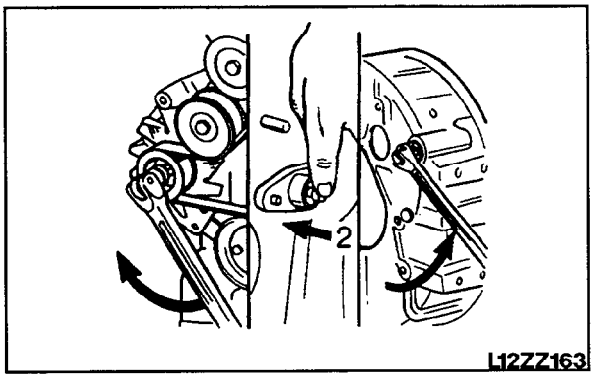
6. Pour in the specified amount of engine oil from oil filter (F).
7. After refilling, check the oil level and ensure that it is correct. (Refer to WHEN REQUIRED.)
   - ★ Refill capacity: 18.5
   - ★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL COOLANT AND LUBRICANTS".
   - ★ Check for oil leak at transmission case and filter.



ENGINE VALVES

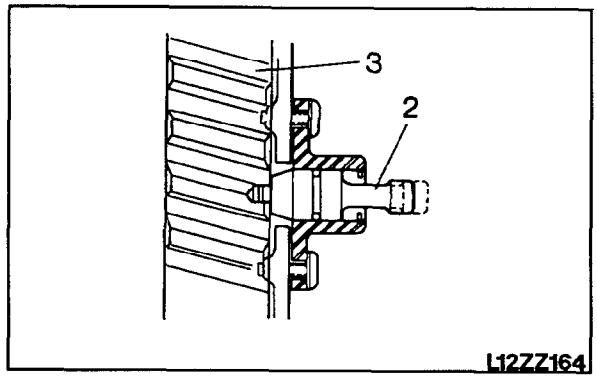
1. Remove valve covers (1).
2. Locate Top Dead Center (TDC) for cylinder number 1 by barring engine slowly while pressing on engine timing pin (2).

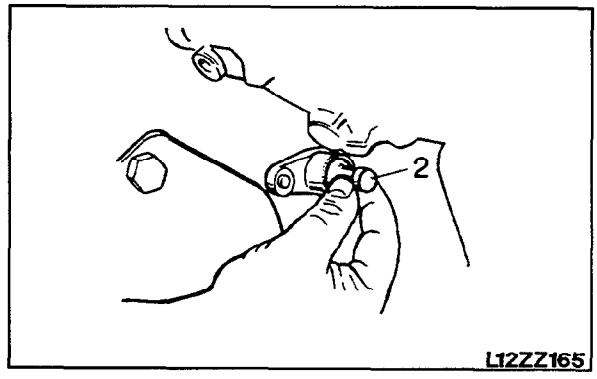




3. When pin (2) engages the hole in camshaft gear (3), cylinder number 1 is at TDC on the compression stroke.

WARNING! Be sure to disengage pin (2) after locating TDC.



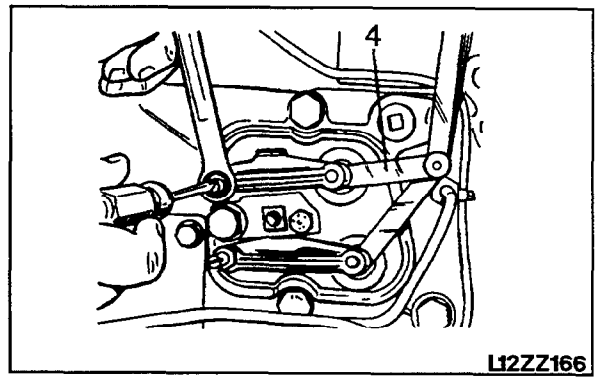


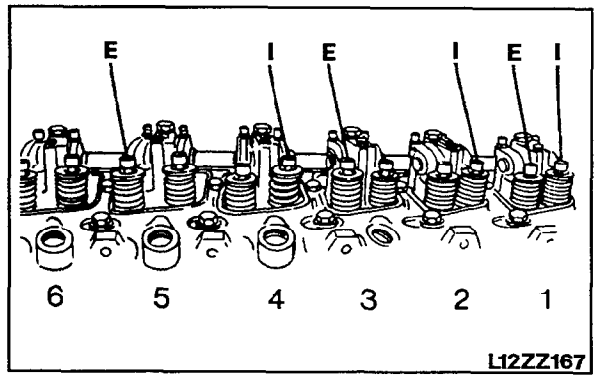
4. Check and adjust the valves indicated by "I" and "E" (I - Intake; E - Exhaust).

   Intake clearance: 0.254 mm
   Exhaust clearance: 0.508 mm
   Check and set valves with engine cold - below 60°C.

   ★ The clearance is correct when some resistance is "FELT" when feeler gauge (4) is slipped between the valve stem and the rocker lever.

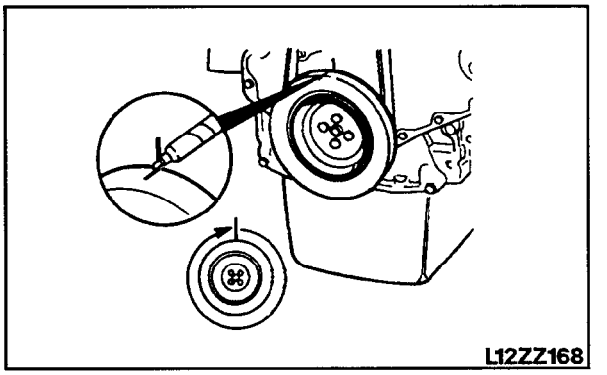
5. Tighten the lock nut to 2.48 kgm and re-check the valve lash.



