

# Operation & Maintenance Manual



# WA320-3

## WHEEL LOADER

SERIAL NUMBERS WA320-3MC - A31001 and up

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Chassis and Engine .....	BEPB005400
<b>PARTS BOOK - MICROFICHE:</b>	
Chassis and Engine .....	BEPM005400
<b>OPERATION AND MAINTENANCE MANUAL:</b>	
Chassis and Engine .....	CEAM003500
<b>SHOP MANUAL:</b>	
Chassis .....	CEBM003300
Engine .....	CEBM000601
<b>STANDARD MAN-HOUR GUIDE:</b>	
Chassis .....	CEKQ000200
Engine .....	N/A
<b>SAFETY MANUAL</b> .....	WLT70-1

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

# INTRODUCTION

### 1. FOREWORD

This manual describes procedures for operation, handling, lubrication, maintenance, checking, and adjustment. It will help the operator and maintenance personnel realize peak performance through effective, economical and safe machine operation and maintenance.

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 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 or Komatsu America International Company 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 can cause a serious accident, if they are not performed in the manner described in this manual.**

**The procedures and precautions given in this manual apply only to intended uses of the machine. If you use your 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.**

**Komatsu America International Company delivers machines that comply with all applicable regulations and standards of the country to which it has been shipped. If this 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 standards and regulations of your country, consult your local distributor or Komatsu America International Company before operating the machine.**

**See safety rules in SAFETY INFORMATION on page 0-2 and in SAFETY starting page 1-1.**

## 2. 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 maintenance and machine operations.

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.

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

Safety precautions are described in SAFETY beginning on page 1-1.

Komatsu America International Company 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 or Komatsu America International Company.

### 3. INTRODUCTION

#### 3.1 INTENDED USE

This WHEEL LOADER is designed to be used mainly for the following work:

- Digging
- Leveling
- Pushing
- Loading

For details of the operating procedures, SEE "12.10 WORK POSSIBLE USING WHEEL LOADER" on page 2-58

#### 3.2 FEATURES

- Curved glass and improved sealing for reduced noise, low vibration cab, viscous mount.
- Console and steering post with unencumbered foot area providing the same comfort level as an automobile.
- Fully hydraulic brake system, which does not require draining water or concerns of rust and freezing.
- Maintenance-free, wet-type disc parking brake (acts also as emergency brake).
- Large capacity pump and 2-stage hydraulic system for reduced cycle time and increased productivity.
- One-touch panel control and optional air conditioner with new refrigerant.
- Full fender system available to help prevent mud or water from splashing on or around the machine.

#### 3.3 BREAKING IN A NEW MACHINE

Your machine has been thoroughly adjusted and tested before shipment. However, operating the machine under severe conditions at the beginning can adversely affect the performance and shorten the machine life. Be sure to break in the machine for the initial 100 hours (as indicated by the service meter).

During break in:

- After starting, let the engine idle for five 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.

The precautions given in this manual for operating, maintenance, and safety procedures are only those that apply when this product is used for the specified purpose. If the machine is used for a purpose that is not listed in this manual, Komatsu America International Company cannot bear any responsibility for safety. All consideration of safety in such operations is the responsibility of the user.

Operations that are prohibited in this manual must never be carried out under any circumstance.

## 4. LOCATION OF PLATES, TABLE FOR SERIAL NUMBER AND DISTRIBUTOR

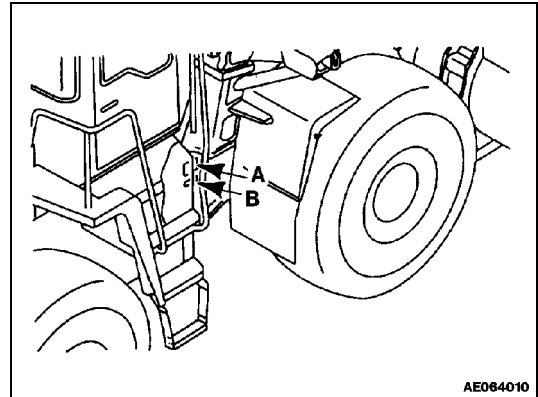
### 4.1 MACHINE SERIAL NO. PLATE POSITION

**(A) Position of plate**

On the center right of the front frame.

**(B) Position of stamp**

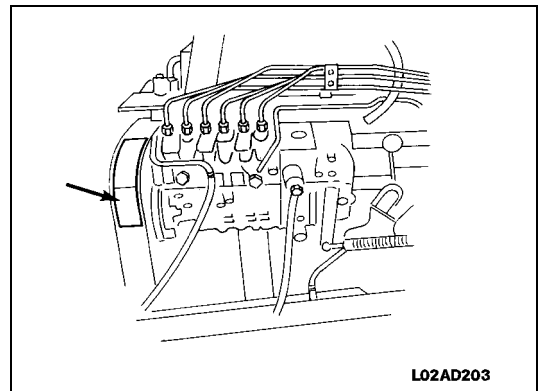
This is stamped on the center of the front frame on the right hand side of the machine.



### 4.2 ENGINE SERIAL NO. PLATE POSITION

**Position of plate**

On the upper right of the cylinder block, when seen from the fan side.



### 4.3 TABLE TO ENTER SERIAL NO. AND DISTRIBUTOR

Machine serial No.:	
Engine serial No.:	
Distributor name:	
Address:	Phone:
Service personnel for your machine:	

**REMARKS**



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# SAFETY



## WARNING

**Read and follow all safety precautions. Failure to do so may result in serious injury or death.**

This safety section also contains precautions for optional equipment and attachments.



## 6. GENERAL PRECAUTIONS

### SAFETY RULES

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

Follow all safety rules, precautions and instructions when operating or performing maintenance on the machine.

The owner and/or operator must replace any and all safety and warning product graphics if they are defaced or removed from the machine.

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.

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.

When working with another operator or a person on work site traffic duty, be sure all personnel understand all hand signals that are to be used.

### SAFETY FEATURES

Be sure all guards and covers are in their proper position. Be sure to replace them after servicing the machine. Have guards and covers repaired immediately if damaged.

#### **Proper position**

Use safety features such as safety lock lever and seat belt properly.

A seat belt is required by OSHA in almost all applications. DO NOT operate this machine without a seat belt.

NEVER remove any safety features. ALWAYS keep them in good operating condition.

#### **Safety lock lever**

#### **Seat belts**

Improper use of safety features could result in serious bodily injury or death.

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

### UNAUTHORIZED MODIFICATION

Any modification made without authorization from Komatsu America International Company can create hazards.

Before making a modification, consult your local distributor. Komatsu America International Company will not be responsible for any injury or damage caused by any unauthorized modification.



WARNING: Failure to follow these safety precautions may lead to a serious accident.

## SAFETY

### CLOTHING AND PERSONAL PROTECTIVE ITEMS

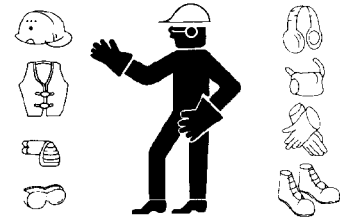
Avoid loose clothing, jewelry, and loose long hair. They can catch on controls or in moving parts and cause serious injury or death. Also, do not wear oily clothes because they are flammable.

Wear a hard hat, safety glasses, safety shoes, mask or gloves when operating or maintaining the machine. Always wear safety goggles, hard hat and heavy gloves if your job involves scattering metal chips or minute materials - this is particularly important when driving pins with a hammer and when cleaning the air filter element with compressed air.

Also check that there are no other personnel near the machine.

#### Cleaning of air cleaner element

Check that all protective equipment functions properly before using the machine.



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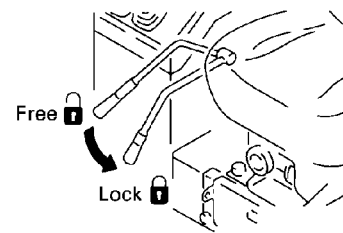
### ALWAYS APPLY LOCK WHEN LEAVING OPERATOR'S SEAT

When standing up from the operator's seat, always place the safety lock lever securely in the LOCK position. If you accidentally touch the equipment levers when they are not locked, the machine or work equipment may move and cause serious injury or damage.

When leaving the machine, lower the work equipment completely to the ground, set the safety lock lever to the LOCK position, then stop the engine and use the key to lock all the equipment locks. Always take the key with you.

#### Work equipment posture

#### Locks



AE060730



## SAFETY



WARNING: For reasons of safety, always follow these safety precautions.

### MOUNTING AND DISMOUNTING

Climbing on the machine improperly can cause injury. NEVER jump on or off the machine. NEVER get on or off a moving machine.

When mounting or dismounting, always face the machine and use the handrails and steps.

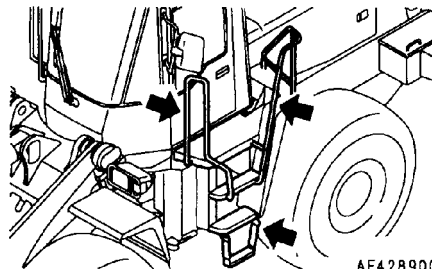
Do not use the machine's controls or hoses as supports when climbing on or off the machine. Controls and hoses can move and do not provide solid support. Movement of the controls may cause unexpected machine movement and injury.

Ensure safety by always maintaining at least three-point contact of hands and feet with the handrails and steps.

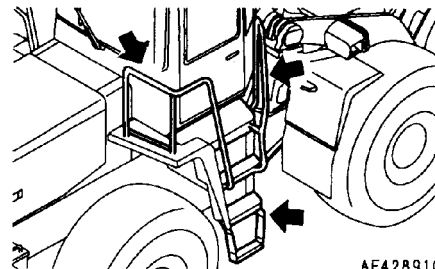
Always remove any oil or mud from the handrails and steps. If they are damaged, repair them and tighten any loose hardware.



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### FIRE PREVENTION FOR FUEL AND OIL

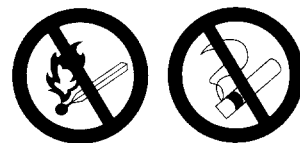
Fuel, oil, and antifreeze can be ignited by a flame. Fuel is particularly **FLAMMABLE** and can be **HAZARDOUS**. Keep any flame away from flammable fluids.

Stop the engine and do not smoke when refueling.

Tighten all fuel and oil caps securely.

Refueling and lubricating should be done in well ventilated areas.

Keep oil and fuel in the determined place and do not allow unauthorized persons to enter.





WARNING: Failure to follow these safety precautions may lead to a serious accident.

**PRECAUTIONS WHEN HANDLING AT HIGH TEMPERATURES**

Engine coolant, engine oil, and hydraulic oil can reach high temperatures, and are under pressure during operation. Attempting to remove the cap, drain the oil or water, or replace the filters may lead to serious burns. Stop the engine and wait for the temperature and pressure to subside, and follow the specified procedures when carrying out these operations.

To prevent hot water from spurting out:

- 1) Turn engine off.
- 2) Allow water to cool.
- 3) Slowly loosen cap to relieve pressure before removing.

To prevent hot oil from spurting out:

- 1) Turn engine off.
- 2) Allow oil to cool.
- 3) Slowly loosen cap to relieve pressure before removing.



**ASBESTOS DUST HAZARD PREVENTION**

Asbestos dust is HAZARDOUS to your health if inhaled.

If you handle materials containing asbestos fibers, follow these guidelines as given below:

NEVER use compressed air for cleaning.

Use water for cleaning to keep down the dust.

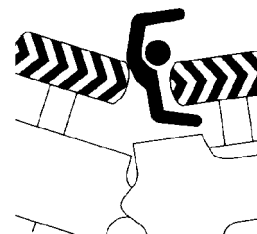
Operate the machine with the wind to your back, whenever possible.

Use an approved respirator.



**CRUSHING OR CUTTING PREVENTION**

Keep hands, arm and all other parts of the body away from movable parts such as between the work equipment and cylinders, or between the machine and work equipment. If the work equipment is operated, the clearance will change and this may lead to serious damage or personal injury.



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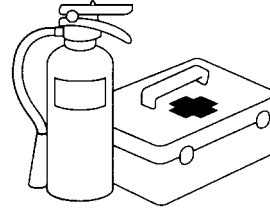
**FIRE EXTINGUISHER AND FIRST AID KIT**

Make sure fire extinguishers of the correct type are kept in good condition and convenient to the operators and other personnel. Make sure the appropriate personnel have been trained in their use.

Provide a first aid kit at the storage point.

Know what to do in the event of a fire.

Be sure you know the phone numbers of persons you should contact in case of an emergency.

**PRECAUTIONS WHEN USING ROPS**

Never operate the machine without a ROPS (ROLL OVER PROTECTIVE STRUCTURE) properly installed and in good condition.

The ROPS is installed to protect the operator if the machine should roll over. It is designed not only to support the load if the machine should roll over, but also to absorb the impact energy.

The ROPS fulfills all the regulations and standards for all countries, but if it is rebuilt without authorization or is damaged when the machine rolls over, its strength may suffer and it may be unable to fulfill its function properly. It can perform if it is repaired or modified in the specified way.

When modifying or repairing the ROPS, always contact your Komatsu America International Company distributor.

Even if the ROPS is installed, it cannot show its full effect if the operator does not fasten the seat belt properly. Always fasten the seat belt when operating.

**PRECAUTIONS FOR ATTACHMENTS**

When installing and using an optional attachment, read the instruction manual for the attachment and the information related to attachments in this manual.

Do not use attachments that are not authorized by your distributor or Komatsu America International Company. Use of unauthorized attachments could create a safety problem and adversely affect the proper operation and useful life of the machine.

Any injuries, accidents, product failures resulting from the use of unauthorized attachments will not be the responsibility of Komatsu America International Company.



WARNING: Failure to follow these safety precautions may lead to a serious accident.

### **PRECAUTIONS WHEN HANDLING ACCUMULATOR**

If the travel damper switch is turned ON when the machine is traveling or when the work equipment is raised, the hydraulic accumulator in the travel damper will instantaneously be connected with the lift cylinder bottom circuit. Be careful when doing this, because the oil then will flow in or out in the direction to balance the oil pressure at the accumulator and lift cylinder bottom, so the work equipment will move.

When releasing the pressure or charging with gas for the work equipment circuit of machines equipped with an accumulator, be careful to follow the instructions given for handling the accumulator.

#### **Method of releasing the pressure or charging with gas.**

The accumulator is charged with high-pressure nitrogen gas, which is extremely dangerous, so heed the following advice and handle the accumulator carefully.

Do not make any holes in the accumulator.

Keep flames and heat away from the accumulator.

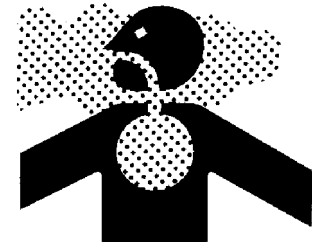
Do not weld anything (such as bosses) to the accumulator.

Gas must be released from an accumulator before it can be discarded; consult your Komatsu America International Distributor.

### **VENTILATION FOR ENCLOSED AREAS**

Be sure to provide adequate ventilation to prevent gas poisoning. If it is necessary to start the engine, or handle fuel, flushing oil or paint with an enclosed or poorly ventilated area, open doors and windows.

Operate fans or similar devices to circulate air if opening doors and windows fails to provide sufficient ventilation.



### **PRECAUTIONS FOR MIRRORS, WINDOWS AND LIGHTS**

Remove all dirt from the surface of the windows and lights to ensure good visibility.

Adjust the side mirror so you can see clearly from the operator's seat, and always keep the surface of the mirror clean. Replace broken glass with a new replacement part(s).

Check that all head lamps and working lamps operate properly.



## 7. PRECAUTIONS DURING OPERATION

### 7.1 BEFORE STARTING ENGINE

#### CHECKS BEFORE STARTING ENGINE

Carry out the following checks before starting the engine at the beginning of the work shift.

Failure to carry out the checks may lead to serious injury or damage.

Completely remove all wood chips, leaves, grass, paper and other flammable materials accumulated in the engine compartment and near the battery. Check fuel, lubrication and hydraulic systems for leaks, and have leaks repaired. Clean up excess oil, fuel or other flammable fluids. Return all fuel containers to their proper storage place, remove all parts and tools from the operator's compartment, and remove dirt from the mirrors, handrails and steps.

#### **Check points**

Check the coolant level, fuel level, and oil level in the engine. Check for clogged air cleaner, and check for damage to the electric wiring.

#### **Checks before starting**

Adjust the operator's seat to a position where it is easy to carry out operations, and check for wear or damage to the seat belt and seat belt mounting equipment.

#### **Adjusting operator's seat**

#### **Handling seat belt**

Check that the gauges work properly, and check that the control levers are at the PARKING position.

#### **Method of checking operation of gauges**

Remove all dirt from the surface of the window glass and lights to ensure good visibility.

Adjust the side mirror to a position that gives best view from the operator's seat, and clean the mirror surface. Replace broken mirror glass.

Check that the front lamps and working lamps operate properly. Repair broken lamps promptly.

Check that the safety lock is in the LOCK position before starting the engine.

Check that a fire extinguisher of the proper type is present and check the method of using it.

Do not operate the machine near fire or flame.





WARNING: Failure to follow these safety precautions may lead to a serious accident.

## 7.2 OPERATING MACHINE

### WHEN STARTING ENGINE

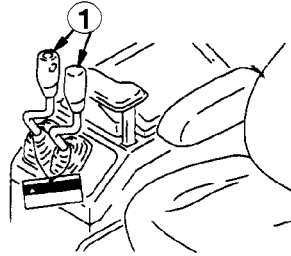
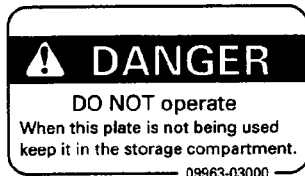
Walk around your machine again just before mounting it, and check for people and objects that might be in the way.

Never start the engine if a warning tag has been attached to a control lever (1).

When starting the engine, sound the horn to alert nearby personnel.

Start and operate the machine only when seated.

An additional worker may ride in the machine only when sitting in a passenger seat. Do not allow anyone to ride on the machine body.



AE418500A

### CHECKS AFTER STARTING ENGINE

Failure to carry out the checks properly after starting the engine will lead to delays in discovery of abnormalities, and this may lead to serious injury or damage to the machine.

When carrying out the checks, use a wide area where there are no obstructions. Do not allow anyone near the machine.

Check the operation of the gauges and equipment, and check the operation of the bucket, lift arm, brakes, travel system and steering system.

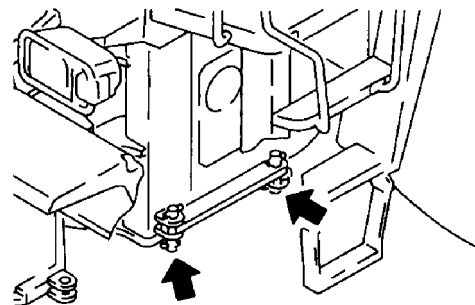
Listen for abnormality in the sound of the machine; check for vibration, heat, and/or smell; check gauges.

Check also that there is no leakage of air, oil or fuel.

If any abnormality is found, carry out repairs promptly.

If the machine is used when it is not in proper condition, it may lead to serious injury or damage to the machine.

Before traveling or starting operations, check that safety bar is securely locked in the FREE position.



AE060791

**PRECAUTIONS WHEN STARTING TO MOVE**

Before starting to move, check again that there is no one in the surrounding area and that there are no obstacles.

When starting, sound the horn to alert nearby personnel.

Always operate the machine only when seated in the operator's seat.

Always fasten the seat belt.

Do not allow anyone to ride on the machine body.

Check that the backup alarm works properly.



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**CHECK WHEN CHANGING DIRECTION**

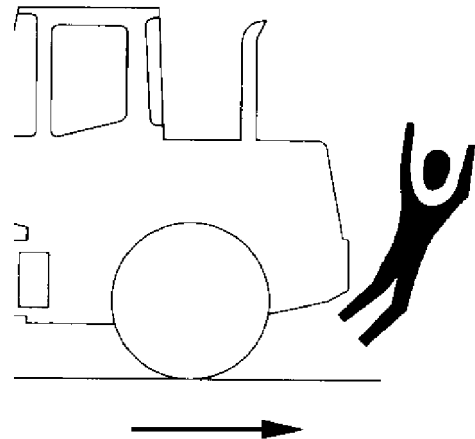
Be aware of the area surrounding the machine before moving the machine or its work equipment.

Sound the horn to warn people in the area.

Check that there is no one near the machine. Be particularly careful to check behind the machine. A clear view of this area is obscured by the engine cover.

When operating in the areas that may be hazardous or have poor visibility designate a person to direct work site traffic.

Ensure that no unauthorized person can come within the direction of turning or direction of travel. Always be sure to carry out these precautions even if the machine is equipped with mirrors and a backup alarm.



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WARNING: Failure to follow these safety precautions may lead to a serious accident.

**PRECAUTIONS WHEN TRAVELING**

Never turn the key to the OFF position in the starting switch when traveling.

It is dangerous if the engine stops when the machine is traveling, because the steering becomes heavy. If the engine stops, apply the brake immediately to stop the machine.

It is dangerous to look around excessively when operating. Concentrate on your work.

It is dangerous to drive too fast, or to start suddenly, stop suddenly, turn sharply or zig zag.

If you find any abnormality in the machine during operation (noise, vibration, smell, incorrect gauge readings, air leakage, oil leakage, etc.) move the machine immediately to a safe place and investigate the cause of the problem.

Set the work equipment to a height of 40-50 cm (16-20 in) from the ground level and travel on level ground.

When traveling, do not operate the work equipment control levers. If the work equipment control levers have to be operated, stop the machine first, then operate the levers.

Do not operate the steering wheel suddenly. The work equipment may hit the ground surface and cause the machine to lose its balance, or may damage the machine or structures in the area.

When traveling on rough ground, travel at low speed, and avoid sudden changes in direction.

Avoid traveling over obstacles. IF the machine has to travel over an obstacle, keep the work equipment as close to the ground as possible, and travel at low speed.

When traveling or carrying out operations, always keep your distance from other machines or structures to avoid collisions.

NEVER enter water in excess of the permissible water depth. **Permissible water depth**

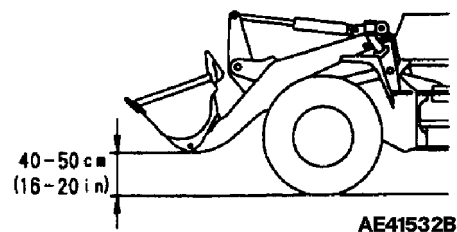
**PRECAUTIONS FOR OPERATION” on page 2-63.**

When passing over bridges or structures on private land, check first that the structure is strong enough to support the mass of the machine. When traveling on public roads, check first with the relevant authorities and follow their instructions.

Always obey the traffic regulations when traveling in public roads. This machine travels at a lower speed than automobiles, so keep to the side of the road and be careful to leave the center of the road free for other vehicles.

The tires can overheat and develop excess pressure if subjected to sustained high speed use, for which they were not designed. Tires then may fail, causing loss of control.

If you must travel continuously consult Komatsu America International, or your distributor.





**TRAVELING ON SLOPES**

Traveling on a slope can allow the machine to tip over or slip to the side.

When traveling on slopes, keep the bucket approximately 20 - 30 cm (8-12 in) above the ground. In case of emergency, quickly lower the bucket to the ground to help the machine stop.

Do not travel on grass, fallen leaves, or wet steel plates. With these slippery coverings, even slight slopes may cause the machine to slip to the side, so travel at low speed and be sure the machine travels only directly up or directly down the slope.

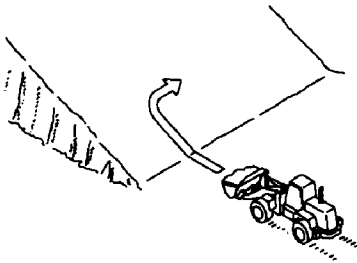
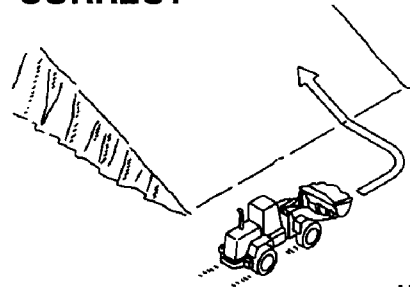
When traveling downhill, never shift gear or place the transmission at neutral. It is dangerous to coast without the braking force of the engine. Always place the transmission in a low gear before starting to travel downhill.

When traveling downhill, use the engine braking and travel slowly. If necessary, use engine braking along with the vehicle brake to control the travel speed.

If the engine stops with the machine on a slope immediately depress the brake pedal fully to apply the brakes. Then lower the bucket to the ground and apply the parking brake to hold the machine in position.

When traveling up or down hills with a loaded bucket, always travel with the bucket facing uphill (travel forward when going uphill; travel in reverse when going downhill).

Traveling on a slope with a loaded bucket alters the vehicle's balance, increasing the chance it can tip.

**INCORRECT****CORRECT**

AE060810

**PROHIBITED OPERATIONS**

To prevent the machine from turning over or the work equipment being damaged because of overload, always keep the load below the maximum specified for the machine. Never use the machine beyond its capacity.

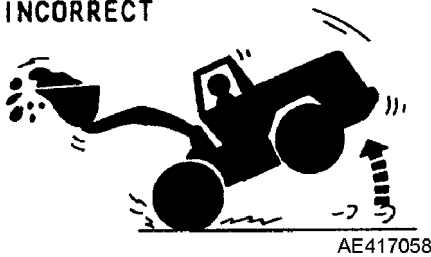


WARNING: Failure to follow these safety precautions may lead to a serious accident.

**PRECAUTIONS WHEN OPERATING**

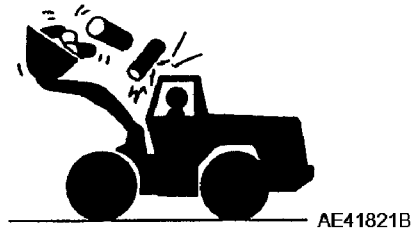
Be careful not to approach too close to the edge of cliffs. When making embankments or landfills, or when dropping soil over a cliff, dump one pile, then use the next pile to push the first pile. The load suddenly becomes lighter when a load is pushed over a cliff or when the machine reaches the top of a slope. When this happens there is danger in that the travel speed may suddenly increase, so be sure to reduce the travel speed prior to the danger. Use caution when the bucket is fully loaded, never start, turn, or stop the machine suddenly. Use caution when handling unstable loads, such as round or cylindrical objects, or piled sheets. If the work equipment is raised high there is danger the load may fall on the operator's compartment and cause serious damage or injury. Avoid raising the work equipment too high or tipping the bucket back too much. If the work equipment is suddenly lowered or suddenly stopped, the reaction may cause the machine to tip.

**INCORRECT**



AE417058

**INCORRECT**



AE41821B

Use particular care when carrying a load. Do not use the bucket or lift arm for crane work. Carry out only work that is specified as the purpose of the machine. Carrying out other operations will cause breakdowns.

**Specified operations** See "12.10 WORK POSSIBLE USING WHEEL LOADER" on page 2-58.

Ensure good visibility:

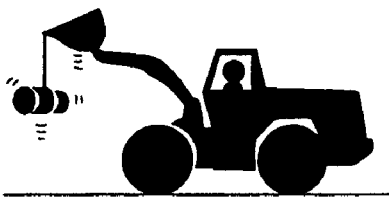
When operating in dark areas, turn on the working lamps and front lamps. Install job site lighting when necessary.

Limit operations in fog, mist, snow or heavy rain, or other conditions where visibility is poor. If necessary, wait for the weather to clear so visibility is sufficient for work.

Avoid collisions:

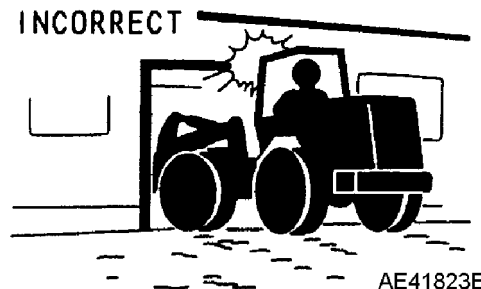
Use care positioning the bucket, especially when operating in tunnels, under bridges, under electric wires or other places where height is limited.

**INCORRECT**



AE41822B

**INCORRECT**



AE41823B

## SAFETY



WARNING: For reasons of safety, always follow these safety precautions.

### DO NOT GO CLOSE TO HIGH-VOLTAGE CABLES

Going close to high-voltage cables can cause electrical shock. Always maintain the safe distance given below between the machine and the electric cable.

The following actions are effective in preventing accidents:

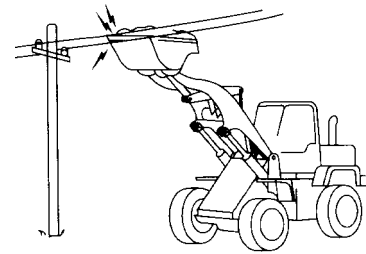
- 1) Wear shoes with rubber or leather soles.
- 2) Use a signalman to give a warning if the machine approaches too close to the electric cable.

If the work equipment should touch the electric cable, the operator should not leave the operator's compartment.

When carrying out operations near high voltage cables, do not let anyone come close to the machine.

Check with the electric utility company about the voltage of the cables before starting operations.

Voltage	Min. safety distance	
	m	ft
6.6 kV	3 m	10 ft
33.0 kV	4 m	14 ft
66.0 kV	5 m	17 ft
154.0 kV	8 m	27 ft
275.0 kV	10 m	33 ft



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### ENSURE GOOD VISIBILITY

When working in dark places, install working lamps and head lamps, and set up lighting in the work area if necessary.

Stop operations if the visibility is poor, such as in mist, snow, or rain, and wait for the weather to improve to a condition that allows the operation to be carried out safely.



WARNING: Failure to follow these safety precautions may lead to a serious accident.

## SAFETY

### OPERATE CAREFULLY ON SNOW

When working on snow or icy roads, even a slight slope may cause the machine to slip to the side, so always travel at low speed and avoid sudden starting, stopping, or turning.

After a heavy snowfall, the road shoulder and objects placed beside the road are buried in the snow and cannot be seen, so always carry out snow-clearing operations carefully.

When traveling on snow-covered roads, always install tire chains.

When traveling on snow-covered slopes, never use the brakes to stop the machine suddenly. Lower the bucket to the ground to stop the machine.

The load may change greatly, according to the type of snow, reduce the load and be careful not to let the machine slip.

### DO NOT HIT WORK EQUIPMENT

When working in places where there are height limits, such as in tunnels, under bridges, under electric cables, or in garages, be extremely careful not to hit the work equipment.

### METHOD OF USING BRAKES

Do not put your foot on the brake pedal unless necessary.

Do not depress the brake pedal repeatedly unless necessary.

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

Note for machines with boosters: when the engine stops, the brake pedal effort becomes 3.5 times heavier.

### WORKING ON LOOSE GROUND

Do not operate the machine on soft ground. It is difficult to extract the machine after it gets stuck.

Avoid operating your machine too close to the edge of cliffs, overhangs, and deep ditches. If these areas collapse, your machine could fall or tip over and result in serious injury or death. Remember that the soil after heavy rain, earthquake, or blasting is weakened in these areas.

Earth laid on the ground and the soil near ditches are loose. They can collapse under the weight or vibration of your machine.

Install the HEAD GUARD (FOPS, or Fallen Object Protective Structure) if working in areas where there is danger of falling rocks and dirt.

When operating in places where there is danger of falling rocks or danger of the machine turning over, always install ROPS and seat belt.



**WARNING:** For reasons of safety, always follow these safety precautions.

**PARKING THE MACHINE**

Park on level ground where danger of falling rocks, flooding and/or landslides is minimal. If the machine must be parked on a slope, block the wheels to prevent the machine from moving. Then dig the work equipment into the ground.

When parking on public roads, provide fences and signs, such as flags or lights, so the machine can be seen clearly. Park the machine so it doesn't obstruct traffic.

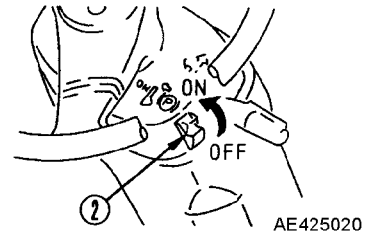
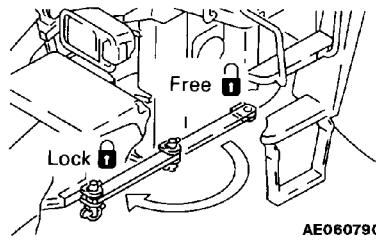
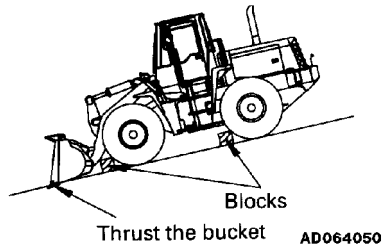
**Parking procedure . See "12.13 PARKING MACHINE" on page 2-67.**

When leaving the machine, lower the work equipment completely to the ground, set the safety lock lever to the LOCK position, then stop the engine and use the key to lock all the equipment.

Always take the key with you.

**Work equipment posture . See "12.13 PARKING MACHINE" on page 2-67.**

**Places to lock. See "12.17 LOCKING "on page 2-69.**





WARNING: Failure to follow these safety precautions may lead to a serious accident.

## SAFETY

### PRECAUTIONS IN COLD AREAS

After completing operations, remove all water, snow or mud from the wiring harness connectors and/or sensors. Cover these parts.

If the water freezes, it will cause malfunctions when the machine is used, which may lead to accidents.

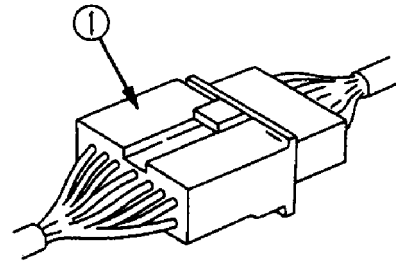
Warm up the machine thoroughly. If the machine is not thoroughly warmed up, control lever operation and machine reaction will be slow, leading to accidents.

Operate the control levers to relieve the hydraulic pressure (raise to above the set pressure for the hydraulic circuit and release the oil to the hydraulic tank) to warm up the oil in the hydraulic circuit. This ensures good response from the machine and prevents malfunctions.

Do not charge the battery or start the engine with a different power source if the machine's battery electrolyte is frozen. There is danger that this will ignite the battery.

Before charging the battery or starting the engine with a different power source, make sure the battery electrolyte has thawed. Check for leakage of electrolyte before starting.

#### **Battery charge rate**



**AE305820**



## 7.3 TRANSPORTATION

### LOADING AND UNLOADING

Loading and unloading the machine always involves potential hazards. **EXTREME CAUTION SHOULD BE USED.**

When loading or unloading the machine, run the engine at low idling and travel at low speed.

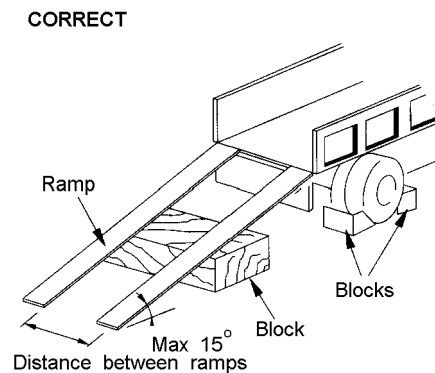
Perform loading and unloading on firm, level ground only. Maintain a safe distance from the edge of road. **ALWAYS** block the wheels of the hauling vehicle and support both ramps with blocks before loading and unloading.

**ALWAYS** use ramps of adequate strength. Be sure the ramps are wide and long enough to provide a safe loading slope.

Be sure that the ramps are securely positioned and fastened, and that the two sides are at the same level. Be sure the ramp surface is clean and free of grease, oil, ice and loose materials. Remove dirt from the machine tires.

Drive straight. **NEVER** correct steering on ramps. If necessary, drive away from the ramps and climb again. After loading, block the machine tires and secure the machine with tie-downs.

#### Loading and unloading Tie-downs



### SHIPPING

When shipping the machine on a hauling vehicle, obey all state and local laws governing the weight, width, and length of a load. Also obey all applicable traffic regulations.

Determine the shipping route while taking into account the width, height and weight of the load.

#### Height, width, load of machine

Before passing over bridges or structures on private land, first check that the structures will support the mass of the machine. When traveling on public roads, check with the relevant authorities for instructions.

The machine can be dismantled for transportation; consult your Komatsu distributor for assistance.



WARNING: Failure to follow these safety precautions may lead to a serious accident.

## 7.4 BATTERY

### BATTERY HAZARD PREVENTION

Battery electrolyte contains sulfuric acid and can quickly burn the skin and eat holes in clothing. If you spill acid on yourself, immediately flush the area with water.

Battery acid could cause blindness if splashed into the eyes. If acid gets into the eyes, flush them immediately with large quantities of water and see a doctor at once.

If you accidentally drink acid, drink a large quantity of water or milk, beaten egg or vegetable oil. Call a doctor or poison prevention center immediately.

When working with batteries. ALWAYS wear safety glasses or goggles.

Batteries generate hydrogen gas. Hydrogen gas is very EXPLOSIVE, and is easily ignited with a small spark or flame.

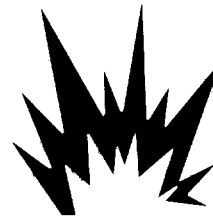
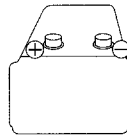
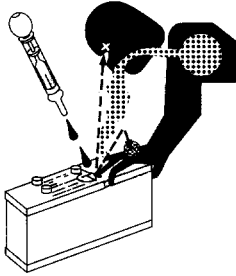
Before working with batteries, stop the engine and turn the starting switch to the OFF position.

Avoid short-circuiting the battery terminals through accidental contact with metallic objects, such as tools, across the terminals.

When removing or installing, check which is the positive (+) terminal and negative (-) terminal.

Tighten the battery cap securely.

Tighten the battery terminals securely. Loosened terminals can generate sparks and lead to an explosion.



### STARTING WITH BOOSTER CABLES

Mistakes in connecting booster cables can cause a fire:

Use two workers (one in the operator's seat).

ALWAYS wear safety glasses or goggles when starting the machine with booster cables.

When starting from another machine, do not allow the two machines to touch.

Be sure to connect the positive (+) cable first when installing the booster cables. Disconnect the ground or negative (-) cable first when removing them.

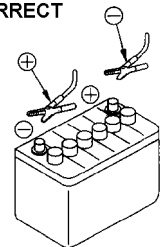
If any tool touches between the positive (+) terminal and the chassis, it will cause sparks. This is dangerous, so be sure to work carefully.

Connect the batteries in parallel: positive to positive and negative to negative.

When connecting the ground cable to the frame of the machine to be started, be sure to connect it as far as possible from the battery.

**Starting with booster cables  
on page 2-84.**

INCORRECT







**CHARGING BATTERY**

The battery can explode if handled incorrectly during charging. Be sure to heed the following and check safety information supplied by the battery charger manufacturer.

Remove the battery caps to disperse hydrogen gas and charge in well-ventilated area.

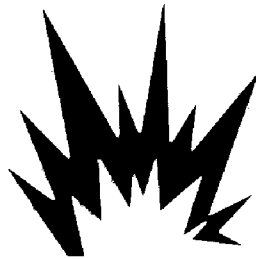
Set the voltage of the charge to match the voltage of the battery to be charged. If mis-matched, the charger may overheat and catch fire.

Connect the positive (+) charging clip of the charger to the positive (+) terminal of the battery, then connect the negative (-) charging clip to the negative (-) terminal of the battery. Be sure to tighten both terminals securely.

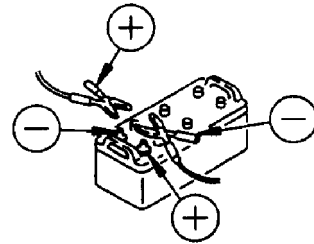
If the battery charge is less than 1/10 of the rated charge, and high speed charging is carried out, set to a value below the rated capacity of the battery.

If there is an excessive flow of charging current, the battery electrolyte may leak or evaporate, to catch fire or explode.

**INCORRECT**



**A0055110**



**AE063650**



WARNING: Failure to follow these safety precautions may lead to a serious accident.

## 7.5 TOWING

### WHEN TOWING

Towing incorrectly may lead to serious personal injury or damage.

Make sure all workers involved with the towing agree on signals before starting.

If the problem machine's engine will not start or has a failure in its brake system, contact your Komatsu distributor for repairs.

Keep personnel away from the machines, especially the area between the towed and towing machines.

When using another machine to tow this machine, use a wire rope with ample strength for the weight of this machine.

NEVER tow a machine on a slope.

Wear heavy leather gloves when handling wire rope. Do not use a kinked or frayed wire rope.

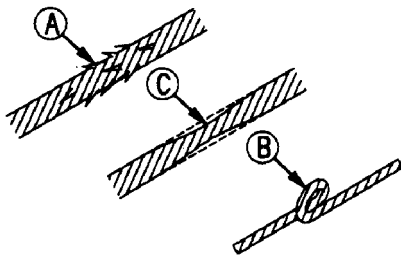
Do not straddle the towing cable or wire rope.

When connecting up a towing machine, do not let anyone enter the area between the towing machine and the equipment being towed.

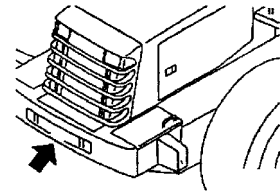
Set the towing machine and the towing connection of the equipment being towed in a straight line when connecting it.

Place pieces of wood between the wire ropes and body to protect them from wear or damage.

#### Towing method



AE305840



AE064060



## 8. PRECAUTIONS FOR MAINTENANCE

### 8.1 BEFORE CARRYING OUT MAINTENANCE

#### NOTIFICATION OF FAILURE

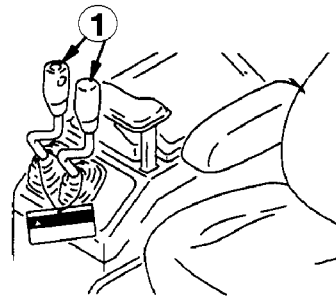
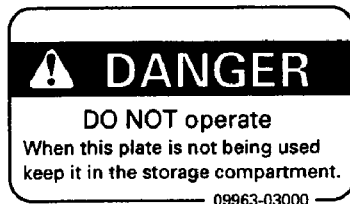
Carrying out maintenance not described in the Komatsu operation and maintenance manual may lead to unexpected failures. Contact your Komatsu distributor for repairs.

#### WARNING TAG

If others start the engine or operate the controls while you are performing service or lubrication, you could suffer serious injury or death.

ALWAYS attach the WARNING TAG to the control lever in the operator's cab to alert others that you are working on the machine. Attach additional warning tags around the machine, if necessary.

These tags are available from your distributor. (Part No. 09963-03000)



AE418500A



WARNING: Failure to follow these safety precautions may lead to a serious accident.

**CLEAN BEFORE INSPECTION AND MAINTENANCE**

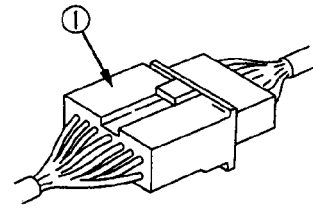
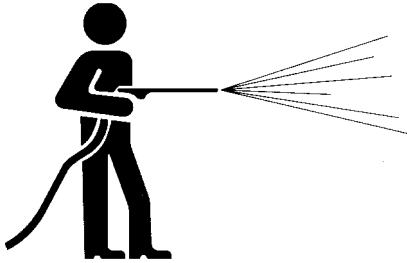
Clean the machine before inspection and maintenance so that Procedures can be carried out safely without entry by dirt into the machine. Problem areas are less likely to be obscured by mud and debris. Chances of personal injury from falls or flying debris are lessened.

When washing the machine

Wear non-slip shoes to maintain your footing on wet surfaces.

Wear protective clothing, especially when cleaning with steam or high pressure water. Steam can cause burns. Water under pressure can cause injury.

Do not spray water directly on the electrical system (sensors, connectors, etc.)(1). Water in the electrical system may cause defective operation and malfunctions.



AE305820

**KEEP WORK PLACE CLEAN AND TIDY**

Do not leave hammers or other tools lying around in the work place. Wipe up all grease, oil and other substances. Always keep the work place clean and tidy to allow safe operations, minimize tripping, slipping and falls.

**APPOINT LEADER WHEN WORKING IN GROUPS**

When repairing the machine or when removing and installing work equipment, appoint a leader to coordinate activities. Misunderstandings between workers can cause accidents.

**RADIATOR COOLANT LEVEL**

When inspecting the radiator coolant level, stop the engine and allow the temperature to subside. Check the coolant level in the sub-tank. Under normal conditions, do not open the radiator cap.

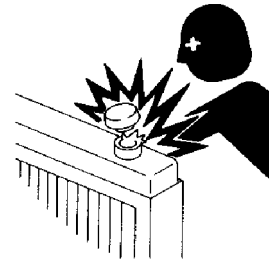
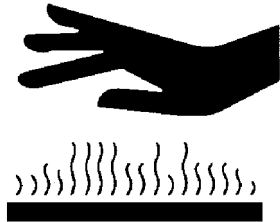
If there is no sub-tank, or if the radiator must be removed:

Wait for the radiator temperature to go down before checking the coolant level.

Be careful not to actually touch the radiator or engine; place a hand near the engine or radiator to check the air temperature.

Release the internal pressure before loosening the radiator cap, and remove the radiator cap slowly.

When adding coolant and/or additives, add it to the sub-tank.





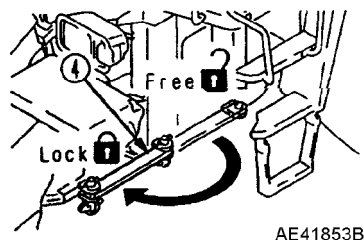
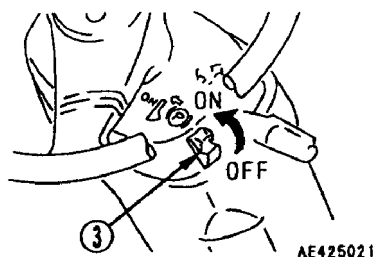
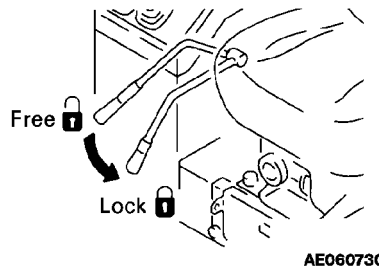
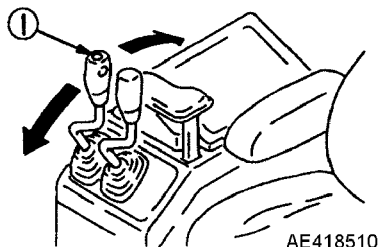
WARNING: Failure to follow these safety precautions may lead to a serious accident.