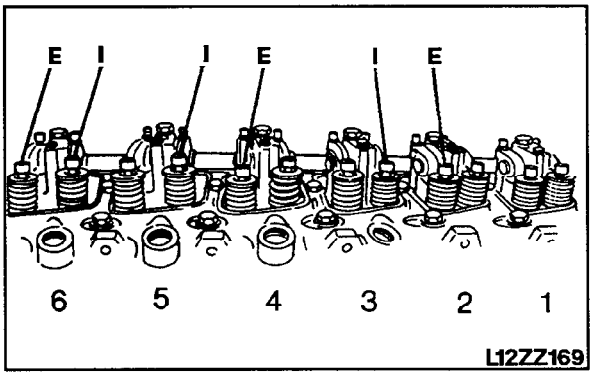


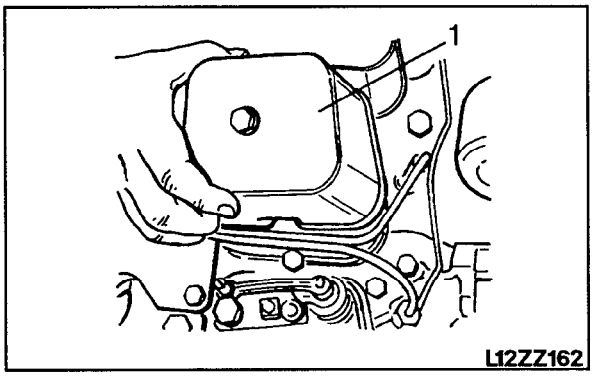
6. Mark the pulley and rotate the crankshaft 360 degrees.

   ★ Be sure timing pin is disengaged.



7. Set the valves indicated by "I" and "E".
8. Tighten the lock nut to 2.48 kgm and recheck the valve lash.
9. Install valve covers (1) and tighten cap screws to 2.48 kgm.





DRIVE BELT

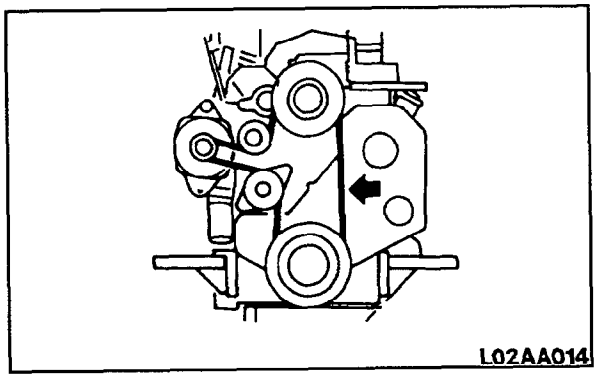
1. Measure the belt deflection at the longest span of the belt when pressed with the finger.

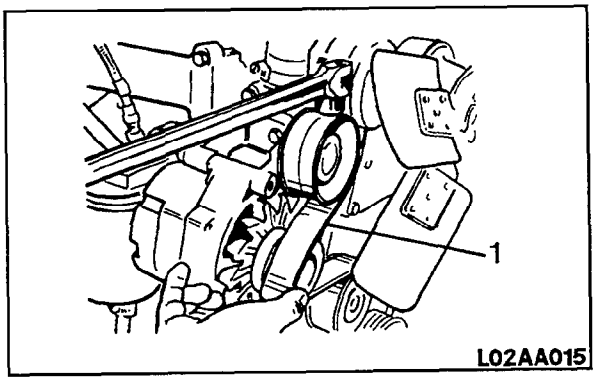
   Maximum deflection: 9.5 - 12.7 mm

★ Cummins belt tension gauge ST-1293 may be used. The required gauge value is 36 to 50 kg.

DRIVE BELT, TENSIONER BEARING AND FAN HUB

1. Remove drive belt (1) and complete the following steps:
2. Inspect the belt for damage.

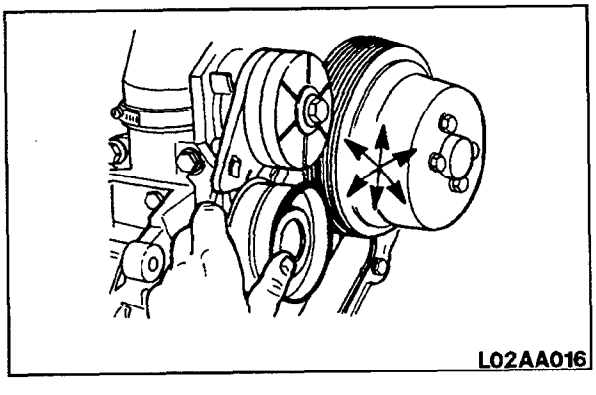




3. Check the tensioner bearing.

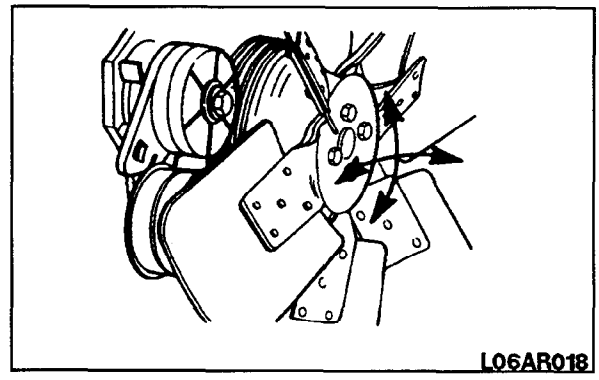
   ★ The tensioner pulley should spin freely with no rough spots detected under hand pressure.

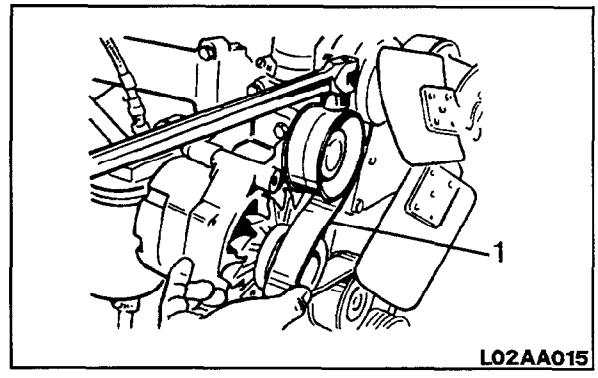
4. Check the fan hub bearing.



★ The fan hub should spin freely without excessive end play.