**STOP THE ENGINE BEFORE CARRYING OUT INSPECTION AND MAINTENANCE**

Always stop the machine on firm flat ground and stop the engine before carrying out inspection and maintenance.

If it is necessary to run the engine when carrying out maintenance, such as when cleaning the inside of the radiator, place the safety lock lever in the LOCK position and carry out the operation with two workers. One worker should sit in the operator's seat so that he can stop the engine immediately if necessary. He should also be extremely careful not to touch any lever by mistake. Touch the levers only when they have to be operated.

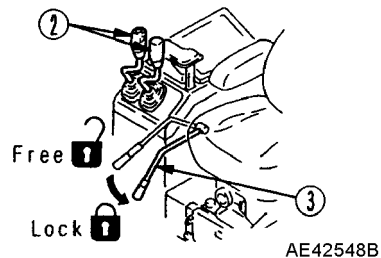
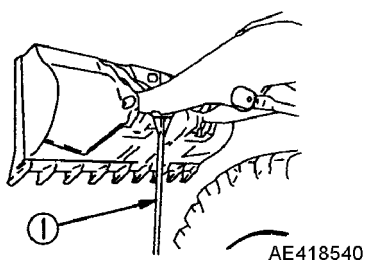
The worker carrying out the maintenance should be extremely careful not to touch or get caught in any moving parts.



**WORK EQUIPMENT SUPPORT**

When carrying out inspection and maintenance with the bucket raised, fit stand (1) securely under the lift arm to prevent the work equipment from descending.

Place work equipment control lever (2) at HOLD, and set safety lock lever (3) to the LOCK position.





## PROPER TOOLS

Use only tools suited to the task. Using damaged, low quality, faulty, or makeshift tools could cause personal injury.

### Tools



## PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

Replace the following safety-related and fire-related components periodically:

Fuel system: Fuel hose, spilling hose, and fuel tube cap

Hydraulic system: Pump outlet hose, and front and rear pump branch hoses

Replace these components periodically with new ones, regardless of whether or not they appear to be defective. These components deteriorate over time.

Replace or repair any such components if any defect is found, even though they have not reached the time specified.

Special skills and/or equipment may be required, so contact your Komatsu distributor.

**Replacement of safety critical components**

**CRITICAL PARTS” on page 3-22.**

## USE OF LIGHTING

Use lighting with anti-explosion specifications, especially when checking fuel, oil, battery electrolyte, window washer fluid or other flammable materials. If correct lighting is not used, danger of explosion exists

Areas with insufficient lighting have increased risk of injury. Install proper lighting.

Never use open flame (e.g. cigarette lighter) for illumination. Flammable liquids and gases near the machine can ignite.

When using the machine as the power supply for the lighting, follow the instructions in this manual.





WARNING: Failure to follow these safety precautions may lead to a serious accident.

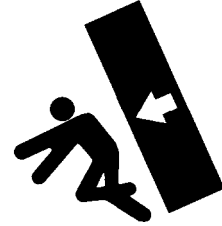
## 8.2 DURING MAINTENANCE

### PERSONNEL

Only authorized personnel can service and repair the machine. Extra precaution should be used when grinding, welding, and/or using a sledge-hammer.

### ATTACHMENTS

Place attachments that have been removed from the machine in a safe place so that they do not fall. If they fall on you or others, serious injury could result.



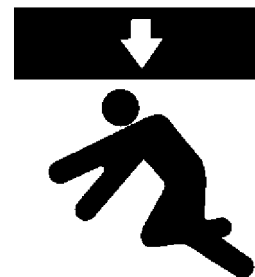
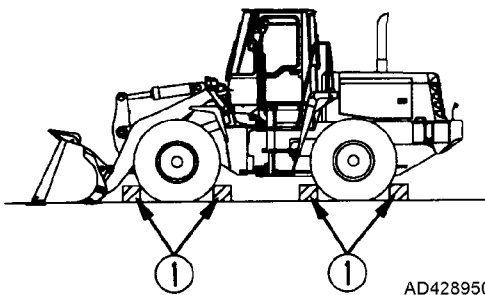
### WORK UNDER THE MACHINE

Always lower all movable work equipment to the ground or to the lowest position before performing service or repairs under the machine.

When carrying out maintenance with the work equipment or chassis raised, lock the front and rear frames with the safety lock, always place the levers in the HOLD position, then lock the control levers with the safety lock, and block the work equipment and chassis.

Always block the machine tires securely.

Never work under the machine if the machine is poorly supported.





## SAFETY



WARNING: For reasons of safety, always follow these safety precautions.

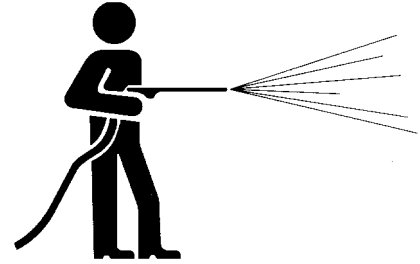
### KEEP THE MACHINE CLEAN

Spilled oil or grease, or scattered tools or broken pieces are dangerous because they may cause you to slip or trip.

Always keep your machine clean and tidy.

If water gets into the electrical system, there is danger that the machine may not move or may move unexpectedly.

Do not use water or steam to clean the sensors, connectors, or the inside of the operator's compartment.



### RULES TO FOLLOW WHEN ADDING FUEL OR OIL

Spilled fuel and oil may cause you to slip, so always wipe it up immediately.

Always tighten the cap of the fuel and oil fillers securely.

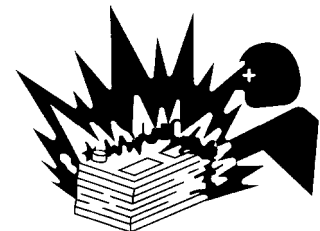
Never use fuel for washing any parts.

Always add fuel and oil in a well-ventilated place.



### PRECAUTIONS WITH BATTERY

When repairing the electrical system or when carrying out electrical welding, remove the negative (-) terminal of the battery to stop the flow of current.





WARNING: Failure to follow these safety precautions may lead to a serious accident.

## SAFETY

### HANDLING HIGH-PRESSURE HOSES

Do not bend high-pressure hoses or hit them with hard objects. Do not use any bent or cracked piping, tubes or hoses. They may burst during use.

Always repair any loose or broken fuel hoses or oil hoses. If fuel or oil leaks, it may cause a fire.

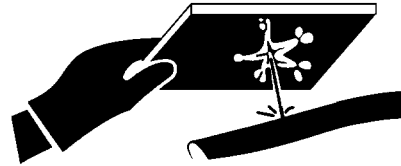
### PRECAUTIONS WITH HIGH PRESSURE OIL

Do not forget that the work equipment circuits are always under pressure.

Do not add oil, drain oil, or carry out maintenance or inspection before completely releasing the internal pressure.

Oil leaking under high pressure, even from small holes, is dangerous. A jet of high-pressure oil that hits the skin or enters the eye can cause serious injury. Always wear safety glasses and thick gloves, and use a piece of cardboard or a sheet of wood to check for oil leakage.

Obtain medical attention immediately for anyone struck by a jet of high-pressure oil.



### PRECAUTIONS FOR MAINTENANCE AT HIGH TEMPERATURE OR HIGH PRESSURE

Immediately after stopping machine operations, the engine cooling water and oil at all parts remain at high temperatures and under high pressure. The hot fluids will cause burns and/or other injury if the radiator cap is removed, or the oil or water are drained, or the filters are replaced.

Wait for the temperature to go down, then carry out the inspection and maintenance in accordance with the procedures given in this manual.

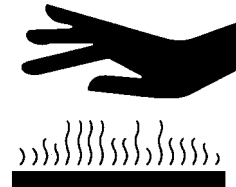
**Clean inside of cooling system check lubricating oil level, add oil  
page 3-38.**

**Checking cooling water level, engine oil pan level, brake oil level, add oil or water  
BEFORE STARTING" on page 3-47.**

**Checking hydraulic oil level, adding oil**

**Changing oil, replacing filters**

**SERVICE" on page 3-51.**



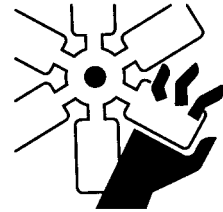
## SAFETY



WARNING: For reasons of safety, always follow these safety precautions.

### ROTATING FAN AND BELT

Keep away from rotating parts and be careful not to let anything get caught in them. If your body or tools touch the fan blades or fan belt, they may be cut off or sent flying, so never touch any rotating parts.



### TIRE MAINTENANCE

Disassembly, repair, and assembly of tires requires special equipment and skill; please ask your tire repair shop to carry out repairs.

### CHECKS AFTER INSPECTION AND MAINTENANCE

Failure to carry out inspection and maintenance fully, or failure to check the function of various maintenance items may cause unexpected problems and may even lead to personal injury and/or damage.

Stop the engine and address these questions.

Have all the inspection and maintenance locations been checked?

Have all inspection and maintenance items been carried out correctly?

Have any tools or parts dropped inside the machine (especially dangerous if fallen items disrupt control levers)?

Are hydraulic and cooling water systems free of leaks?

Are bolts and fasteners tight?

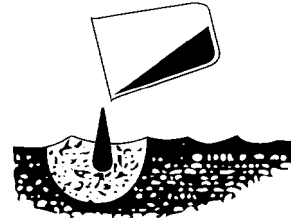


WARNING: Failure to follow these safety precautions may lead to a serious accident.

**WASTE MATERIALS**

Never dump waste oil in a sewer system, rivers, etc.  
Always put oil drained from your machine in containers. Never drain oil directly on the ground.  
Obey appropriate laws and regulations when disposing of harmful objects such as oil, fuel, coolant, solvent, filters, batteries, and others.

INCORRECT



**8.3 TIRES**

**HANDLING TIRES**

If tires are not used under the specified conditions, they may overheat and burst or be damaged by sharp stones on rough road surfaces. This may lead to serious injury or damage.

To maintain safety, always keep the following conditions.

Inflate the tires to the specified pressure. Abnormal heat is generated particularly when the inflation pressure is too low.

**Selection of tires**

**Suitable inflation pressure**

Use the specified tires.

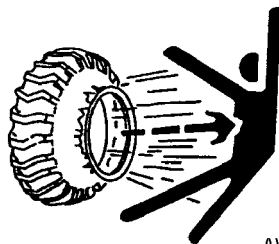
The values given in this manual for tire inflation pressures and permissible speed are general values. The actual value may differ depending on the type of tire and the condition under which they are used. For details, please contact your distributor or tire maker.

If the tire is heated when installed to the wheel, flammable gas is produced. If this catches fire, the tire may explode and cause serious injury or damage. Unlike when a tire is punctured and burst, if a tire explodes, it produces a highly destructive force, so the following operations are strictly prohibited when the tire is installed to the wheel.

Welding of the rim.

Lighting fires or carrying out welding operations near the wheel or tire.

If you do not understand the proper procedure for maintenance or replacement of the wheel or tire, and you use the wrong method, the wheel or tire may burst and cause serious injury or damage. When carrying out such maintenance, please consult your distributor or tire maker.



AW636370



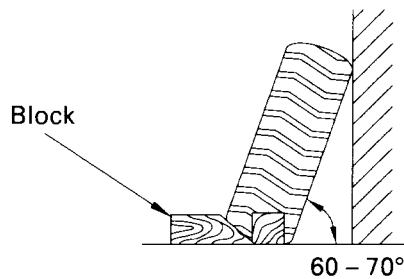
AW636380

**STORING TIRES AFTER REMOVAL**

As a basic rule, store the tire in a warehouse which unauthorized persons cannot enter. If the tires are stored outside, always erect a fence around the tires and put up a "No Entry" and other warning signs that even children can understand.

Stand the tire on level ground, and block it securely so that it cannot roll or fall over. If the tire rests on its side, it will be flattened and will deteriorate.

If the tire should fall over, get out of the way quickly. The tires for construction equipment are extremely heavy, so trying to hold the tire may lead to serious injury.

**A0055130**



WARNING: Failure to follow these safety precautions may lead to a serious accident.

1. Precautions before starting.

**! WARNING**

Improper operation and maintenance can cause serious injury or death.

Read manual and labels before operation and maintenance.  
Follow instructions and warnings in manual and in labels on machine.

Keep manual in machine cab near operator.  
Contact Komatsu distributor for a replacement manual.

LO2AD204

2. Precautions for safety lock lever.

**! WARNING**

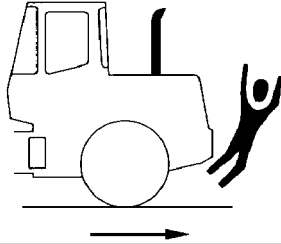
To avoid hitting unlocked operation levers, lower equipment to ground and move **SAFETY LOCK LEVER** (located near seat) to **LOCK** position before standing up from operator's seat.

Sudden and unwanted machine movement can cause serious injury or death.

LO2AD205

3. Precautions when traveling in reverse.

**! WARNING**



To prevent **SEVERE INJURY** or **DEATH**, do the following before moving machine or its attachments:

- Honk horn to alert people nearby.
- Be sure no one is on or near machine.
- Use spotter if view is obstructed.

Follow above even if machine equipped with back-up alarm and mirrors.

LO2AD206

4. Precautions for parking brake.

**! WARNING**

If the switch is set to **RELEASE**, a serious accident could result, as this operation releases the parking brake and the machine may move off suddenly. Never set the switch to **RELEASE** except when towing a disabled machine. Before towing such machine, read its manual carefully and be sure to follow the instructions given therein.

LO2AD207

Part number 419-93-A1410 includes safety labels 1-3; part number 419-93-A1421 identifies safety label 4.

## SAFETY



WARNING: For reasons of safety, always follow these safety precautions.

5. Do not enter.

**! DANGER**



Crush Hazard. Can cause severe injury or death. When machine is being operated, never place yourself in articulated area of machine.

L02AD208

7. Precautions for high temperature coolant.

**! WARNING**

Hot water hazard.

To prevent hot water from spurting out:

- Turn engine off.
- Allow water to cool.
- Slowly loosen cap to relieve pressure before removing.

L02AD210

6. Precautions for safety bar.

**! WARNING**

If safety bar is unlocked, machine can jackknife unexpectedly when it is being transported or hoisted.

Jackknifing can cause serious injury or death to bystanders.

- Always lock safety bar when machine is being transported or hoisted.
- If necessary, lock safety bar during servicing or maintenance.

L02AD209

8. Precautions when oil is at high temperature.

**! WARNING**

Hot oil hazard.

To prevent hot oil from spurting out:

- Turn engine off.
- Allow oil to cool.
- Slowly loosen cap to relieve pressure before removing.

L02AD211

9. Precautions when handling battery cable.

**! WARNING**

Improper use of booster cables and battery cables can cause an explosion resulting in serious injury or death.

Follow instructions in manual when using booster cables and battery cables.

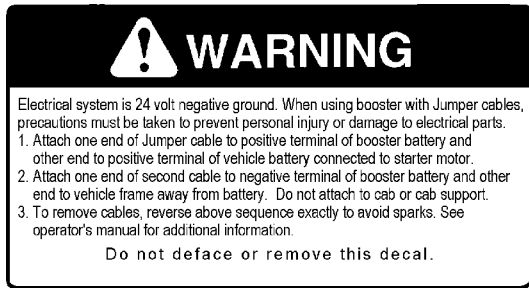
L02AD212

Part number 421-93-21311 includes safety labels 5-9.



**WARNING:** Failure to follow these safety precautions may lead to a serious accident.

10. Precautions when using booster cables (419-93-AZ130).



M02AD272

11. High pressure warning.



12. Do not climb on fender.



13. Do not go under work equipment.





## SAFETY



WARNING: For reasons of safety, always follow these safety precautions.

14. Do not open when engine is running.



15. Do not come near machine.



16. Precautions for back-up alarm (417-931-A180).



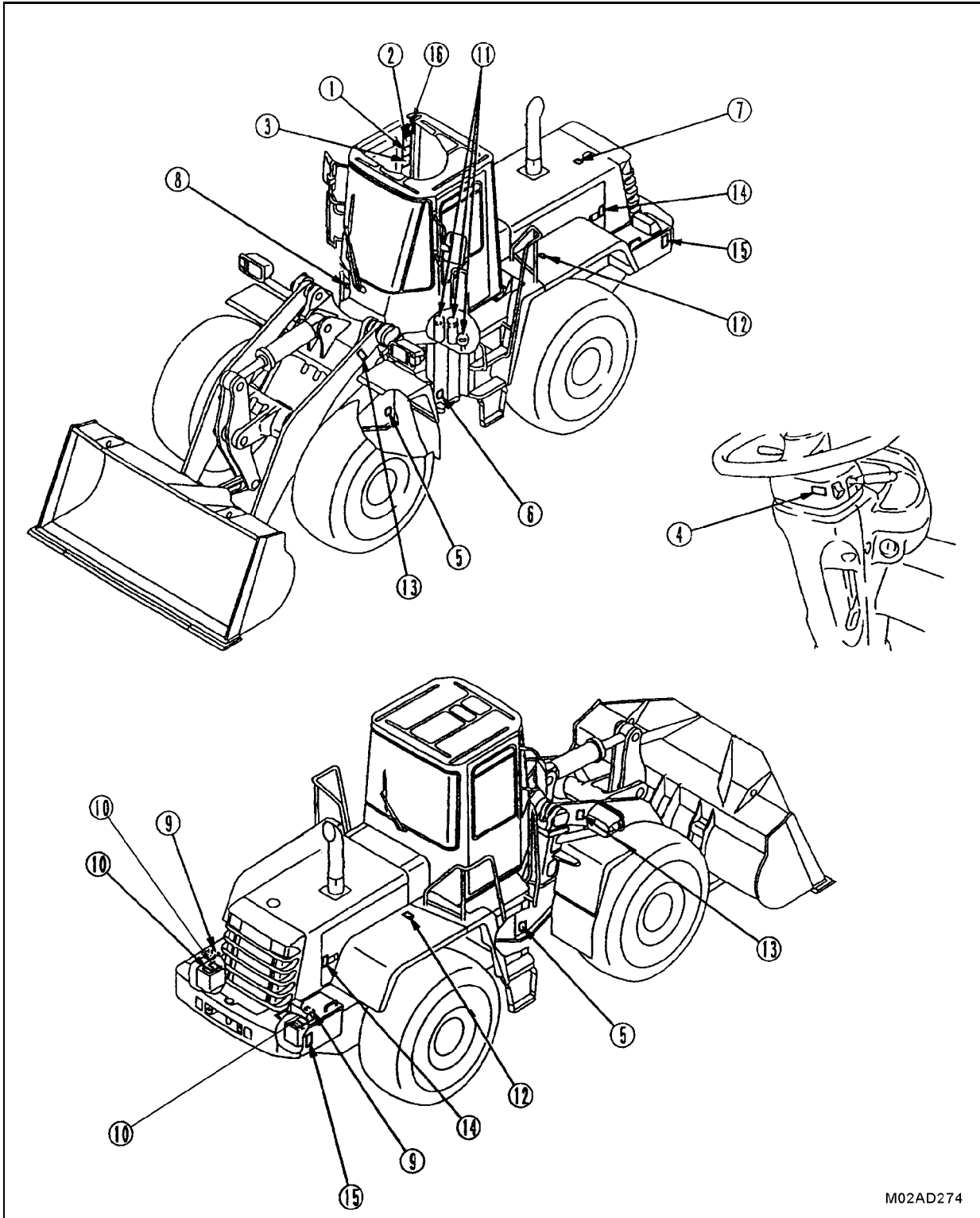
## POSITIONS FOR ATTACHING SAFETY LABELS

Keep these labels clean. If they are lost or damaged, replace with a new label. Safety labels may be available in languages besides English. Contact your distributor for more information.



WARNING: Failure to follow these safety precautions may lead to a serious accident.