5. Install the drive belt (1).





EVERY 2000 HOURS SERVICE

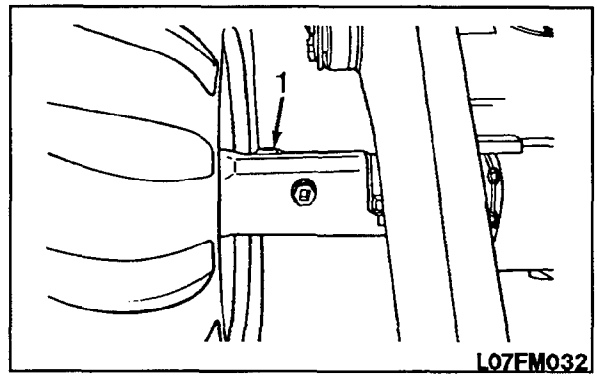
★ **Maintenance for every 50, 100, 250, 500 and 1000 hours should be carried out at the same time.**

DRIVE AXLES

★ Use the same procedure to change the oil for the front and rear axles.

1. Remove front and rear oil filler plugs (1), then remove drain plugs (2) to drain the oil.
2. After draining the oil, clean drain plugs (2), then install them.
3. Add oil to the specified level through the oil filler ports of the axle housing.
4. Check the oil level and ensure that is correct. (Refer to WHEN REQUIRED.)

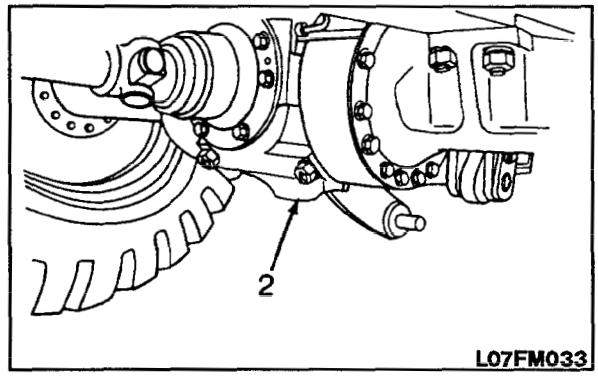
Front



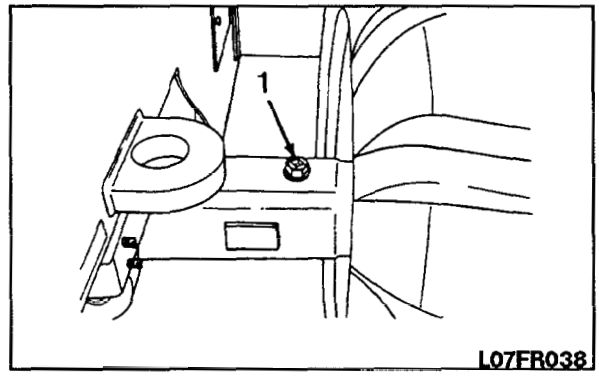
★ Refill capacity: 14 ℓ (each axle)

★ The type of lubricant used depends on the ambient temperature. Select according to the table "FUEL, COOLANT AND LUBRICANTS".

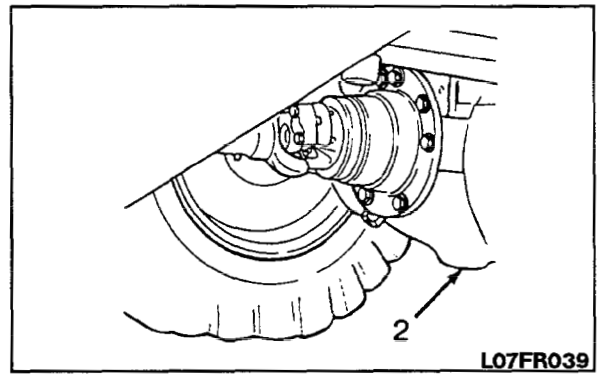
Front



Rear

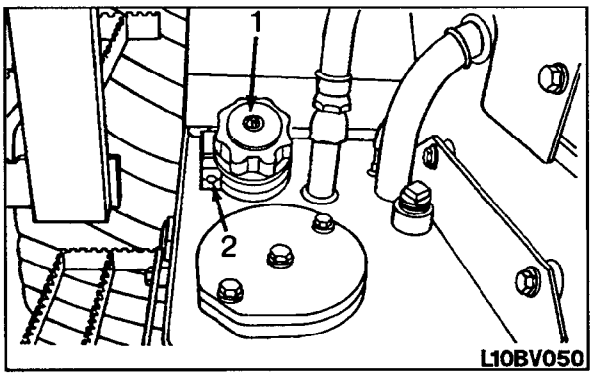


Rear



HYDRAULIC TANK BREATHER

1. Loosen bolt (1) at the top of the cap.
2. Turn wrench (2) clockwise and hold it, then remove the cap by turning it counterclockwise to take out the element.
3. Coat the O-ring of the new element with grease, then install the element.
4. Align the cap with the body and tighten the bolts.

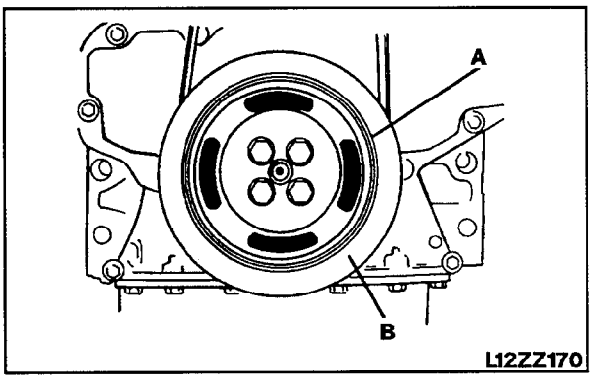


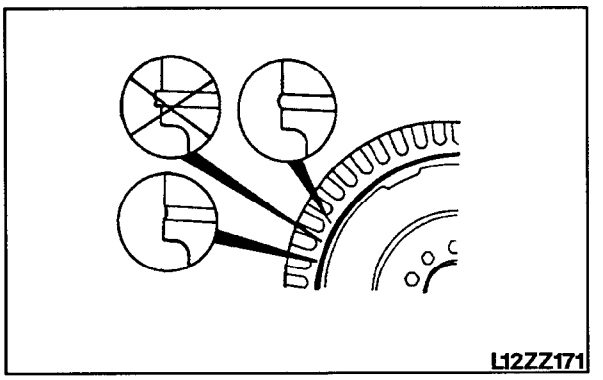
BRAKE DISC

Ask your distributor to check and repair brake disc.

VIBRATION DAMPER

1. Check the index lines (A) on the damper hub and the inertia member (B). If the lines are more than 1.59 mm out of alignment, replace the damper.
2. Inspect the rubber member for deterioration. If pieces of rubber are missing or if the elastic member is more than 3.18 mm below the metal surface, replace the damper.





COOLING SYSTEM

COOLANT RECOMMENDATIONS / SPECIFICATIONS

For coolant recommendations / specifications, refer to "COOLANT" under "LUBRICANTS, FUEL AND COOLANT".

CHANGING COOLANT AND FLUSHING SYSTEM

★ Stop the machine on level ground when cleaning or changing the coolant.

★ Use antifreeze during all seasons to protect the cooling system from corrosion as well as freezing damage.

★ A mixture of 50% water and 50% ethylene-glycol base antifreeze is required for operation of the engine in temperature environments above -37° C.

1. Stop the engine.

★ Check for damaged hoses and loose or damaged hose clamps. Replace as required. Check the radiator for leaks, damage and build up of dirt. Clean and repair as required.

2. Turn cap (1) slowly until it comes off.

WARNING! Do not remove cap (1) while coolant is hot. Hot coolant may spout out. When removing radiator cap, lift the lever to relieve inner pressure.

3. Open drain valve (2) at the bottom of the radiator and plug (3) in the bottom of the water inlet on the engine side to drain off the coolant.

4. Drain off all the water, then close up drain valve (2), plug (3), and pour in soft water (ex: city water) up to the vicinity of the water filler.

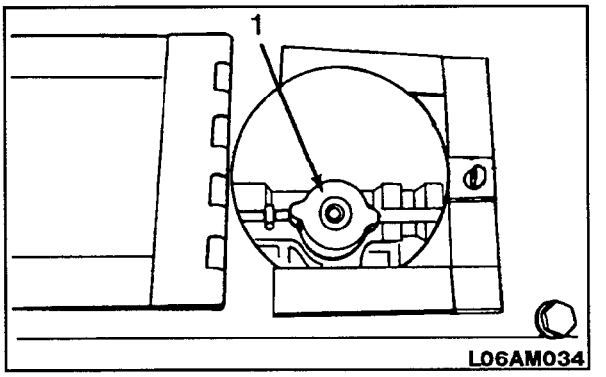
5. When the water reaches the vicinity of the water filler, put the engine at low idling, open drain valve (2), plug (3), then pass water through the cooling system for 10 minutes.

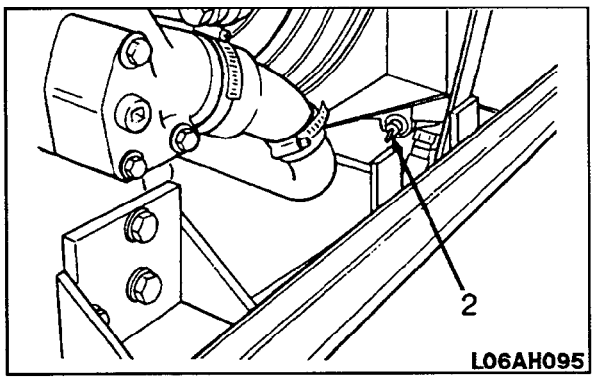
   ★ When doing this, adjust the inflow and outflow of water so that the radiator is always full.

★ The antifreeze/DCA4 mixture **must** be changed every two years.

★ In tropical climates where antifreeze availability may be limited, use a corrosion inhibitor (Cummins liquid DCA), or an equivalent to protect the engine cooling system.

★ Do not operate the engine without a thermostat.





6. After flushing with water, stop the engine. Close drain valve (2) and drain plug (3) after draining water.

7. After draining water, clean with a flushing agent.

   ★ If the system shows mineral build-up, scale, rust or oil, use a heavy duty radiator cleaner and follow the manufacturer's direction.

   ★ Do NOT use caustic cleaners in the cooling system. Aluminum components will be damaged.

   ★ Follow the instructions on the label of the flushing agent used to clean the system.

8. After cleaning the cooling system, again flush the system with soft water until clean water flows out of the drain openings. Then close drain valve (2) and plug (3), and pour in soft water (ex: city water) up to the vicinity of the water filler.

9. When the water reaches the vicinity of the water filler, put the engine at low idling, open drain valve (2) and plug (3), then pass water through the cooling system until clean water comes out from drain valve (2) and plug (3).

   ★ When doing this, adjust the inflow and outflow of water so that the radiator is always full.

10. When the water becomes completely clean, stop the engine, drain water and close drain valve (2) and plug (3).

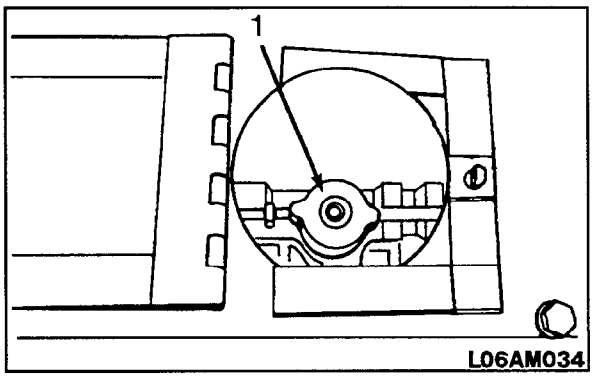
    ★ During filling, air must be vented from the engine coolant passage. Adequate venting is provided for a fill rate of 30 liters/minute.

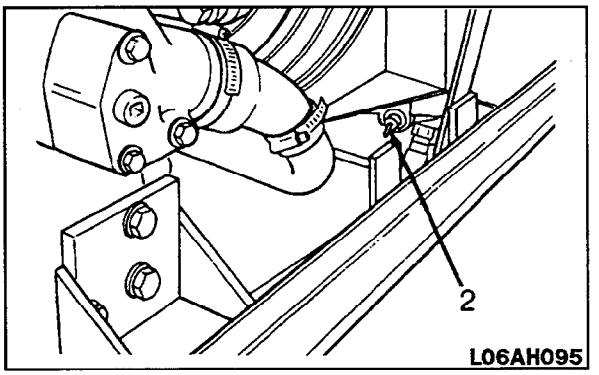
11. Fill the cooling system with the correct mixture of water, antifreeze and the correct amount of DCA4.