## SAFETY

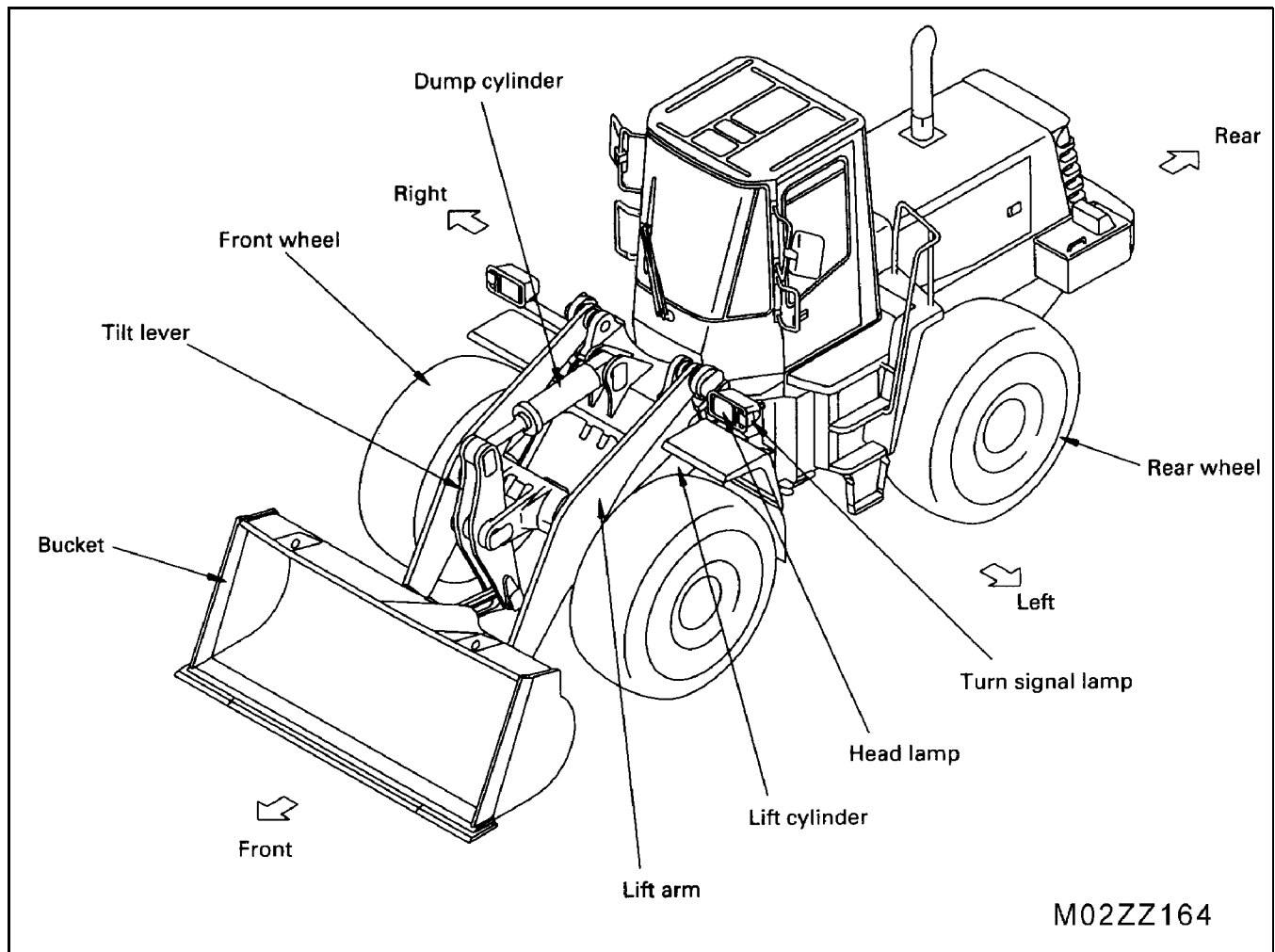


# OPERATION

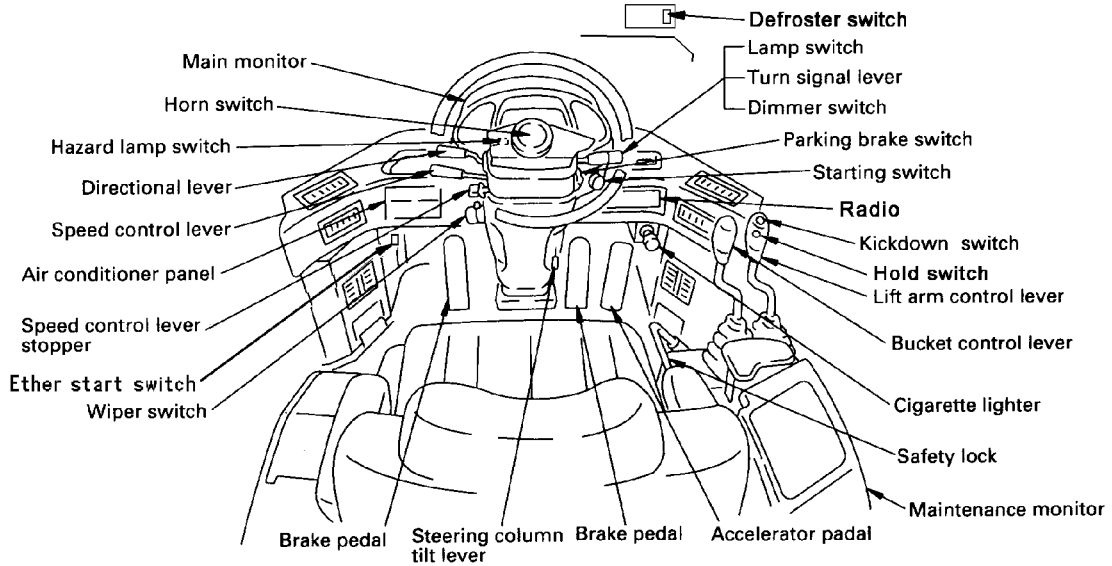
## 10. GENERAL VIEW

### 10.1 GENERAL VIEW OF MACHINE

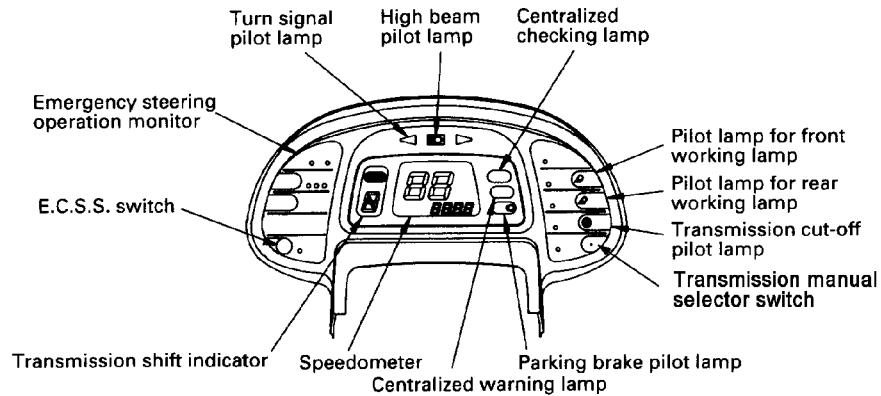
If directions are indicated in this manual, they refer to the directions shown by the arrows in the diagram below.



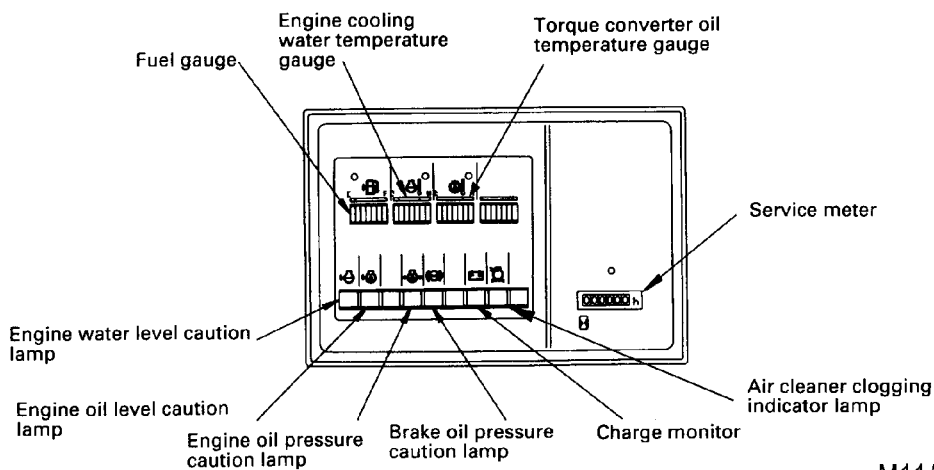
10.2 GENERAL VIEW OF CONTROLS AND GAUGES



MAIN MONITOR



MAINTENANCE MONITOR



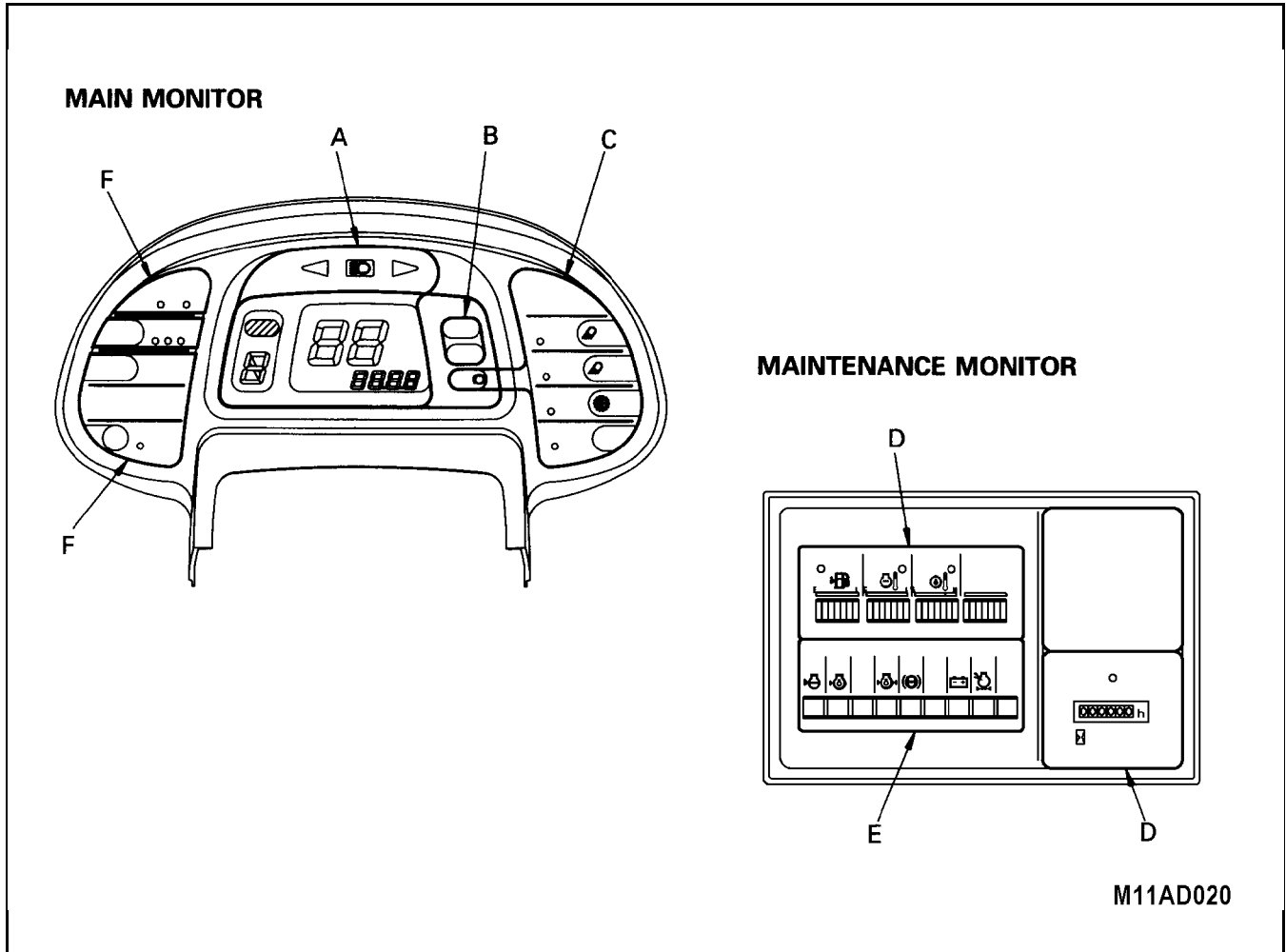
M11AD019

## 11. EXPLANATION OF COMPONENTS

The following is an explanation of the devices needed for operating the machine.

To carry out suitable operations correctly and safely, it is important to understand fully the methods of operating the equipment and the meanings of the displays.

### 11.1 MACHINE MONITORS



The machine monitor system consists of the main monitor (in front of the operator's seat) and the maintenance monitor (on the right side of the operator's seat).

The monitor system can be divided functionally into the alarm display portions (B, E) and the meter display portions (A, C, D,) and option display portion (F).

#### Alarm Display Portions (B, E) (11.1.1)

These consist of the centralized check lamp (CHECK), central warning lamp (CAUTION), and warning pilot lamps (engine water level, engine oil level, brake oil pressure, engine oil pressure, battery charge, and air cleaner clogging)

### **Meter Display Portion (A, C, D) (11.1.2)**

These consists of meters (speedometer, fuel gauge, engine water temperature gauge, torque converter oil temperature gauge, service meter, transmission shift indicator) and the pilot lamps (turn signal indicator, head lamp Hi beam, preheating, front working lamp, rear working lamp, transmission cut-off, parking brake).

### **Option Display Portion (F)**

This consists of the monitor lamps and switches for the emergency steering system, and E.C.S.S. (Electronically Controlled Suspension System).

For details of each system or component, see OPTIONS, ATTACHMENTS.

### **TESTING ACTUATION OF MACHINE MONITOR SYSTEM**

When the starting switch is turned to the ON position before starting the engine, all monitor lamps, gauges and centralized warning lamps will light up for approximately three seconds, and the alarm buzzer will sound for approximately one second.

Then 88 is displayed on the speedometer and 8 is displayed on the transmission shift indicator.

Finally, there will be two beeps to indicate that the monitor check has been completed.

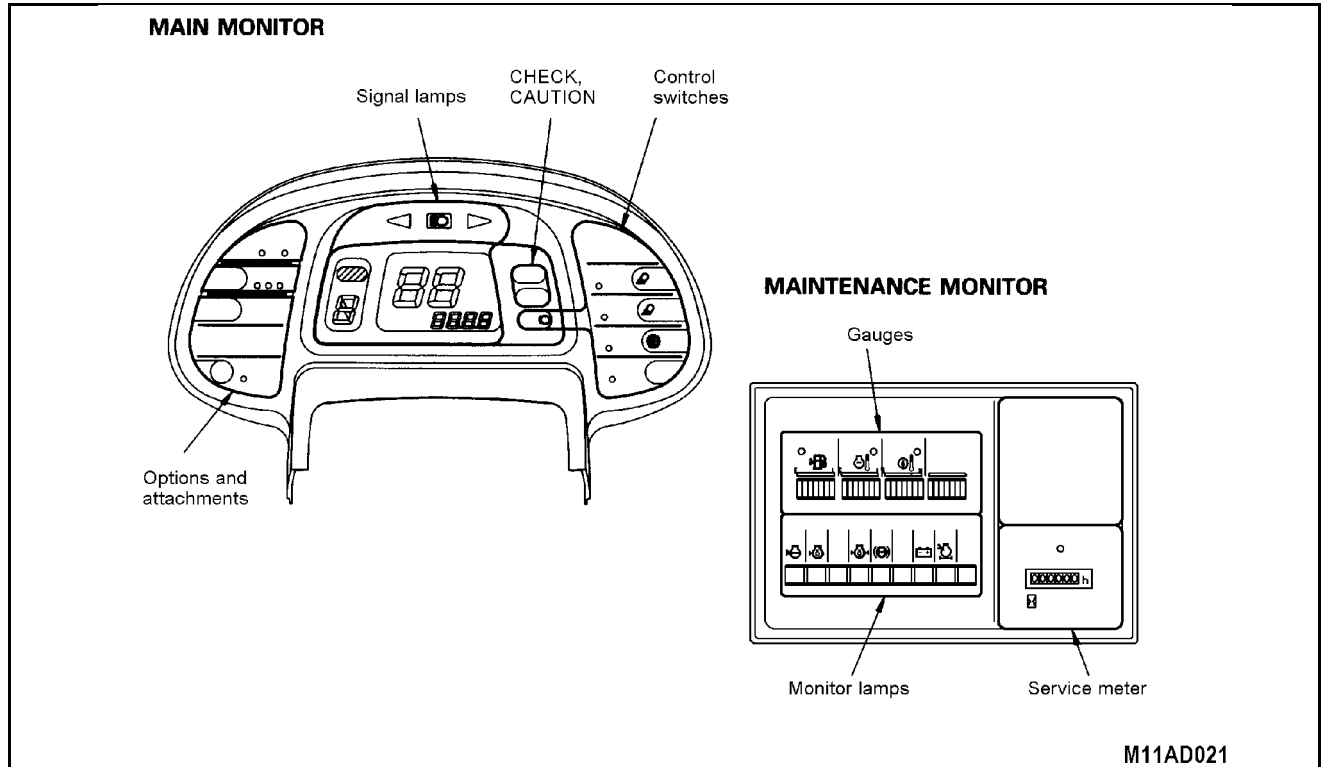
If the monitor lamps do not light up, there is probably a failure or disconnection. Please contact your distributor for inspection.

When the starting switch is turned to the ON position, if the directional lever is not at the neutral position, the central warning lamp (CAUTION) will flash and the alarm buzzer will sound intermittently. If this happens, return the lever to the neutral position, and the lamps will go out and the buzzer will stop.

The monitor check cannot be carried until engine has been stopped for at least 30 seconds.

# OPERATION

## 11.1.1 WARNING DISPLAYS



### 1. CENTRAL CHECK LAMP (CHECK)



#### WARNING

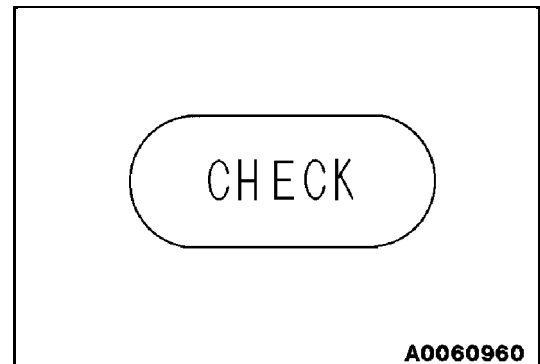
**If this monitor flashes, stop the machine for inspection and/or repairs as soon as possible.**

If any abnormality is found in the CHECK items before starting the engine (engine oil level, engine water level), the monitor lamp for the abnormal location will flash and the central CHECK lamp will also flash.

Check the location for which the monitor lamp is flashing and inspect. When carrying out the checks before starting, do not rely simply on the monitor. Always carry out the specified maintenance items.

If when carrying out checks before starting, the engine oil level is abnormal, the engine oil level will change when the engine is started. So even if there is any abnormality, the central CHECK lamp and monitor lamp will stop flashing.

If there is any abnormality in the engine water level, the central CHECK lamp will go out when the engine is started, but instead of this, the central CAUTION lamp will flash and the alarm buzzer will sound intermittently.





If there is any abnormality in the battery charging system when the engine is running, the battery charge caution pilot lamp will flash and the central CHECK lamp will also flash at the same time. If the lamps flash, check the charging circuit.

## 2. CENTRAL CAUTION LAMP (CAUTION)

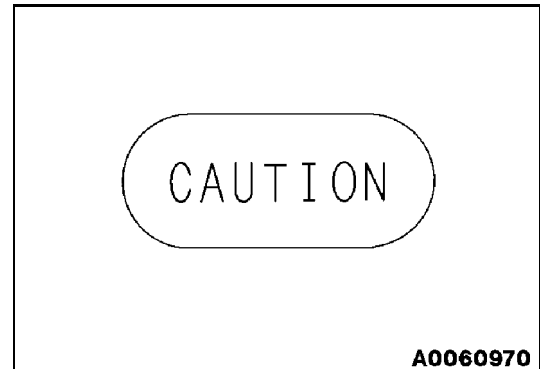


### WARNING

**If this monitor lamp flashes, stop the engine immediately (or run it only at low idle speed) and check the following.**

An abnormality in any CAUTION item when the engine is running (engine water temperature, torque converter oil temperature, engine water level, brake oil pressure, engine oil pressure) will sound the alarm buzzer intermittently and will flash the central CAUTION lamp and the monitor lamp for the location of the abnormality.

If the fuel gauges enters the red range when the engine is running, the fuel gauge will flash and the central CAUTION lamp will also flash. If they flash, check the fuel level and add fuel.



## 3. ENGINE WATER LEVEL CAUTION LAMP

This warns the operator that the coolant level in the radiator has dropped.

When carrying out the checks before starting (main switch ON, engine stopped):

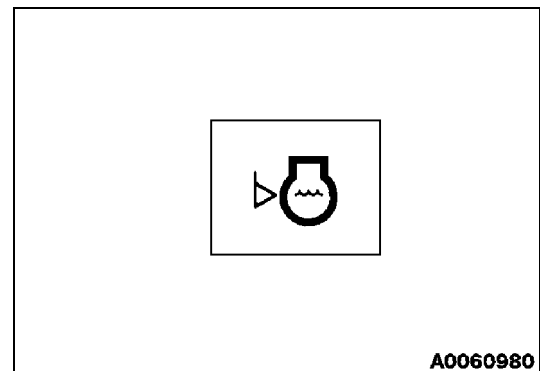
If the level of coolant in the radiator is low, the caution pilot lamp and central CHECK lamp will flash.

If the monitor lamps flash, check the coolant level in the radiator sub-tank and add water.

When operating (engine running):

If the condition is normal the caution pilot lamp should be off. If the level of the coolant in the radiator is too low, the warning pilot lamp and the central CAUTION lamp will flash, and the alarm buzzer will sound intermittently.

If the monitor lamps flash, stop the engine, check the level of the coolant in the radiator and sub-tank, and add water. Stop the machine on level ground before carrying out this check.



## OPERATION

### 4. ENGINE OIL LEVEL CAUTION PILOT LAMP

This warns the operator that the level of oil in the engine oil pan has dropped.

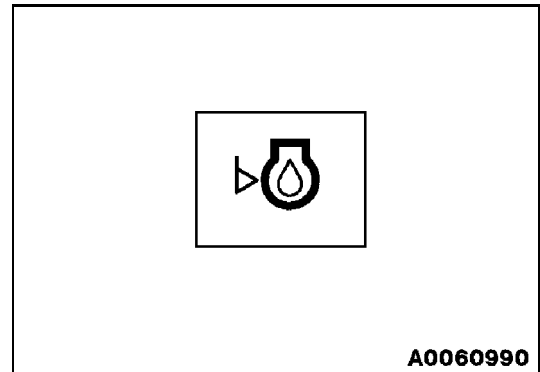
When carrying out checks before starting:

If the oil level in the engine oil pan is low, the caution pilot lamp and central CHECK lamp will flash.

If the monitor lamps flash, check the oil level in the engine oil pan and add oil.

When operating:

Even if the engine oil level caution pilot lamp is flashing during check before starting, it will go out when the engine is started.



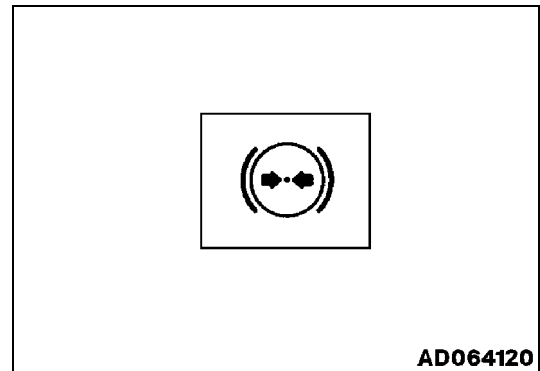
### 5. BRAKE OIL PRESSURE CAUTION PILOT LAMP

This warns the operator that the brake oil pressure has dropped.

When the engine is stopped, the brake oil pressure circuit is not actuated, so the caution pilot lamp and central CHECK lamp are also off.

When operating:

If the brake oil pressure goes down, the caution pilot lamp and the central CAUTION lamp will flash, and the alarm buzzer will sound intermittently. If the monitor lamps flash, stop the engine immediately and check the brake oil pressure circuit.



#### REMARKS:

The monitor lamp may flash for approximately 10 seconds immediately after the engine is started and go out. This is because pressure is being stored in the brake accumulator. It does not indicate any abnormality.

## 6. ENGINE OIL PRESSURE CAUTION PILOT LAMP

This warns the operator that the engine lubricating oil pressure has dropped below a preset level.

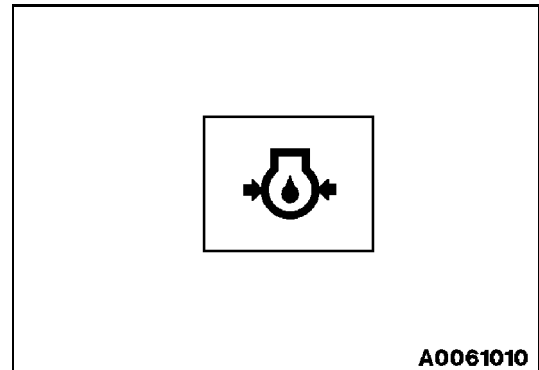
If it flashes, stop the engine. Damage can occur if the engine is run with insufficient oil pressure. Check that oil level is correct. However, diagnosis of other oil pressure problems may require special tools and trained personnel.

Check before starting: Lights up

Engine started or running:

When the engine is started, the lubrication pressure builds up and the lamp goes out.

If the engine lubrication pressure drops, the warning pilot lamp and the central CAUTION lamp will flash, and the buzzer will sound intermittently.



## 7. BATTERY CHARGE CAUTION PILOT LAMP

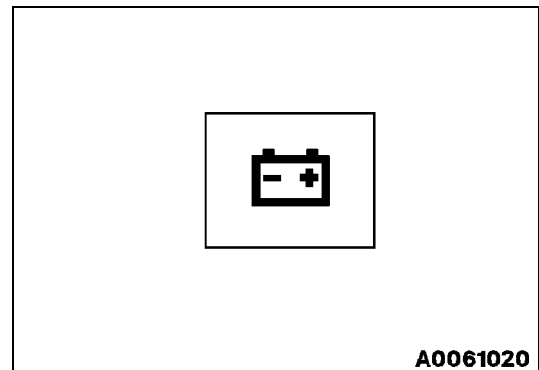
This warns the operator that there is an abnormality in the charging system when the engine is running.

Check before starting: Lights up

Engine started or running:

When the engine is started, the alternator generates electricity and the lamp goes out.

If any abnormality occurs in the charging system, the caution pilot lamp and the central CHECK lamp will flash. If they flash, check the engine charging circuit.



## 8. AIR CLEANER CLOGGED PILOT LAMP

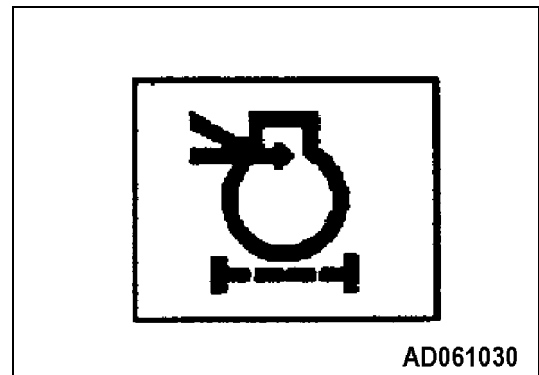
When the engine is running, this warns the operator that the air cleaner element is clogged.

Check before starting: OFF

When operating:

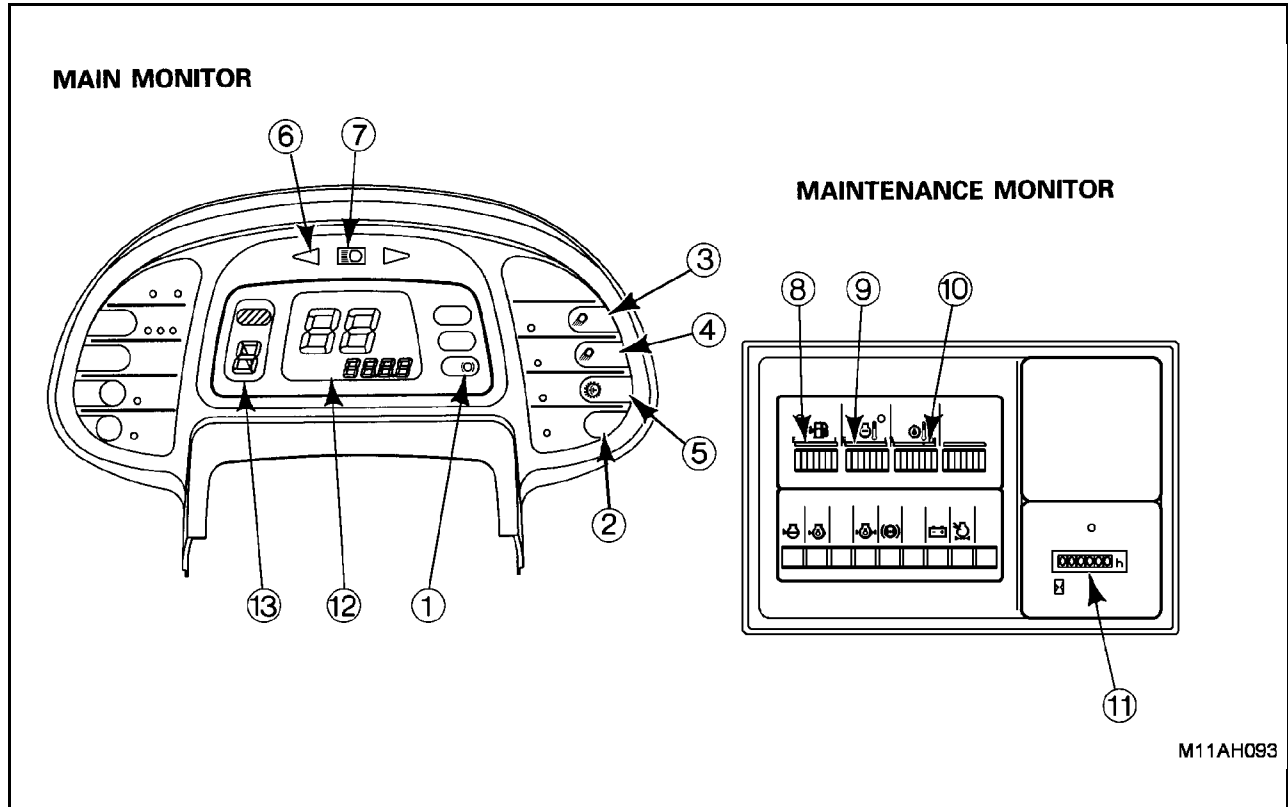
If the air cleaner becomes clogged, the caution pilot lamp and central CHECK lamp will flash.

If they flash, clean or replace the element.



# OPERATION

## 11.1.2 METER DISPLAY PORTION



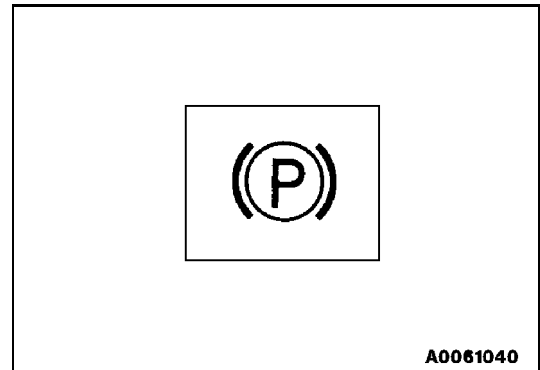
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### PILOT DISPLAY

When the starting switch is ON, the pilot display lights when display items are functioning.

#### 1. PARKING BRAKE PILOT LAMP

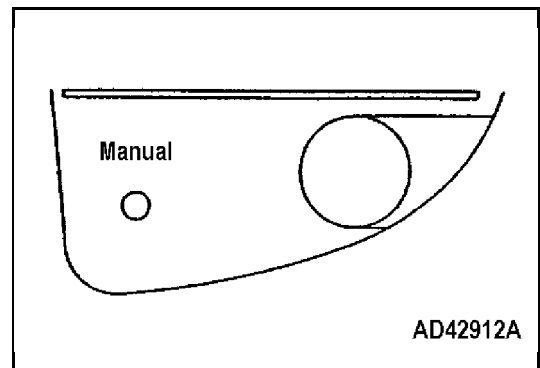
This lamp lights up when the parking brake is applied.



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#### 2. TRANSMISSION AUTO SHIFT MANUAL SELECTOR PILOT LAMP

When manual transmission is selected, this pilot lamp glows. If Auto Shift transmission is selected, this pilot lamp is off.



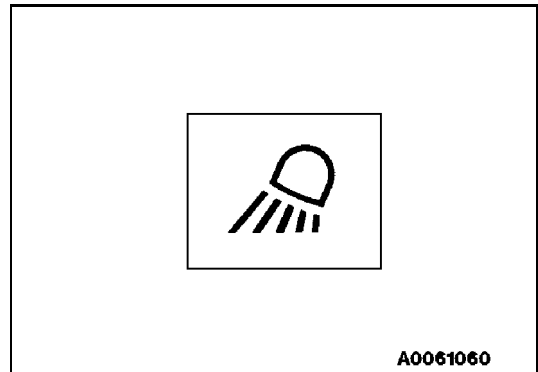
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**3. FRONT WORKING LAMP PILOT LAMP**

This lamp lights up when the front working lamp is switched ON.

**4. REAR WORKING LAMP PILOT LAMP**

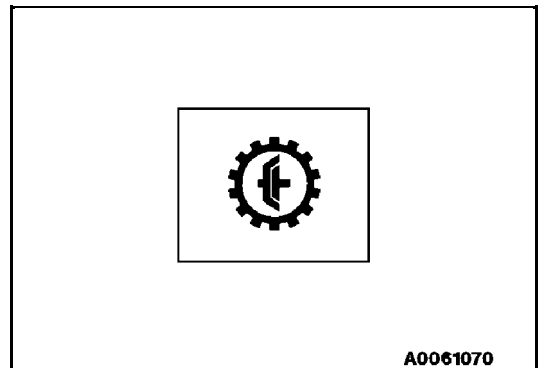
This lamp lights up when the rear working lamp is switched ON.



**5. TRANSMISSION CUT-OFF PILOT LAMP**

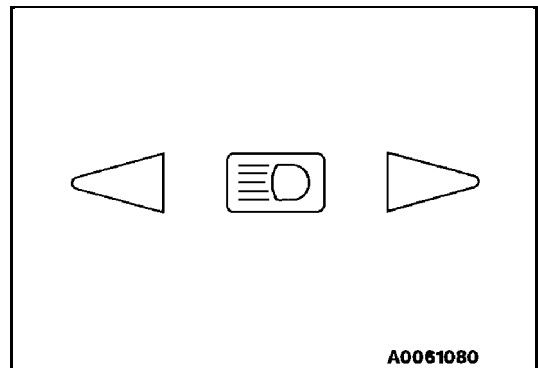
This lamp lights up when the transmission cut-off switch is turned to ON.

If the monitor lamp is ON and the left brake pedal is depressed, the transmission will be returned to neutral.



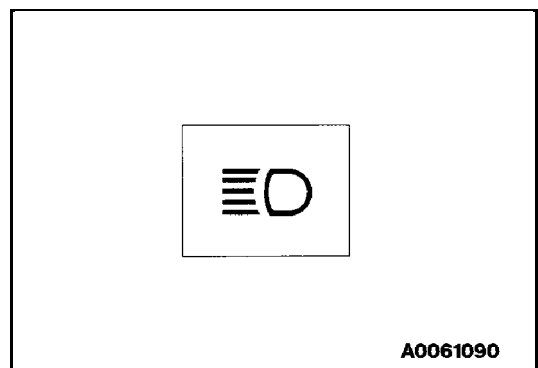
**6. TURN SIGNAL PILOT LAMP**

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



**7. HIGH BEAM PILOT LAMP**

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



**METERS**

## OPERATION

### 8. FUEL GAUGE

This gauge indicates the amount of fuel in the fuel tank.

E: Tank is EMPTY

F: Tank is FULL

The lamp should light up in the green range during operation. If it enters the red range during operation, it means that there is less than 44 liters (11.6 US gal.) of fuel left, so check and add fuel.

### 9. ENGINE COOLING WATER TEMPERATURE GAUGE

This gauge indicates the temperature of the cooling water.

If the temperature is normal during operation, the green range will light. If the red range lights during operation, stop the machine and run the engine with no load at mid-range speed until the green range lights.

If the lamps light up to the 1st red level, the engine water temperature gauge lamp and central CAUTION lamp will flash; when the lamps light up to the 2nd red level, the alarm buzzer will also sound intermittently.

### 10. TORQUE CONVERTER OIL TEMPERATURE GAUGE

This gauge indicates the temperature of the torque converter oil.

If the temperature is normal during operation, the green range will light.

If the red range lights during operation, stop the machine and run the engine with no load at mid-range speed until the green range lights.

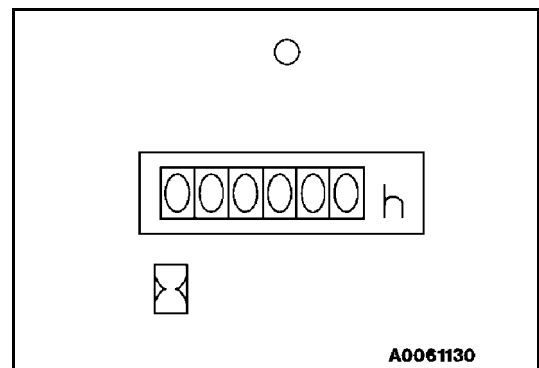
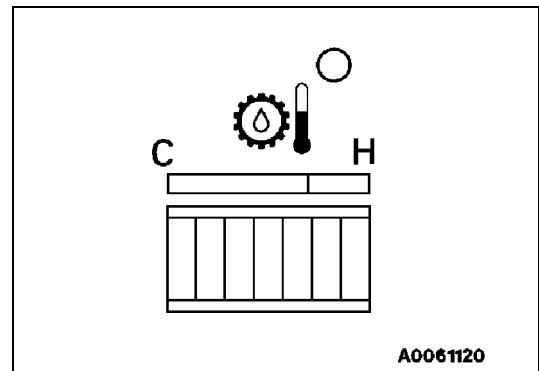
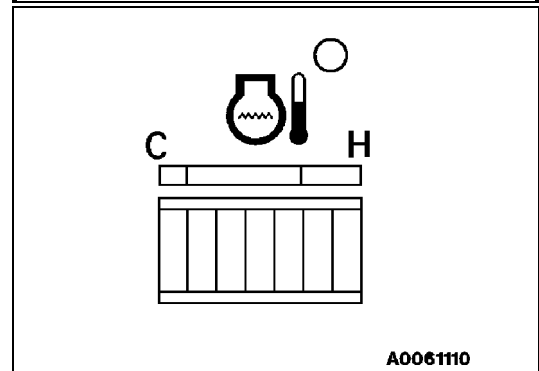
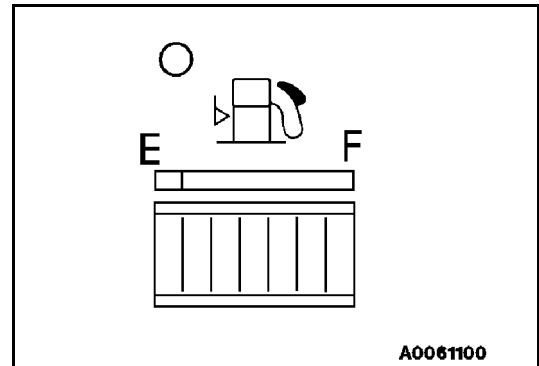
If the lamps light up to the 1st red level, the torque converter oil temperature gauge lamp and central CAUTION lamp will flash; when the lamps light up to the 2nd red level, the alarm buzzer will also sound intermittently.

### 11. 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.

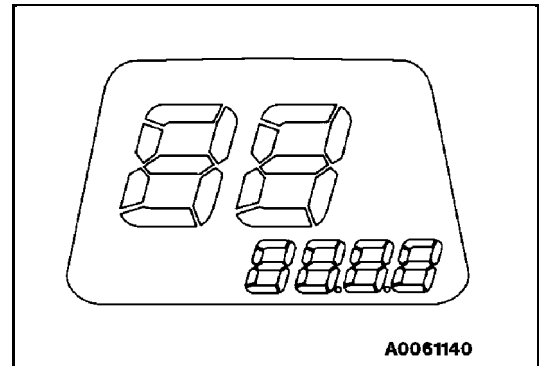
While the engine is running, the green pilot lamp on the service meter flashes to show the service meter advances.

The service meter advances by 1 when the engine is operated for one hour, regardless of the engine speed.



## 12. SPEEDOMETER

This meter indicates the travel speed of the machine.

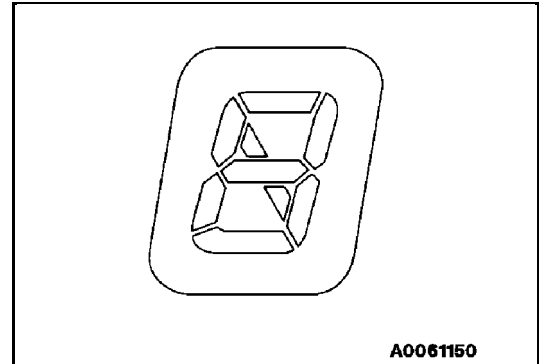


## 13. TRANSMISSION SHIFT INDICATOR

This indicates the present speed range of the transmission.

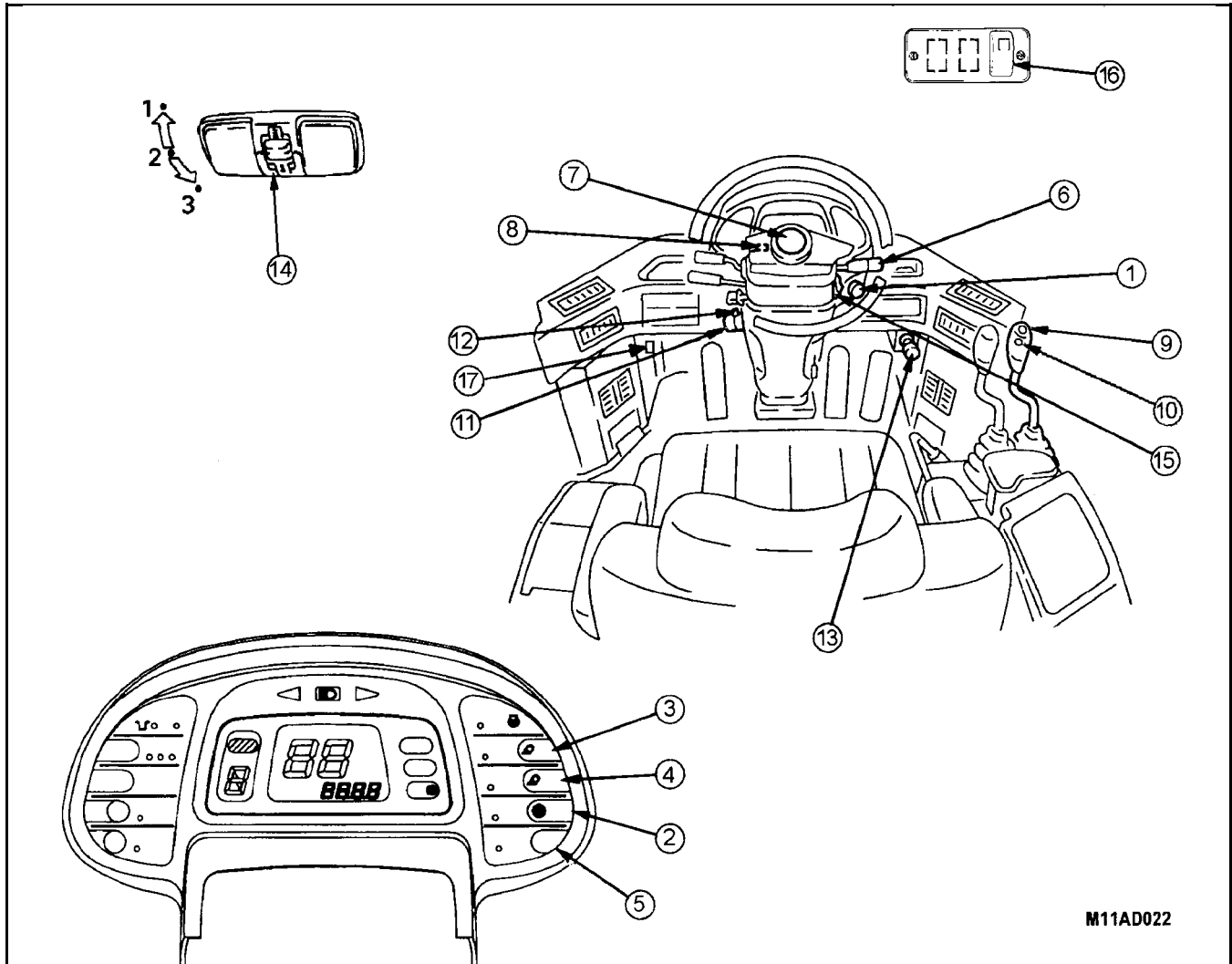
When the directional lever is at N position, N is displayed on the indicator.

When the directional lever is at the F or R position, the shift position of the speed lever is displayed as numeral.



# OPERATION

## 11.2 SWITCHES



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### 1. STARTING SWITCH

This switch is used to start or stop the engine.

#### OFF position

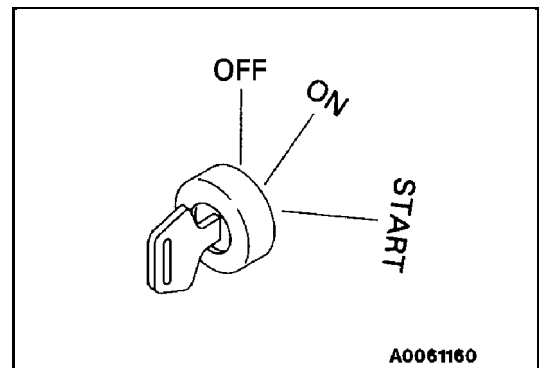
The key can be inserted and removed at this position. When the key is turned to this position, the electric circuit is turned off and the engine stops.

#### ON position

Electric current flows in the charging, lamp and accessory circuits. Keep the starting switch key at the ON position while the engine is running.

#### START position

The engine-start position -- hold key at this position during cranking (20 seconds or less). Immediately after starting the engine, release the key which will automatically return to ON position.



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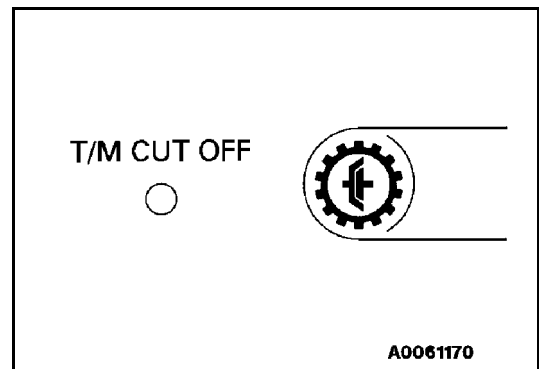
**2. TRANSMISSION CUT-OFF SWITCH**

**⚠ WARNING**

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

Press the push button to switch ON and OFF. When the pilot lamp is pressed, it will light up and come ON; if it is pressed again, the pilot lamp will go out and the transmission cut-off will be turned off.

Normally, leave this switch in the ON position.  
 (1) OFF: Left brake pedal acts as normal brake (like right brake pedal).  
 (2) ON: Left brake pedal acts as normal brake, but also switches the transmission to NEUTRAL.  
 If the switch is ON, the transmission cut-off pilot lamp will light.

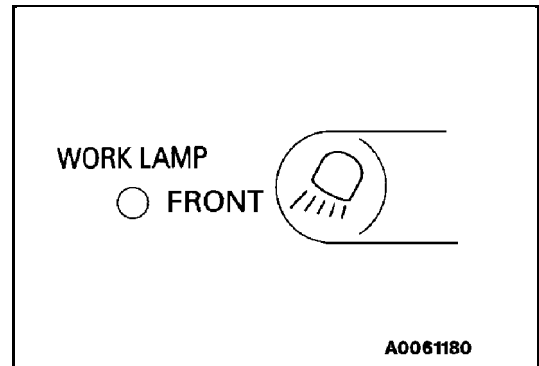


**3. FRONT WORKING LAMP SWITCH**

**⚠ WARNING**

Always turn the working lamp off before traveling on public roads.

When turning on the front work lamp, turn the lamp switch to the ON position for the side clearance lamp or ON position for the head lamp, then operate the switch. When the pilot lamp is pressed, it will light up and come ON; if it is pressed again, the pilot lamp will go out and the working lamp will be turned to OFF. The working lamp will not light up if the lamp switch is not at the ON position for the side clearance lamp or ON position for the head lamp.