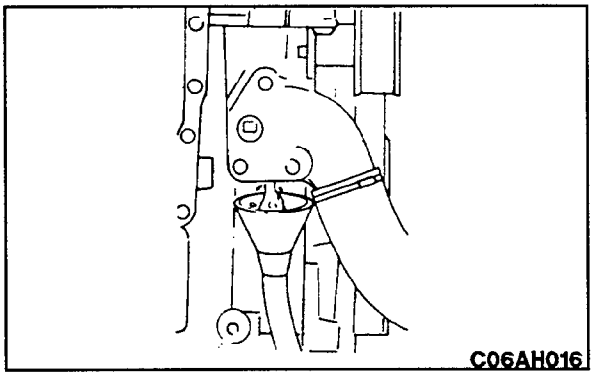
12. Run the engine for 5 minutes at low idling to eliminate air trapped in the cooling system, and run the engine for 5 minutes at high idling. (leave water filler cap (1) off during this operation.)

13. Stop the engine and 3 minutes later supply the system with the correct mixture of water, antifreeze and the correct amount of DCA4 up to the bottom of the radiator filler opening.

14. Repeat Steps 12 and 13 to ensure that the coolant mixture is up to the bottom of the radiator filler opening. Install and tighten the radiator cap.







SECTION 4
SPECIFICATIONS

WARNING ! REFER TO AND READ ALL SAFETY PRECAUTIONS IN SECTION 1.

SPECIFICATIONS

GENERAL SPECIFICATIONS

ENGINE

Make and Model	KDC 410T diesel engine
Type	4-stroke, water cooled, overhead valve, direct injection, turbocharger
Displacement	3.92 liter (239 in^3)
Number of cylinders	Four (4)
Bore and stroke	102 mm x 120 mm (4.02 in x 4.72 in)
Flywheel horsepower @ 2500 rpm	70.1 kW (94 HP)

All-speed mechanical governor.

Gear-pump-driven force-lubrication with full-flow filters. All filters are spin-on type for easy maintenance.

Dry, cyclopack air cleaner with dust evacuation valve for longer element service.

24 V/5.5 Kw electric starting motor. 24 V/45A alternator. 2 x 12 V/110 Ah batteries.

TRANSMISSION

3-element, single-stage, single-phase torque converter.

Full power-shift, counter-shaft type transmission. A neutral safety circuit allows starting only when directional control lever is in neutral.

Travel Speed	Forward	Reverse
1st	4.2 MPH 6.8 km/h	4.3 MPH 7.0 km/h
2nd	8.6 MPH 13.8 km/h	8.8 MPH 14.1 km/h
3rd	21.4 MPH 34.5 km/h	21.7 MPH 35.0 km/h

AXLES & FINAL DRIVES

Four-wheel drive system.

A semi-floating front axle is fixed to the front frame. Center-pin-supported, semi-floating rear axle with a oscillation of ± 12°.

A spiral bevel gear for reduction and planetary gear, single reduction final drive.

Front and rear torque proportioning differentials minimize tire slippage on soft or wet terrain.

BRAKES

Service brakes: Hydraulically actuated, inboard-mounted, wet, disc brakes actuate all four wheels. Two pedals are provided. Both can be used for normal braking; however, the left pedal can be used for braking and transmission neutralizing simply by actuating a switch.

Parking brake: Dry disc type applied on front output coupling of the transmission.

STEERING SYSTEM

Center-pivot frame articulation. Orbital type, full-hydraulic steering independent of the engine RPM's.

A wide articulation angle of 40° on each side for a minimum turning radius of 13'7" or 5065 mm at the outside corner of the bucket.

HYDRAULIC SYSTEM

A gear pump for steering and loader control.

Capacity (discharge flow) at engine 2500 RPM
Loader 35.0 U.S. gal/min 133 ltr.

Relief valve setting

Loader	2990 psi	210 kg/cm²
Steering	2700 psi	190 kg/cm²

Control valves
A 2-spool type control valve.

Hydraulic cylinders

Hydraulic cylinders	Number of cylinders	Bore	Stroke
Boom	2	4.33" 110 mm	1'11" 589 mm
Bucket	1	4.72" 120 mm	1'5" 423 mm

Hydraulic cycle time (rated load in bucket)

Raise	5.2 sec.
Dump	1.1 sec.
Lower (empty)	3.0 sec.

SERVICE REFILL CAPACITIES

Cooling system	4.2 U.S. gal.	16 ltr.
Fuel tank	31.7 U.S. gal.	120 ltr.
Engine	2.8 U.S. gal.	10.5 ltr.
Brake oil tank	0.3 U.S. gal.	1 ltr.
Hydraulic system	10.0 U.S. gal.	38 ltr.
Differential and final drive case (each side)	3.7 U.S. gal.	14 ltr.
Torque converter and transmission	4.9 U.S. gal.	18.5 ltr.