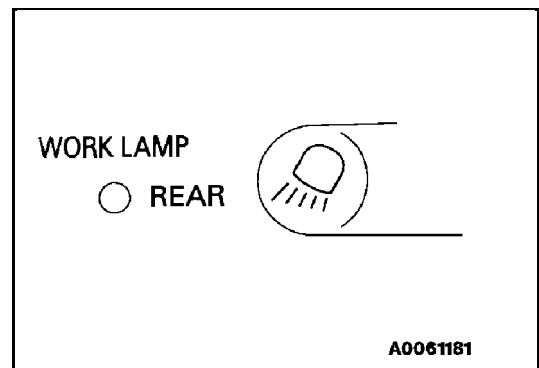
**4. REAR WORKING LAMP SWITCH**

**⚠ WARNING**

Always turn the working lamp off before traveling on public roads.

When turning on the rear working lamp, turn the lamp switch to the ON position for the side clearance lamp or ON position for the head lamp, then operate the switch.

When the pilot lamp is pressed, it will light up and come ON; if it is pressed again, the pilot lamp will go out and the working lamp will be turned to OFF. The working lamp will not light up if the lamp switch is not at the ON position for the side clearance lamp or ON position for the head lamp.

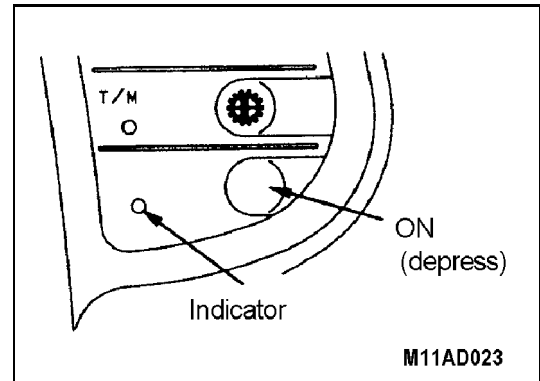


## OPERATION

### 5. TRANSMISSION SELECTOR SWITCH

This switch when depressed once selects the “on” position, or manual transmission mode. The lamp is lit. Depressing the switch again selects the “off” position, which is Auto-Shift transmission mode, and the lamp is off.

Normal operation should be in the “off” position, Auto-Shift transmission mode, with the indicator lamp off. See “11.3 CONTROL LEVERS, PEDALS” on page 2-21, for additional information.



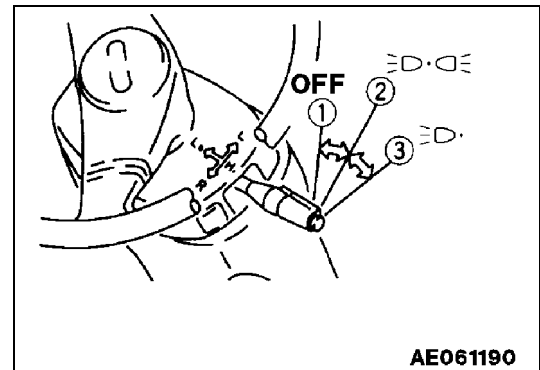
### 6. LAMP SWITCH/TURN SIGNAL LEVER/DIMMER

This lever performs three functions.

#### LAMP SWITCH

To illuminate lamps, side clearance lamps, tail lamps, and instrument panel lighting rotate the end as follows

- (1) OFF
- (2) position: Side clearance lamp, tail lamps, and gauge lighting light up
- (3) position: Head lamps light up in addition to lamps at (2) position



#### REMARKS:

The lamp switch can be operated regardless of the position of the lever.

#### TURN SIGNAL LEVER

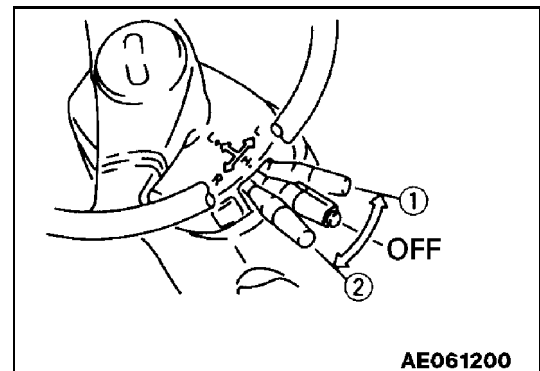
The lamp switch lever also operates the turn signal lamps.

- (1) LEFT TURN: Push lever FORWARD.
- (2) RIGHT TURN: Pull lever BACK.

#### REMARKS:

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

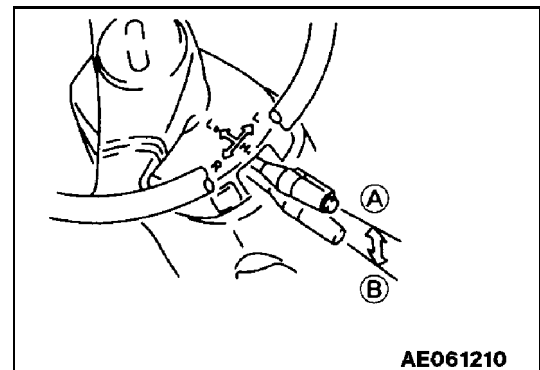
When the steering wheel is turned to the neutral position, the turn signal lever will return automatically to OFF. If not, return the lever to OFF manually.



#### DIMMER SWITCH

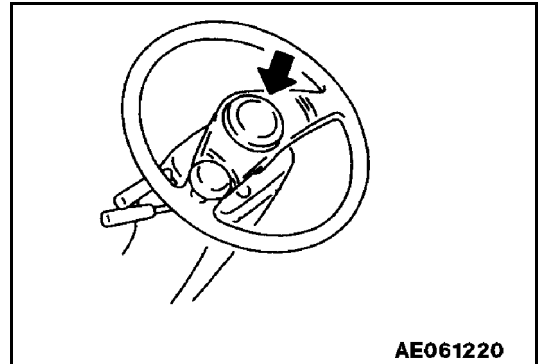
This switches the head lamp between high beam and low beam.

- (A) Low beam
- (B) High beam



## 7. HORN BUTTON

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



## 8. HAZARD LAMP SWITCH



### WARNING

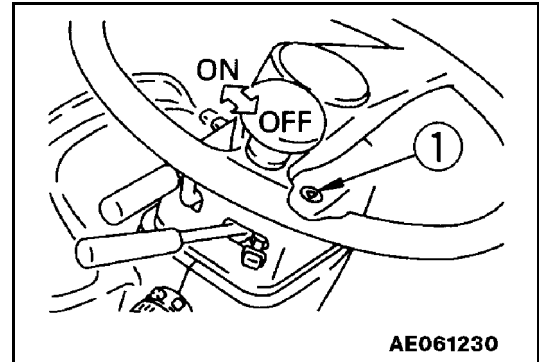
Use the hazard lamps only in emergencies. Using the hazard lamps when traveling will cause problems for other machines.

This switch is used in emergencies, such as when the machine breaks down.

ON: All turn signal lamps flash.

### REMARKS:

When this switch is turned to the ON position, the turn direction indicator lamps and turn indicator pilot lamp flash, and the display lamp (1) lights up at the same time.



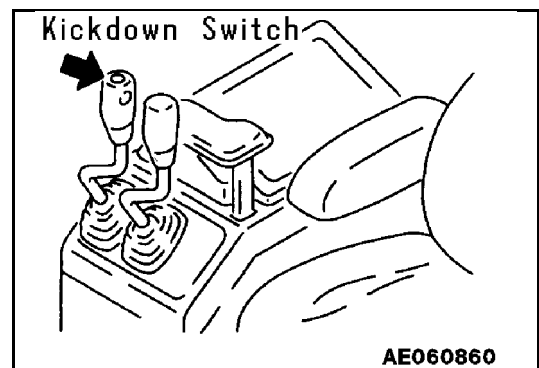
## 9. KICKDOWN SWITCH

When the speed control lever is in 2nd, and the switch at the top of the knob of the lift arm control lever is pressed, the transmission will shift down to 1st gear.

This switch is used to increase the drawbar pull in digging operations.

### REMARKS:

To cancel the kickdown switch, move the directional lever to REVERSE or NEUTRAL, or move the speed control lever to any position except 2nd. It is also possible to cancel the kickdown switch by operating the parking brake switch or by turning the starting switch OFF.

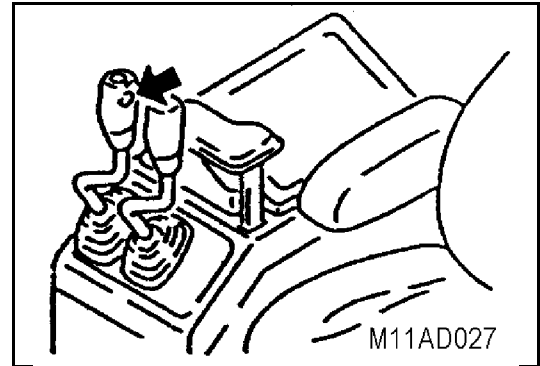


## OPERATION

### 10. HOLD SWITCH

The Hold switch, located on the lift lever, will maintain the transmission gear. When this switch is depressed, transmission indicator light on the main monitor panel will light. Depressing this switch again will release the transmission hold function and the indicator light will go off. The transmission hold feature is recommended to maintain travel speed (up and down slopes, grading, etc.).

When the transmission hold function is engaged, the manual speed control lever can be used to change gears.

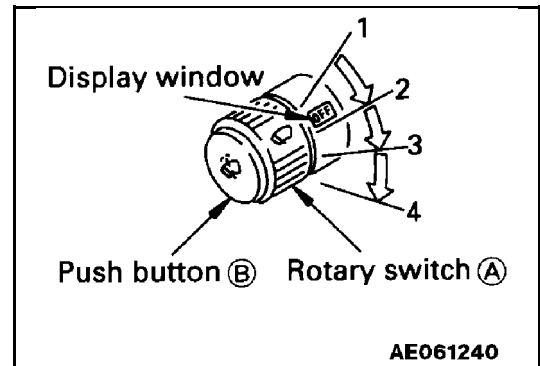


### 11. FRONT WIPER SWITCH

Turn switch (A) to operate the front wiper.

If button (B) is pressed, washer fluid will spray out on to the front glass.

Switch position	Window display	Operation
1	OFF	OFF
2	INT	Intermittent wiper
3	1	Low-speed wiper
4	2	High-speed wiper

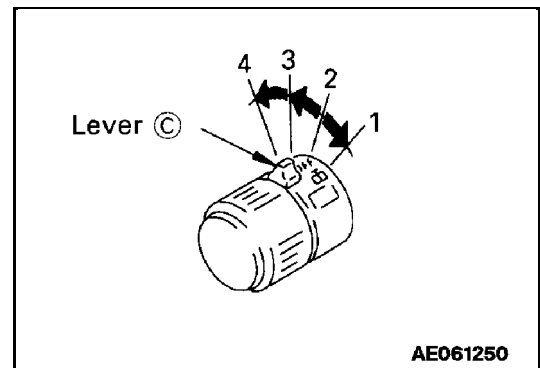


### REAR WIPER SWITCH

Turn lever (C) to operate the rear wiper.

Position of switch	Display	Operation
1		Washer fluid sprayed
2	OFF	OFF
3		Wiper actuated
4		Washer fluid sprayed, wiper actuated

1 2 .

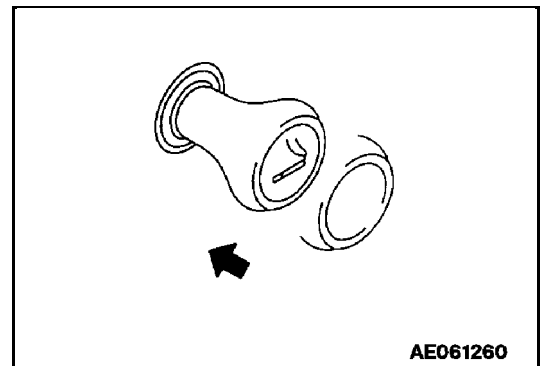


### 13. CIGARETTE LIGHTER

This is used to light cigarettes. Its seven-amp receptacle also can power electric accessories.

To use the lighter, push its knob in. After a few seconds it will spring back. At that time remove the lighter and light your cigarette.

After the lighter has cooled, it can be removed and set aside. Electric current (seven amps) then is available at the lighter receptacle to power accessories.



## 14. ROOM LAMP SWITCH

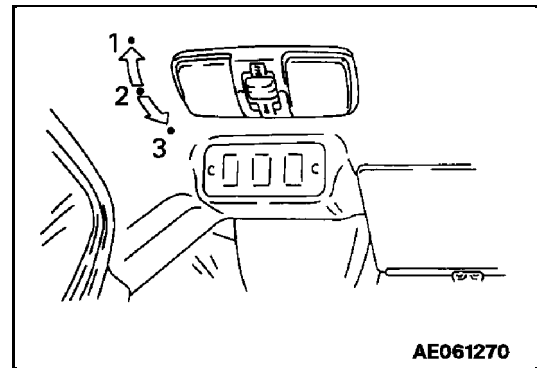
### REMARKS:

The room lamp can light even if the main switch is OFF. To avoid draining the vehicle battery, turn the switch to position 1 or OFF before leaving the operator's compartment. When operating with the cab door fully open, set the switch to position 1 (OFF).

Position 1: OFF, lights are off.

Position 2: Lights when door is opened.

Position 3: ON, lights remain on.



## 15. PARKING BRAKE SWITCH



### WARNING

**Always apply the parking brake when leaving the machine or parking it.**

**Even if the parking brake switch is turned ON, for safety precaution keep the brake pedal depressed until the parking brake pilot lamp lights up.**

This switch operates the parking brake.

- (1) ON position: The parking brake is applied, and the parking brake pilot lamp lights up.
- (2) OFF position: The parking brake is released.

### REMARKS:

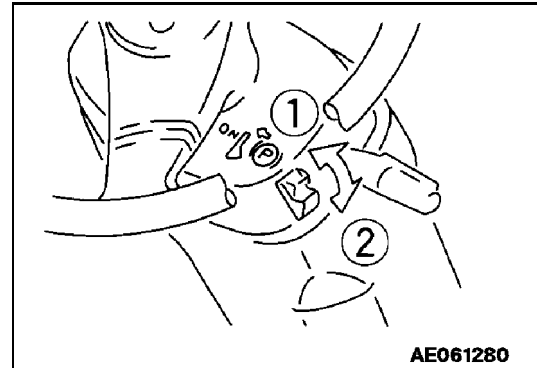
If the directional lever is placed in F (FORWARD) or R (REVERSE) with the parking brake applied, the warning lamp will flash and the alarm buzzer will sound.

When the starting switch is turned to OFF, the parking brake is automatically applied. Before starting the engine, turn the parking brake switch to ON, then turn it to OFF. The machine does not start when the directional lever is operated with the parking brake applied.

### NOTE:

**Never use the parking brake switch to apply the brakes when traveling, except in an emergency. Apply the parking brake only after the machine has stopped.**

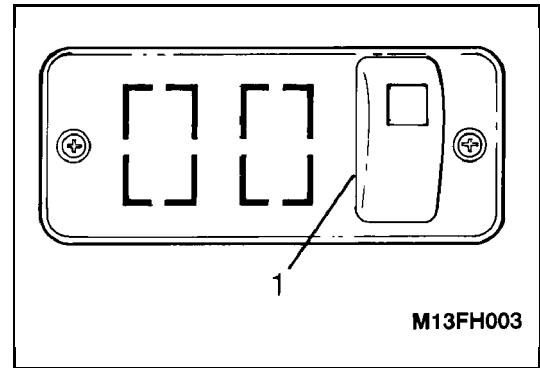
**If the parking brake has been used as an emergency brake when traveling at high speed (near the maximum speed), contact your distributor to have the parking brake checked for any abnormality.**



## OPERATION

### 16. REAR WINDOW DEFROSTER

Switch (1) energizes a timing circuit to power the window defroster. Place the defroster switch to ON and the system will operate approximately 10 minutes, long enough in most cases to clear the window.



### 17. ETHER START SWITCH



#### WARNING

Do not keep this switch at the "ON" position for more than five seconds.

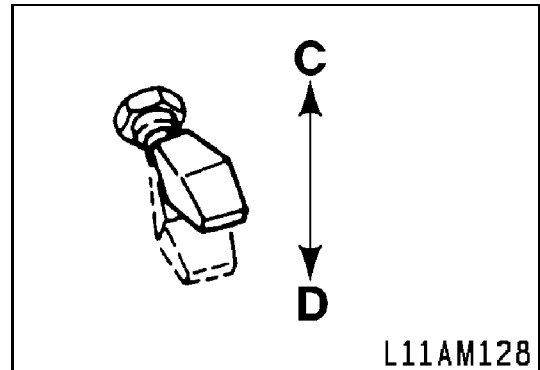
This switch is used when starting the engine in cold weather.

#### C. ON POSITION:

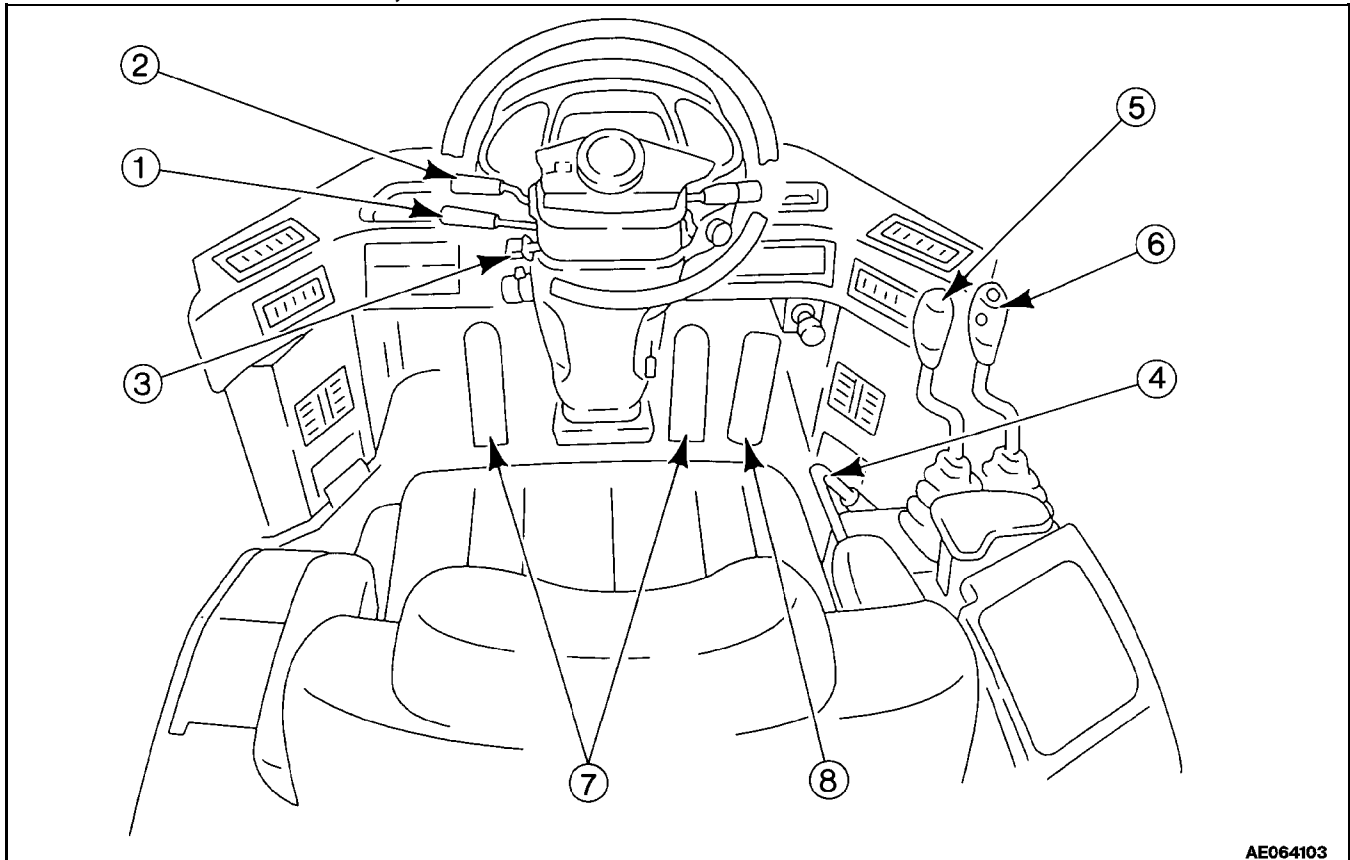
A fixed amount of ether (approx. 3 cc each time) is injected into the engine air intake to make it easier to start the engine in cold weather.

#### D. OFF POSITION:

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



11.3 CONTROL LEVERS, PEDALS



AE064103

**1. SPEED CONTROL LEVER**

**MANUAL SHIFT**

This lever controls the travel speed of the machine. This machine has a 4-FORWARD, 4-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 and 4th speeds are used for traveling.

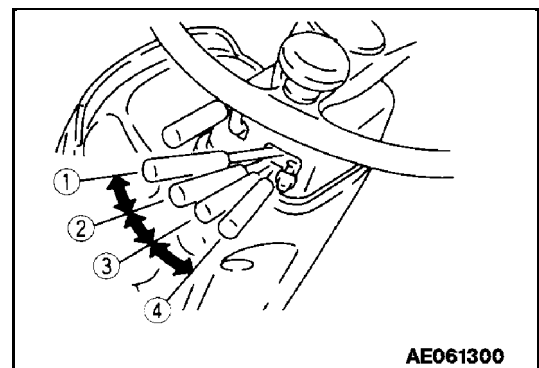
However, the speed control lever stopper prevents the shift to 3rd or 4th. Disengage the stopper before trying to shift gears.

- Position (1): 1st
- Position (2): 2nd
- Position (3): 3rd
- Position (4): 4th

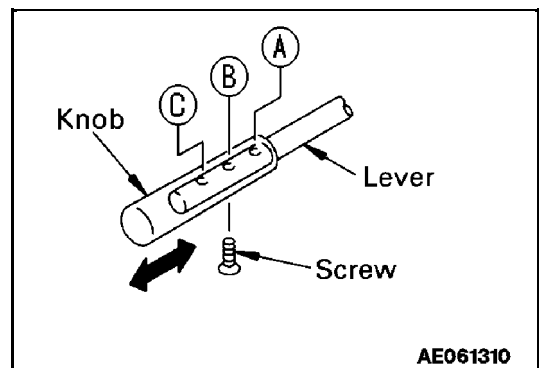
**REMARKS:**

The length of the lever can be adjusted to 3 stages (position (A), (B) or (C)). To adjust the length, remove the screw at the bottom of the lever knob, slide the knob to the desired position, then tighten the screw again.

(The machine is shipped with the lever at position (B).)



AE061300



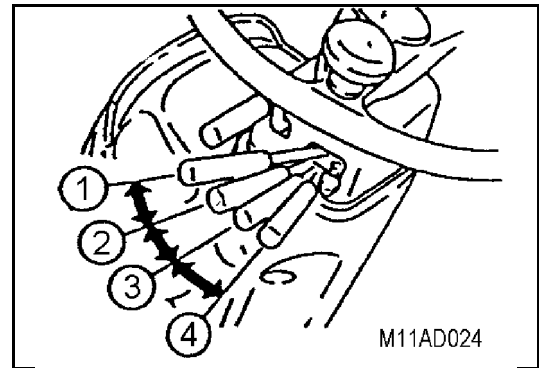
AE061310

AUTO SHIFT FUNCTION

## OPERATION

The Auto Shift transmission can change from second to fourth gear to cope with operating conditions.

- (1) Position First gear
- (2) Position Second gear
- (3) Position Third gear
- (4) Position Fourth gear



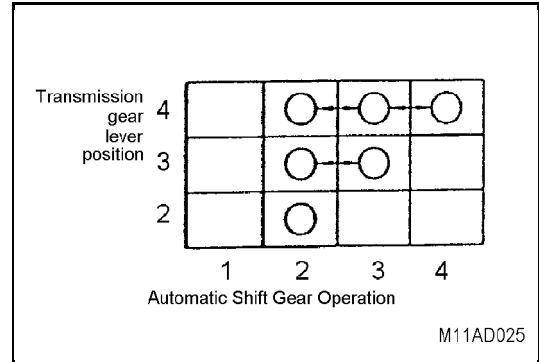
This chart illustrates the Auto Shift gear ranges available according to the shift lever position.

When first gear is selected on transmission gear lever, the Auto Shift function does not operate. First gear is maintained.

When downshifting from second to first gear, use the kick down switch on top of the lift lever.

The kick down switch can operate from any gear or direction, but its use should be limited to speeds less than 12 km/hr.

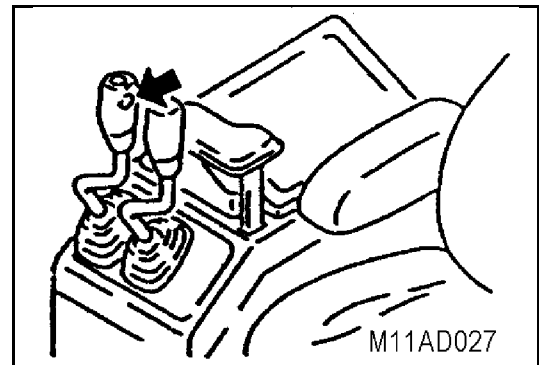
Kick down feature is recommended for use during load and carry operations.



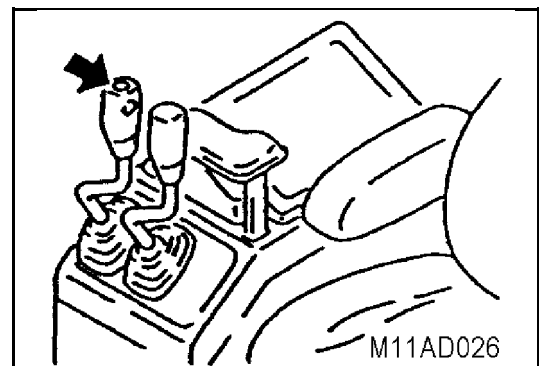
The Hold Switch has been included to bypass automatic shifting, as for an operation that requires holding a steady speed -- up slope down slope, grading, etc. Progress won't be interrupted by an inadvertent gear shift.

Depress Hold Switch (side of lift lever) and transmission will be held in the same gear as shown on the main monitor. The transmission won't change from that speed range until the operator selects another transmission gear.

The manual speed control lever can be used to shift up or down to change travel speed.



When kick down switch is depressed and transmission is changed from second gear to first gear and then travel speed is increased, transmission will change automatically to second gear.





## 2. DIRECTIONAL LEVER

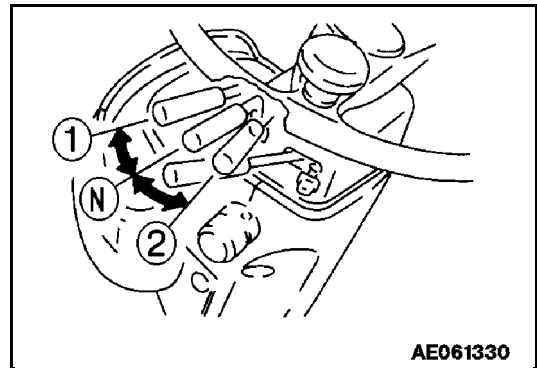
This lever is used to change the direction of travel of the machine. The engine cannot be started if the directional lever is not at N (neutral).

- Position (1): Forward
- Position (N): Neutral
- Position (2): Reverse

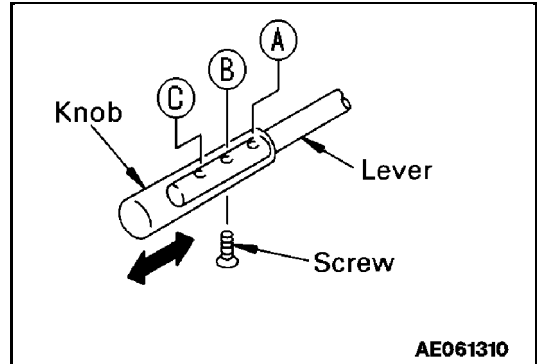
### REMARKS:

The length of the lever can be adjusted to 3 stages (positions (A) (B) or (C)). To adjust the length, remove the screw at the bottom of the lever knob, slide the knob to the desired position, then tighten the screw again.

(The lever is installed to position (B) when it is shipped from the factory.)



AE061330

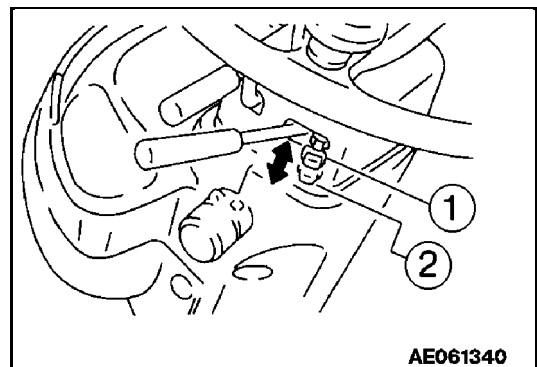


AE061310

## 3. 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



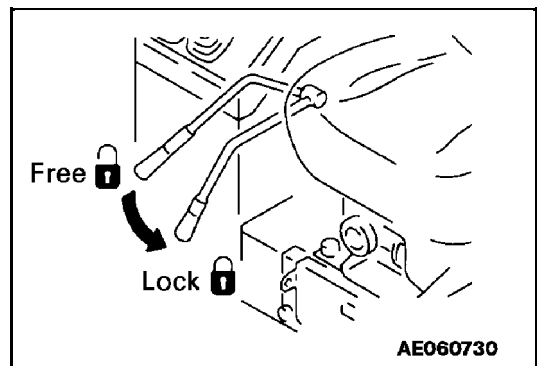
AE061340

## 4. SAFETY LOCK LEVER

### WARNING

When leaving the operator's compartment, set the safety lock lever securely to the LOCK position. If the control levers are not locked, and they are touched by mistake, this could lead to a serious accident. If the safety lock lever is not placed securely in the LOCK position, the control levers may not be properly locked. Check that the situation is as shown in the diagram. When parking the machine or during maintenance, always lower the bucket to the ground and apply the lock.

This is used to lock the work equipment levers. Push the lever down to apply the lock.



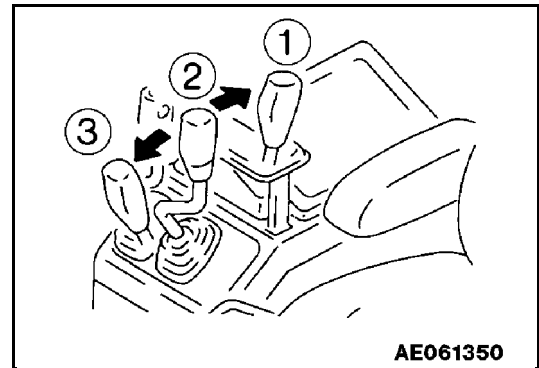
AE060730

## OPERATION

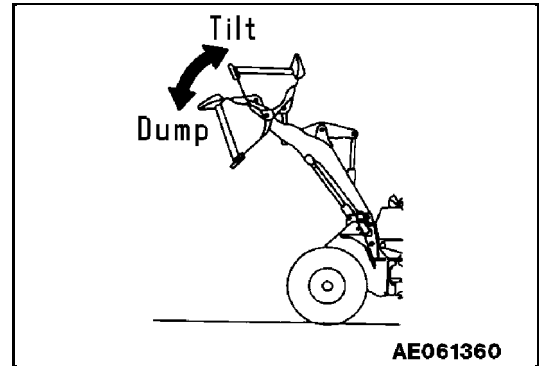
### 5. BUCKET CONTROL LEVER

This lever operates the bucket.

- (1) TILT (↗): When the bucket control lever is pulled further from the TILT position, the lever is stopped in this position until the bucket reaches the preset position of the positioner, and the lever returns to the HOLD position.
- (2) HOLD (↔): The bucket is kept in the same position.
- (3) DUMP (↘): When the bucket control lever is pulled to rotate the bucket down, the lever is stopped in this position until the bucket reaches the preset position of the positioner, and the lever returns to the HOLD position.



AE061350

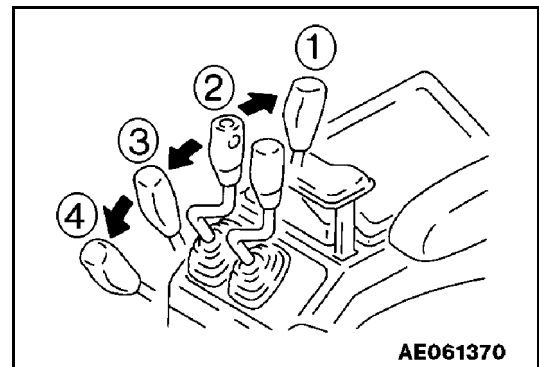


AE061360

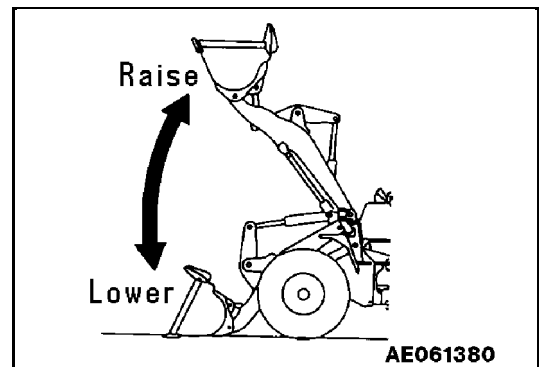
### 6. LIFT ARM CONTROL LEVER

This lever is used to operate the boom.

- (1) RAISE (↗): When the lift arm control lever is pulled further from the RAISE position, the lever is stopped in this position until the lift arm reaches the preset position of the kick-out, and the lever is returned to the HOLD position.
- (2) HOLD (↔): The lift arm is kept in the same position.
- (3) LOWER (↘): When the lift arm control lever is pulled further from the RAISE position to retract the cylinders and lower the boom, the lever is stopped in this position until the lift arm reaches the preset lowest position, and the lever is returned to the HOLD position.
- (4) FLOAT (↕): The lift arm moves freely under external force.



AE061370



AE061380

## 7. BRAKE PEDALS



### WARNING

When traveling downhill, use the engine as a brake, and always use the right brake pedal.  
Do not use the brake pedals repeatedly unless necessary.  
Do not put your foot on this pedal unless necessary.

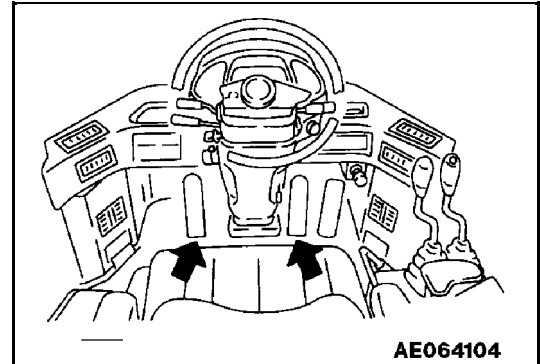
### Right brake pedal

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

### Left brake pedal.

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

If the transmission cut-off switch is at OFF, the left brake pedal acts in the same way as the right brake pedal.



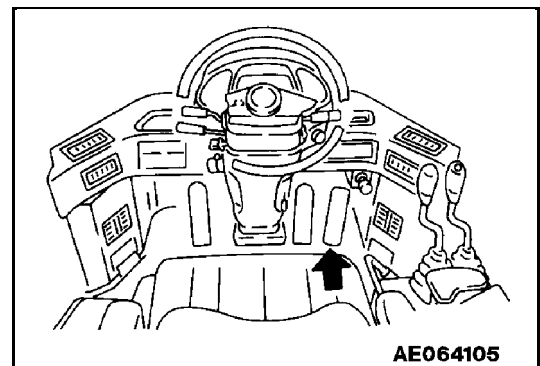
### REMARKS:

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 switch to the ON position.

## 8. ACCELERATOR PEDAL

This pedal controls the engine speed and output.

The engine speed can be freely controlled between low idle and full speed.



## OPERATION

### 11.4 STEERING COLUMN TILT LEVER

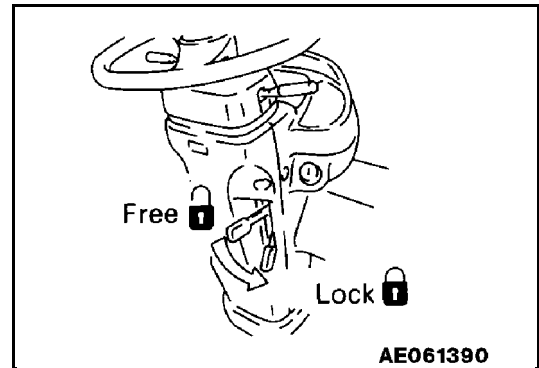
**⚠ WARNING**

**Stop the machine before adjusting the angle of the steering wheel.**

This lever allows the steering column to be tilted forward or backward.

Pull the lever up and move the steering wheel to the desired position. Then push the lever down to lock the steering wheel in position.

Range of adjustment: 125 mm (4.92 in) (stepless)



## 11.5 CAP WITH LOCK

The fuel tank filler port and the hydraulic tank filler port are equipped with locks.

Use the starter key to open and close the cap as follows.

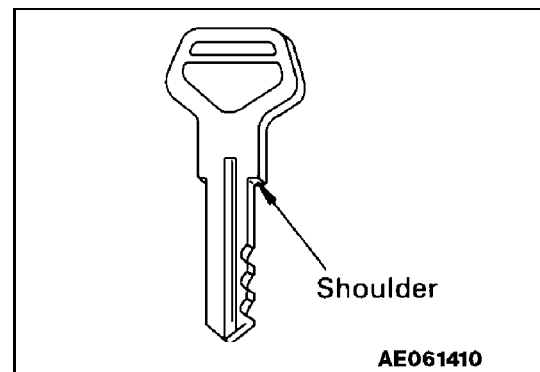
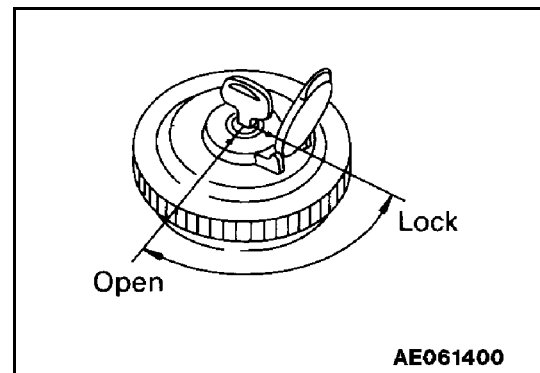
### 11.5.1 METHOD OF OPENING AND CLOSING CAP WITH LOCK

#### TO OPEN THE CAP (For the fuel tank filler port)

1. Insert the key into the cap as far as it will go. If the key is turned before it is inserted all the way in, it could break.
2. Turn the key clockwise, align the match mark on the cap with the rotor groove, then remove the cap.

#### TO LOCK THE CAP

1. Turn the cap into place.
2. Turn the key clockwise and take the key out.



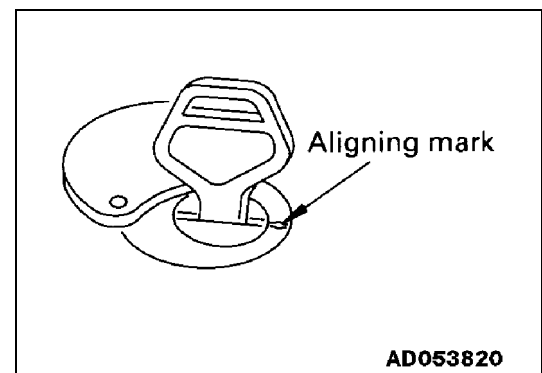
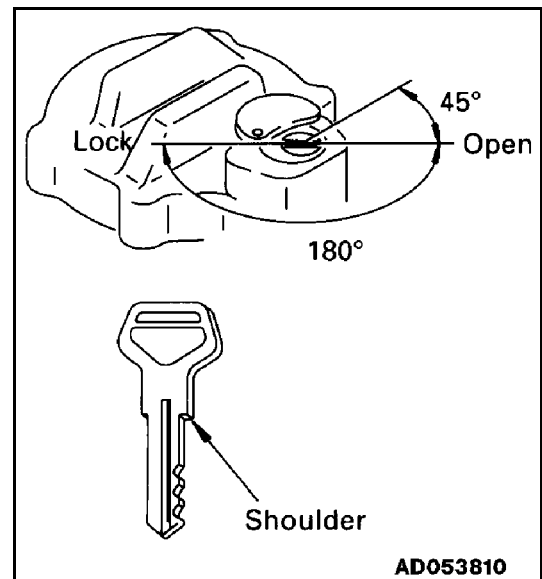
## OPERATION

### TO OPEN THE CAP (For the hydraulic tank filler port)

1. Insert the key into the cap as far as it will go. If the key is turned before it is inserted all the way in, it could break.
2. Turn the key counterclockwise and bring and bring the rotor groove in line with the aligning mark on the cap slowly until a "clicking" sound is made. This releases the lock and allows the cap to be opened.

### TO LOCK THE CAP

1. Turn the cap into place.
2. Turn the key clockwise and take the key out.



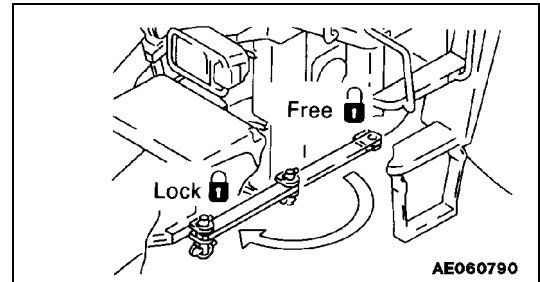
## 11.6 SAFETY BAR



### WARNING

Always use the safety bar for maintenance or when transporting the machine.

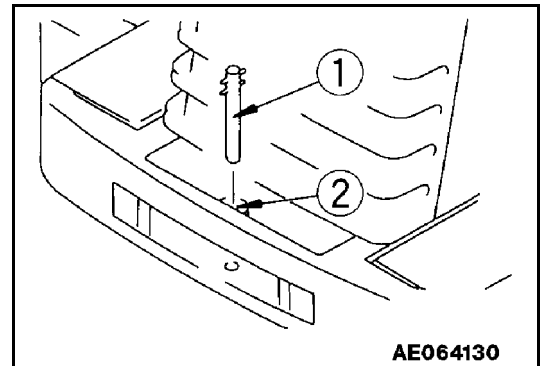
The safety bar is used during maintenance or when transporting the machine. It locks the front and rear frames, and prevents the front and rear frames from pivoting.



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## 11.7 TOWING PIN

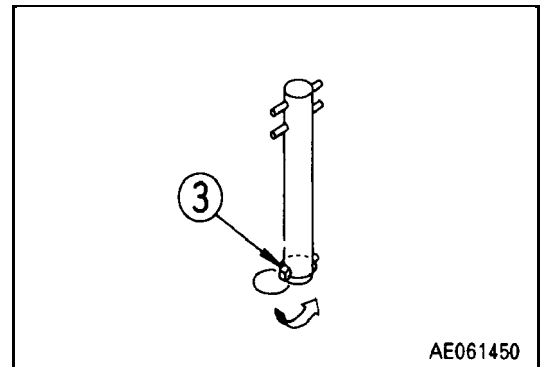
1. Insert towing pin (1) into hole (2) in the counterweight.



AE064130

2. Use lynch pin (3) to set so that the towing pin does not come out.

Carry out this operation in reverse to remove the pin.



AE061450

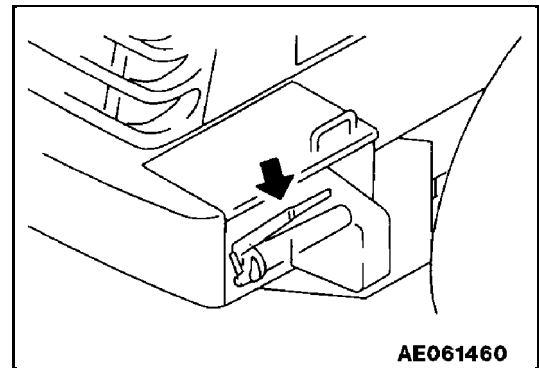
## OPERATION

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### 11.8 GREASE PUMP

The grease pump is stored inside the battery box at the rear of the machine. After using it wipe off all grease stuck to the outside of the pump and then store it in the box.

It can be stored in either the left or right battery box.



AE061460

### 11.9 BACK UP ALARM

This sounds an alarm when the directional lever is set to R position. It is used to warn people behind the machine that the machine will be traveling in reverse.



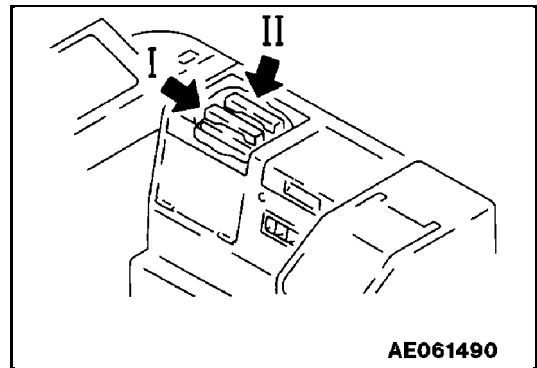
### 11.10 FUSE

**NOTE:** Before replacing a fuse, be sure to turn off the starting switch.

The fuses protect the electrical equipment and wiring from burning out.

If a fuse becomes corroded, or white powder can be seen, or a fuse is loose in the fuse holder, replace the fuse.

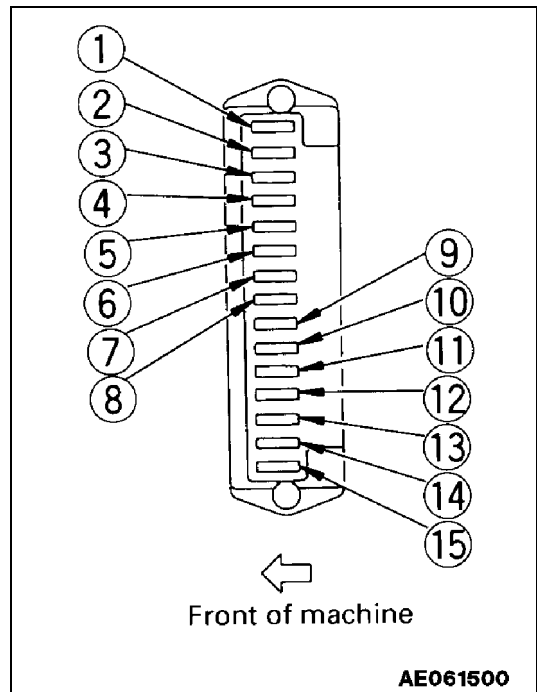
Replace a fuse only with another of the same capacity.