SPECIFICATIONS

Bucket type		General Purpose Bolt-On Cutting Edge		Excavating Bolt-On Cutting Edge		Light Material Bolt-On Cutting Edge	
Bucket Capacity	SAE Rated	1.75 yd^3	1.4 m^3	1.50 yd^3	1.2 m^3	2.25 yd^3	1.7 m^3
	Struck	1.58 yd^3	1.2 m^3	1.30 yd^3	1.0 m^3	1.90 yd^3	1.45 m^3
Bucket Width		7'10	2390 mm	7'10"	2390 mm	7'10"	2390 mm
Bucket Weight		1290 lbs	585 kg	1255 lbs	570 kg	1445 lbs	655 kg
Static Tipping Loads	Straight	13,812 lbs	6265 kg	13,880 lbs	6295 kg	13,635 lbs	6185 kg
	Full Turn	11,995 lbs	5440 kg	12,060 lbs	5470 kg	11,860 lbs	5380 kg
Dumping Clearance, max. height and 45° dump angle		8'8"	2650 mm	8'9.5"	2680 mm	8'4"	2550 mm
Reach @ 7', 2130 mm cutting edge clearance and 45° dump angle		4'5"	1345 mm	4'4"	1330 mm	4'7"	1390 mm
Reach at max. height and 45° dump angle		3'1"	950 mm	3'0"	920 mm	3'7"	1095 mm
Reach with arm horizontal and bucket level		6'4"	1930 mm	6'2"	1890 mm	6'10"	2075 mm
Operating Height	(fully raised)	14'7"	4440 mm	14'5"	4390 mm	15'0"	4580 mm
Overall Length	Bucket ground	19'4"	5900 mm	19'3"	5860 mm	19'10"	6045 mm
	Bucket at carry	19'3"	5870 mm	19'2"	5845 mm	19'7"	5965 mm
Turning radius (bucket at carry, outside corner of bucket)		16'8"	5090 mm	16'7"	5065 mm	16'9"	5115 mm
Digging Depth	0°	2.2"	55 mm	2.2"	55 mm	2.2"	55 mm
	10°	8.3"	210 mm	8.3"	210 mm	9.3"	235 mm
Breakout force		19,470 lbs	8830 kg	20,570 lbs	9330 kg	16,800 lbs	7620 kg
Operating Weight		17,970 lbs	8150 kg	17,935 lbs	8135 kg	18,125 lbs	8220 kg

NOTE: All specifications are subject to change without notice.

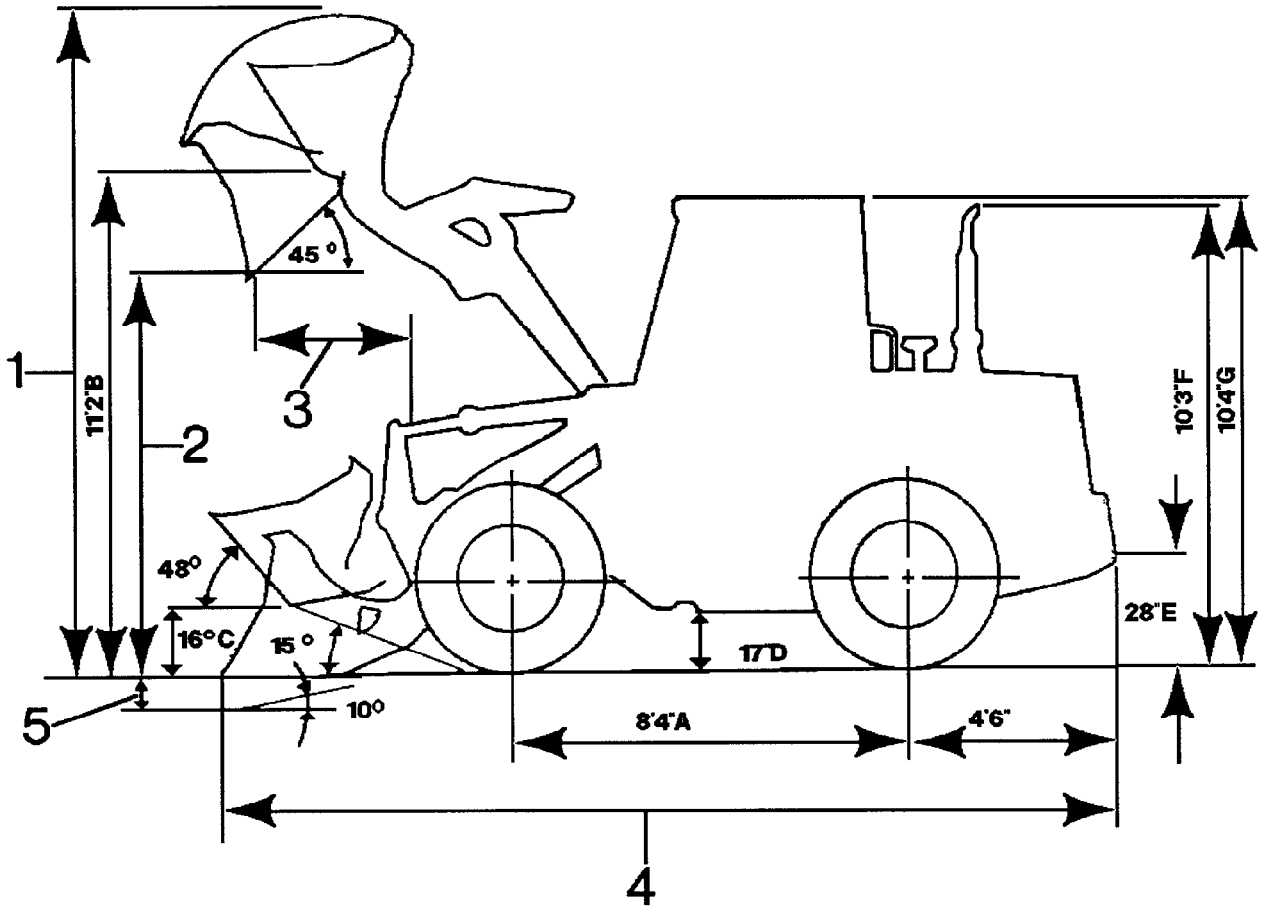
- All dimensions, weights and performance values based on SAE J-732C and J-742B standards.
- Static tipping load and operating weight shown include 17.5-25, 12PR (L2) tires, lubricant, coolant, full fuel tank, ROPS cab, front fenders, additional counterweight and operator. Machine stability and operating weight are affected by counterweight, tire size and other attachments.

Add the following weight changes to operating weight and static tipping loads.

WEIGHT CHANGES

	Change in Operating Weight		Change in tipping load			
			Straight		Full Turn	
Additional Counterweight (removed)	-615 lbs	-280 kg	-1135 lbs	-515 kg	-990 lbs	-450 kg
ROPS Cab (removed)	-880 lbs	-400 kg	-730 lbs	-330 kg	-640 lbs	-290 kg
ROPS Canopy (instead of ROPS Cab)	-430 lbs	-195 kg	-355 lbs	-160 kg	-310 lbs	-140 kg
Bucket Teeth (instead of bolt-on cutting edge)	-110 lbs	-50 kg	-120 lbs	-55 kg	-110 lbs	-50 kg
15.5-25-12PR (L2) tubeless tires	-240 lbs	-110 kg	-176 lbs	-80 kg	-155 lbs	-70 kg
15.5-25-12PR(L3) tubeless tires	-22 lbs	-10 kg	-11 lbs	-5 kg	-11 lbs	-5 kg
17.5-25-12PR(L2)	0		0		0	
17.5-25-12PR(L3) tubeless tires	+176 lbs	+80 kg	+132 lbs	+60 kg	+120 lbs	+55 kg

NOTE: All specifications are subject to change without notice.



L01AD012

1 = Operating Height
2 = Dumping Clearance
3 = Dumping Reach
4 = Overall Length
5 = Digging Depth

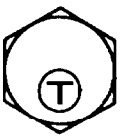
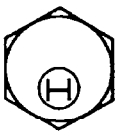
Tires	17.5-25 PR(L2)	
Tread	6'	1829 mm
Width over tires	7'5"	2260 mm

A	Wheelbase	8'4"	2540 mm	E	Hitch height	2'8"	813 mm
B	Hinge pin height, max. height	11'2"	3403 mm	F	Overall height, top of the stack	10'3"	3124 mm
C	Hinge pin height, carry position	16"	406 mm	G	Overall height, ROPS canopy	10'4"	3150 mm
D	Ground clearance	17"	432 mm				

STANDARD TIGHTENING TORQUES

STANDARD TIGHTENING TORQUE OF BOLTS AND NUTS

The following charts give the standard tightening torques of bolts and nuts. Exceptions are given in sections of this manual.

Thread diameter of bolt (mm)	Width across flat (mm)		
		kgm	N•m
6	10	1.35±0.15	13.2±1.4
8	13	3.2±0.3	31.4±2.9
10	17	6.7±0.7	65.7±6.8
12	19	11.5±1.0	112±9.8
14	22	18.0±2.0	177±19
16	24	28.5±3	279±29
18	27	39±4	383±39
20	30	56±6	549±58
22	32	76±8	745±78
24	36	94.5±10	927±98
27	41	135±15	1320±140
30	46	175±20	1720±190
33	50	225±25	2210±240
36	55	280±30	2750±290
39	60	335±35	3280±340

This torque table does not apply to the bolts with which nylon packings or other non-ferrous metal washers are to be used, or which require tightening to otherwise specified torque.

★ N•m (newton meter): 1 N•m ≒ 0.1 kgm

TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

Use these torques for split flange bolts.

Thread diameter of bolt (mm)	Width across flats (mm)	Tightening torque	
		kgm	N•m
10	14	6.7±0.7	65.7±6.8
12	17	11.5±1	112±9.8
16	22	28.5±3	279±29

TIGHTENING TORQUE FOR NUTS OF FLARED FITTINGS

Use these torques for nut part of flared fittings.

Thread diameter of nut part (mm)	Width across flats of nut part (mm)	Tightening torque	
		kgm	N•m
14	19	2.5±0.5	24.5±4.9
18	24	5±2	49±19.6
22	27	8±2	78.5±19.6
24	32	14±3	137.3±29.4
30	36	18±3	176.5±29.4
33	41	20±5	196.1±49
36	46	25±5	245.2±49
42	55	30±5	294.2±49

UNIT CONVERSIONS

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
AREA				
square inch (in^2)	645.16	square millimeter (mm^2)	0.001550003	square inch
	6.4516	square centimeter (cm^2)	0.1550003	square inch
	0.00064516	square meter (m^2)	1550.003	square inch
square foot (ft^2)	0.09290304	square meter (m^2)	10.76391	square foot
square yard (yd^2)	0.8361274	square meter (m^2)	1.195990	square yard
square rod (rod^2)	25.29285	square meter (m^2)	0.03953686	square rod
	0.002529285	square hectometer (hm^2)	395.3686	square rod
acre	4046.856	square meter (m^2)	0.0002471054	acre
	0.4046856	square hectometer (hm^2)	2.471054	acre
square mile ($mile^2$)	2589988.0	square meter (m^2)	0.0000003861022	square mile
	2.589988	square kilometer (km^2)	0.386102175	square mile

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
DENSITY (Mass Density)				
pound per cubic yard (lb/yd^3)	0.5932763	kilogram per cubic meter (kg/m^3)	1.685555	(lb/yd^3)
pound per cubic foot (lb/ft^3)	16.01846	kilogram per cubic meter (kg/m^3)	0.06242797	(lb/ft^3)
pound per cubic inch (lb/in^3)	27.67990	gram per cubic centimeter (g/cm^3)	0.03612730	(lb/in^3)
pound per US gallon (lb/US gal)	0.1198264	kilogram per liter (kg/l)	8.345406	(lb/US gal)
pound per UK gallon (lb/UK gal)	0.09977633	kilogram per liter (kg/l)	10.02242	(lb/UK gal)

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
FORCE				
pound, pound-force (lbf)	4.448222	newton (N)	0.2248089	pound-force
	0.004448222	kilonewton (kN)	224.8089	pound-force
ounce-ounce-force (ozf)	0.2780139	newton (N)	3.596942	ounce force

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
FORCE PER LENGTH				
pound, force per inch (lbf/in)	0.1751268	newton per millimeter (N/mm)	5.710148	pound-force per inch
	175.1268	newton per meter (N/m)	0.005710148	pound-force per inch
pound-force per foot) (lbf/ft)	14.5939	newton per meter (N/m)	0.06852178	pound-force per foot

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
HEAT				
British thermal unit (Btu)	1.055056	kilojoule (kj)	0.9478170	(Btu)
	1055.056	joule (J)	0.0009478170	(Btu)
Btu per hour* (Btu/h)	0.2930711	watt (W)	3.412141	(Btu/h)
Btu per minute* (Btu/min)	17.58427	watt (W)	0.05686902	(Btu/min)
Btu per gallon (Btu/gal)	0.2787163	kilojoule per liter (kJ/l)	3.5878777	(Btu/gal)

*Heat flow rate. Also see POWER.