#### 11.10.1 FUSE CAPACITY AND NAME OF CIRCUIT

##### Fuse box I

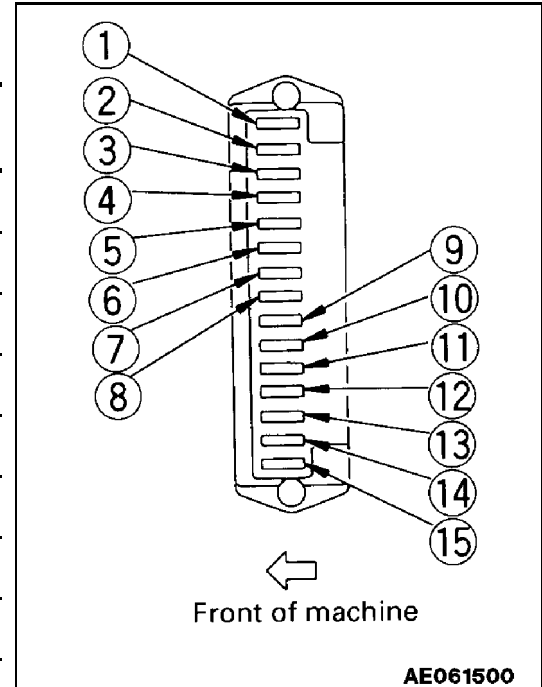
No.	Fuse capacity	Name of circuit
①	20A	Main lamp circuit
②	20A	Backup lamp, brake lamp
③	10A	Turn signal indicator lamp
④	10A	R.H. head lamp
⑤	10A	L.H. head lamp
⑥	10A	R.H. side clearance lamp
⑦	10A	L.H. side clearance lamp
⑧	10A	Parking brake
⑨	10A	Transmission control
⑩	10A	Instrument panel
⑪	10A	Work equipment positioner
⑫	10A	Starting switch
⑬	20A	Hazard lamp
⑮	10A	Spare



## OPERATION

### Fuse box II

No.	Fuse capacity	Name of circuit
①	20A	Front working lamp
②	20A	Rear working lamp
③	20A	Air conditioner
④	20A	Air conditioner
⑤	20A	Wiper, washer
⑥	10A	Auto shift
⑦	10A	Cigarette lighter, radio
⑧	10A	Rotating lamp
⑨	5A	Fuel shut off solenoid
⑩	10A	Spare
⑪	10A	Spare
⑫	10A	Spare
⑬	10A	Spare
⑭	10A	Air suspension seat
⑮	10A	Defroster

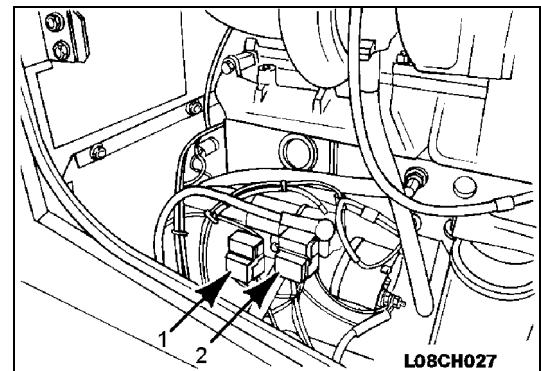


### 11.11 SLOW-BLOW FUSE

If the power does not come on when the starting switch is turned ON, check the slow-blow fuse. Replace a blown fuse with a replacement of the same quality and capacity.

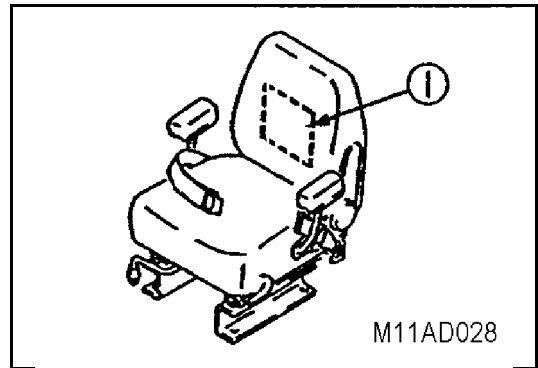
The slow blow fuse is beside the engine on the left hand side of the machine.

- 80A: Main power
- 30A: Battery power (starting switch, hazard)

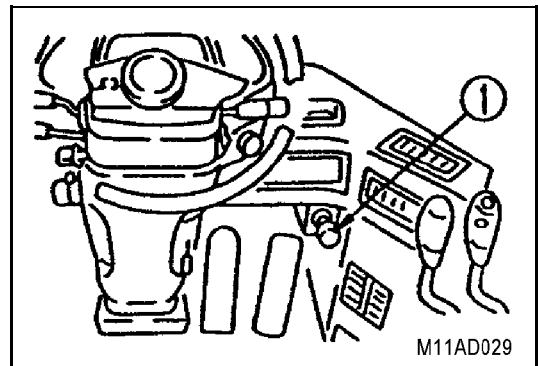


**11.12 STORAGE FOR THIS MANUAL**

Keep this manual in its convenient storage pocket on the rear of the operator's seat.

**11.13 ELECTRIC POWER (with ROPS CAB)**

Electric current (up to 7A (168 W)) is available at the cigarette lighter receptacle.



## 12. OPERATION

### 12.1 CHECKS BEFORE STARTING

#### 12.1.1 WALK AROUND CHECK

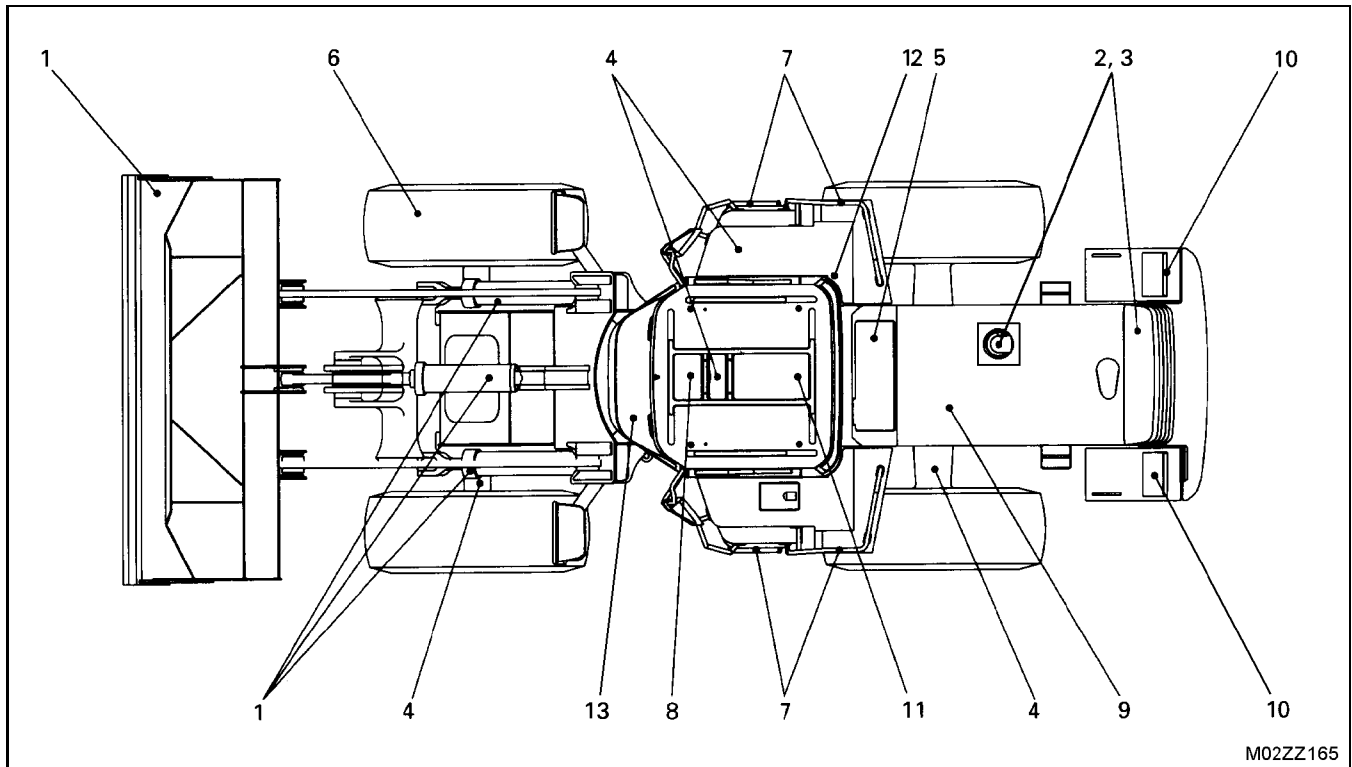


#### WARNING

Leakage of oil or fuel, or accumulation of flammable material around high temperature parts, such as the engine muffler or turbocharger, may cause fire. Check carefully, and if any abnormality is found, repair it or contact your distributor for assistance.

Before starting the engine, look around the machine and under the machine to check for loose nuts or bolts, 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.

Always carry out the items in this section before starting the engine each day.



#### 1. Check for damage, wear, or play in the work equipment, cylinders, linkage and hoses

Check that there are no cracks, excessive wear, or play in the work equipment, cylinders, linkage, or hoses. Report any abnormality to applicable personnel.

**2. Remove dirt and dust from around engine, battery, radiator**

Check for dirt or dust accumulated around the engine or radiator. Check also if there is any flammable material (dead leaves, twigs, grass, etc.) accumulated around the battery or high temperature engine parts, such as the muffler or turbocharger. Remove all dirt or flammable material.

**3. Check for leakage of water or oil around engine**

Check that there is no leakage of oil from the engine or leakage of water from the cooling system. If any abnormality is found, repair it.

**4. Check for oil leakage from transmission case, axle, hydraulic equipment, hydraulic tank, hoses, joints**

Check that there is no oil leakage. If any abnormality is found, repair the place where the oil is leaking.

**5. Check for oil leakage from brake lines**

Check that there is no oil leakage. If any abnormality is found, repair the place where the oil is leaking.

**6. Check for damage or wear to tires, loose mounting bolts**

Check for cracks or peeling of tires and for cracks or wear to the wheels (side rim, rim base, lock ring). Tighten any loose wheel nuts. If any abnormality is found repair or replace the part. If any valve caps are missing, install new caps.

**7. Check for damage handrail and steps, loose bolts**

Repair any damage and tighten any loose bolts.

**8. Check for damage to gauges, monitor, loose bolts**

Check that there is no damage to the gauges and monitor in the operator's cab. If any abnormality is found, replace the parts. Clean off any dirt on the surface.

**9. Check for loose air cleaner mounting bolts**

Check for any loose mounting bolts and tighten if necessary.

**10. Check for loose battery terminals**

Tighten any loose terminals.

## OPERATION

### 11. Check seat belt and equipment



#### WARNING

Replace the seat belt once every three years, at the latest, regardless of its appearance.

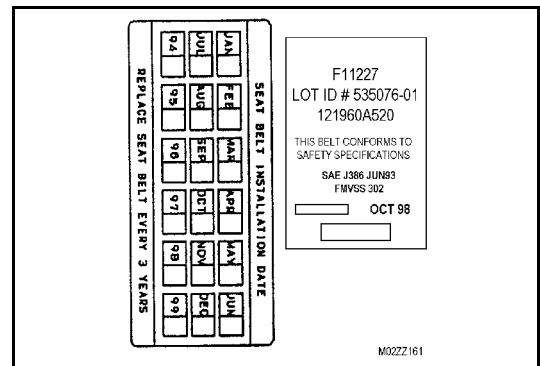
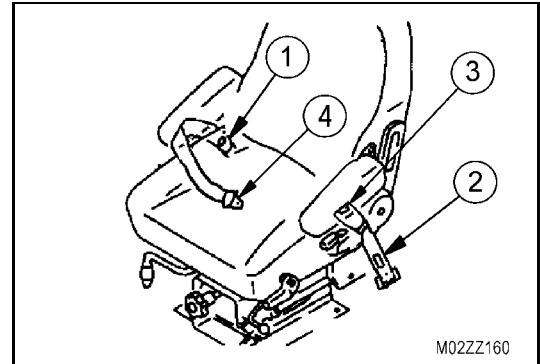
#### REMARKS:

The date of manufacture of the seat belt is marked on the belt near the buckle (2) in the diagram on the right.

Check that there are no loose hardware mounting the seat belt to the machine, and tighten if necessary. Check that the retractor (1) and release button (3) operate freely.

Tightening torque:  $24.5 \pm 4.9$  N

If the belt is damaged or fluff is starting to form, or if there is any damage or deformation of the seat belt holders, replace the seat belt with a new part.



### 12. Check for loose bolts on ROPS

Check for any loose or damaged bolts. If any loose bolts are found tighten them to  $927 \pm 103$  N

If any bolts are damaged, replace them with genuine Komatsu bolts.

### 13. Clean cab window

Clean the cab windows to ensure good visibility when operating the machine.

**12.1.2 CHECK BEFORE STARTING**

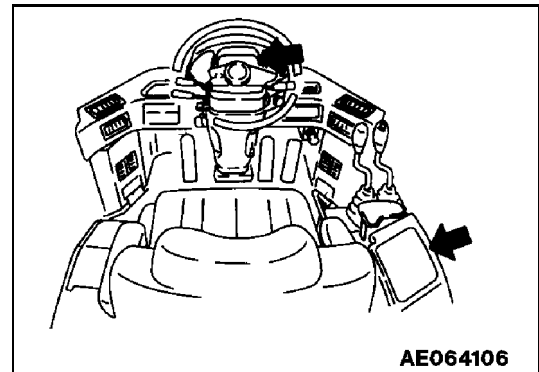
Always carry out the items in this section before starting the engine each day.

**CHECK MONITOR PANEL**

1. Turn the starting switch to ON.
2. Check that all the monitor lamps, the gauges and the warning lamp light up for about 3 seconds and the alarm buzzer sounds for about 1 second.

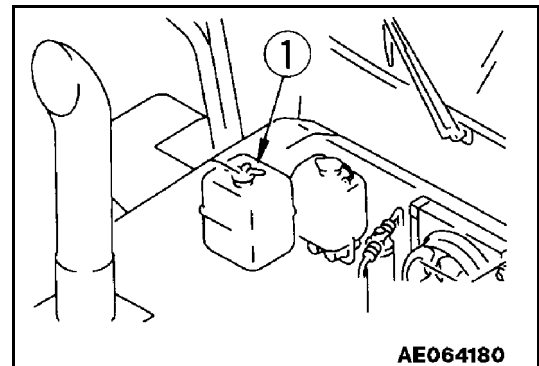
If any monitor lamp does not light up, ask your distributor to inspect the monitor lamp.

Do not carry out the checks before starting using only the monitor; always carry out also the items specified for the periodic maintenance.

**CHECK COOLANT LEVEL, ADD COOLANT****WARNING**

Always wait for the engine to cool down before checking the water level, and check using the radiator overflow sub-tank.

1. Open the top cover at the front of the engine hood in the middle of the machine, and check that the coolant level is between the FULL and LOW marks on the sub-tank (1). If the coolant level is low, add coolant to the FULL mark through the filler in the sub-tank.

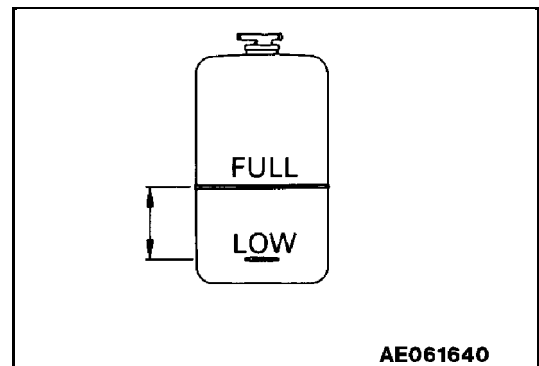


**For complete coolant specifications See “20.6 COOLANT SPECIFICATIONS” on page 3-14.**

2. After adding coolant, tighten the filler cap securely.

**NOTE: If the sub-tank was empty or the volume of coolant added was more than usual, then check for possible leaks.**

**NOTE: Confirm that engine oil is not present in the coolant.**



## OPERATION

### INSPECTION OF TIRES



#### WARNING

Worn or damaged tires may fail and cause death or serious injury. Replace tires that are not in usable condition:

##### Wear

Tires with tread groove less than 15% of that of a new tire.

Tires with extremely uneven wear or stepped-type wear.

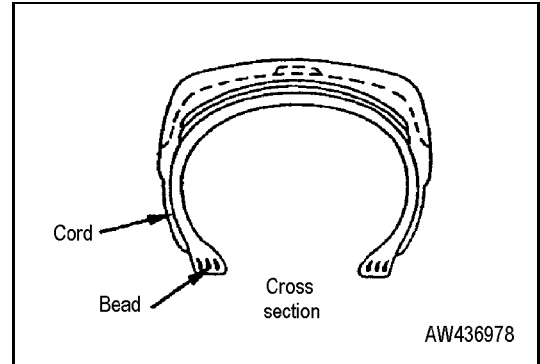
##### Damage

Tires with damage that has reached the cords, or with cracks in the rubber.

Tires with cut or pulled cords or damaged beads.

Leaking or improperly repaired tires.

Deteriorated, deformed or abnormally damaged which otherwise do not seem usable.



### INSPECTION OF RIMS



#### WARNING

Check the rims (wheels) and rings for deformation, corrosion and cracks, especially the side rings, lock rings and rim flanges.

### CHECK FUEL LEVEL, ADD FUEL



#### WARNING

Fuel spilled during refueling is a health and safety hazard. Don't let the fuel overflow; clean up spillage.

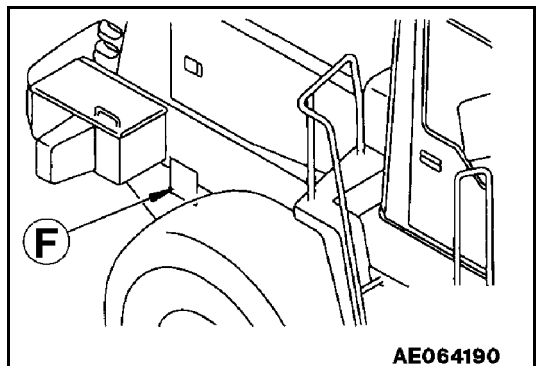
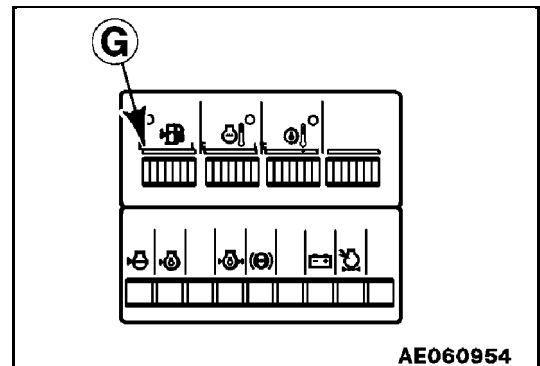
1. Turn the engine starting switch to the ON position, then check the fuel level on the fuel gauge (G). Return the starting switch to the OFF position.
2. Add fuel through filler (F). Fuel capacity: 248 S gal).

For details about the locking cap, see "11.5 CAP WITH LOCK" on page 2-27.

For details of the fuel to use, see "20.1 PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS" on page 3-10.

3. After adding , tighten cap securely.

**NOTE:** Moisture or corrosion may form in the fuel tank. Be sure the fuel tank is filled before storing the machine after a work shift.





**CHECK OIL LEVEL IN ENGINE OIL PAN, ADD OIL**

1. Open the engine side cover at the right rear side of the machine.
2. Remove dipstick (G) and wipe the oil off with a clean cloth.
3. Insert dipstick (G) fully in the guide tube, then take it out again.
4. The oil level should be between the ADD and FULL marks on the dipstick.  
If the oil is below the ADD mark, add engine oil through oil filler (F).

**Oil specifications**

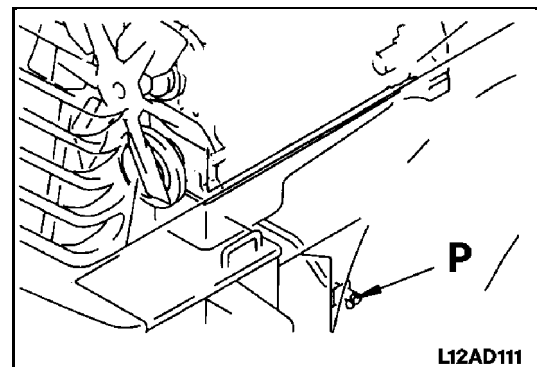
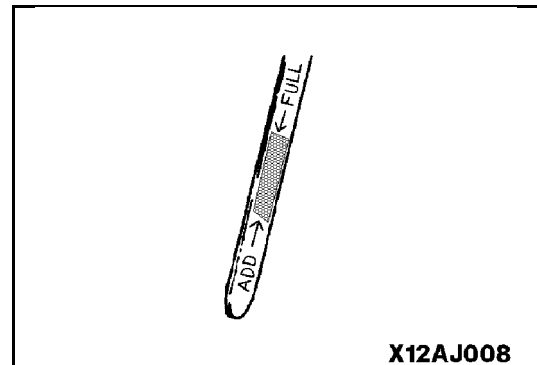
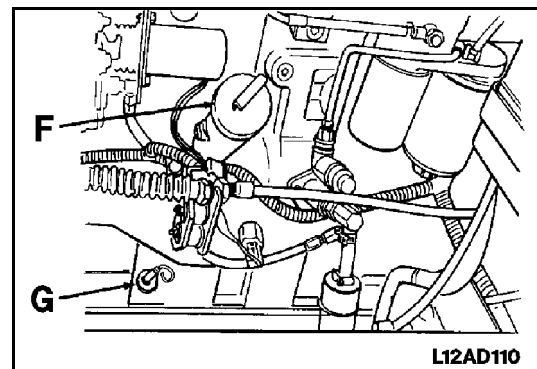
**COOLANT AND LUBRICANTS” on page 3-10.**

5. If the oil is above the FULL mark, drain the excess engine oil from the drain plug (P), and check the oil level again.
6. If the oil level is correct, tighten the oil filler cap securely and close the engine cover.

**REMARKS:**

When checking the oil level after the engine has been operated, wait for at least 15 minutes after stopping the engine before checking.

If the machine is at an angle, make it horizontal before checking.



## OPERATION

### CHECK ELECTRICAL WIRING



#### WARNING

If fuses are frequently blown or if there are traces of a short circuit in the wiring, locate the cause and carry out repair. Accumulation of flammable material (dead leaves, twigs, grass, etc.) around the battery may cause fire, so always remove such material.

Check for damaged fuses and any sign of disconnection or short circuit in the wiring. Check also for loose parts.

Check the following points carefully.

- Battery
- Starting motor
- Alternator

During walk-around checks or checks before starting, always look for and remove any accumulation of flammable material from around the battery.

Contact your distributor for investigation and correction of the cause.