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
LENGTH				
inch (in)	25.4	millimeter (mm)	0.03937008	(in)
	2.54	centimeter (cm)	0.3937008	(in)
	0.0254	meter (m)	39.37008	(in)
microinch (μin)	0.0254	micrometer (μm)	39.37008	(μm)
mil	25.4	micrometer (μm)	0.03937008	mil
micron (μ)	(same as micrometer one for one)			
foot (ft)	0.3048	meter (m)	3.280840	(ft)
yard (yd)	0.9144	meter (m)	1.093613	(yd)
mile	1.609344	kilometer (km)	0.6213712	mile
	1609.344	meter (m)	0.0006213712	mile
rod	5.0292	meter (m)	0.1988388	rod

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
MASS (WEIGHT)				
ounce	28.34952	gram (g)	0.03527397	(oz)
	0.02834952	kilogram	35.27397	(oz)
grain	0.06479891	gram (g)	15.43236	grain
pound (lb)	0.4535924	kilogram (kg)	2.204622	(lb)
short ton (2000 lb)	907.1847	kilogram (kg)	0.001102311	short ton
	0.9071847	megagram (Mg)	1.102311	short ton
long ton	1016.047	kilogram (kg)	0.0009842064	long ton
	1.016047	megagram (Mg)	0.9842064	long ton

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
POWER				
horsepower (hp)	0.7456999	kilowatt (kW)	1.341022	(hp)
	745.6999	watt (W)	0.001341022	(hp)
Btu per hour* (Btu/h)	0.2930711	watt (W)	3.412141	(Btu/h)
Btu per minute* (Btu/min)	17.58427	watt (W)	0.05686902	(Btu/min)

*Also heat flow rate. See HEAT.

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
PRESSURE				
pound force per square inch (psi)	6.894757	kilopascal (kPa)	0.1450377	(psi)
	0.006894757	megapascal (Mpa)	145.0377	(psi)
	0.0703	kilogram force per square centimeter (kg/cm^2)	14.225	(psi)
kilogram force per square centimeter (kg/cm^2)	98.0665	kilopascal (kPa)	0.01019716	(kg/cm^2)
inch of mercury (in Hg)	3.37685	kilopascal (kPa)	0.296134	(in Hg)
inch of water (in H_2O)	0.24884	kilopascal (kPa)	4.0186	(in H_2O)
bar	100.0	kilopascal (kPa)	0.01	bar

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
TEMPERATURE				
degree Fahrenheit (°F)	(°F-32) ÷ 1.8	degree Celsius (°C)	(1.8x°C) + 32	(°F)

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
TEMPERATURE INTERVAL OR TOLERANCE				
degree Fahrenheit (°F)	divide by 1.8	degree Celsius (°C)	1.8	(°F)

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
VOLUME				
cubic yard (yd^3)	0.7645549	cubic meter (m^3)	1.307951	(yd^3)
cubic foot (ft^3)	0.02831685	cubic meter (m^3)	35.31466	(ft^3)
cubic inch (in^3)	16.38706	cubic centimeter (cm^3)	0.06102376	(in^3)
	0.01638706	liter (l)	61.02376	(in^3)
US liquid gallon (US gal)	3.785412	liter (l)	0.2641720	(US gal)
	0.003785412	cubic meter (m^3)	264.1720	(US gal)
US liquid quart (US qt)	0.9463529	liter (l)	1.056688	(US qt)
US liquid pint (US pt)	0.4731765	liter (l)	2.113376	(US pt)
cup	0.2365882	liter (l)	4.226753	cup
US fluid ounce (US fl oz)	0.02957353	liter (l)	33.81402	(US fl oz)
	29.57353	cubic centimeter (cm^3)	0.03381402	(US fl oz)
tablespoon	14.78676	milliliter (ml)	0.06762807	tablespoon
teaspoon	4.928922	milliliter (ml)	0.2028841	teaspoon
UK liquid gallon (UK gal)	4.546092	liter (l)	0.2199692	(UK gal)
	0.004546092	cubic meter (m^3)	219.9692	(UK gal)
UK fluid ounce (UK fl oz)	0.02841307	liter (l)	35.19507	(UK fl oz)
	28.41307	cubic centimeter (cm^3)	0.03519507	(UK fl oz)

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
TORQUE				
pound-force foot (lbf ft) or (ft lb)	1.355818	newton meter (N•m)	0.7375621	(lbf ft) or (ft lb)
	0.1383	kilogram-force meter (kgf•m) or (kg•m)	7.233	(lbf ft) or (ft lb)
pound-force inch (lbf in) or (in lb)	0.1129848	newton meter (N•m)	8.850748	(lbf in) or (in lb)
ounce force inch (ozf in)	0.007061552	newton meter (N•m)	141.6119	(ozf in)
kilogram-force meter (kgf•m) or (kg•m)	9.806650	newton meter (N•m)	0.1019716	(kgf•m) or (kg•m)

UNIT	MULTIPLY BY	TO GET	MULTIPLY BY	TO GET
VELOCITY				
mile per hour (mph)	1.609344	kilometer per hour (km/h)	0.6213712	(mph)
foot per minute (ft/min)	0.3048	meter per minute (m/min)	3.280840	(ft/min)
	0.00508	meter per second (m/s)	196.8504	(ft/min)
foot per second (ft/s)	0.3048	meter per second (m/s)	3.280840	(ft/s)
inch per second (in/s)	25.4	millimeter per second (mm/s)	0.03937008	(in/s)
	0.0254	meter per second (m/s)	39.37008	(in/s)

MEMORANDA

Komatsu America International Company
440 North Fairway Drive
Vernon Hills, IL 60061-8112 U.S.A.
Attn: Technical Publications
Fax No. (847) 970-4186

PROPOSAL FOR MANUAL REVISION

FOR INTERNAL USE ONLY -- No. PMR

PROPOSER		
	NAME OF COMPANY:	LOCATION: PHONE NO:
	DEPARTMENT:	DATE:
	NAME:	

MANUAL NAME:				
MANUAL NO:				
MACHINE MODEL: S/N IF APPLICABLE:				

PAGE NO:

PROBLEM:

Attach photo or sketch.
If more space is needed, use another sheet.

FOR INTERNAL USE ONLY

CORRECTIVE ACTION: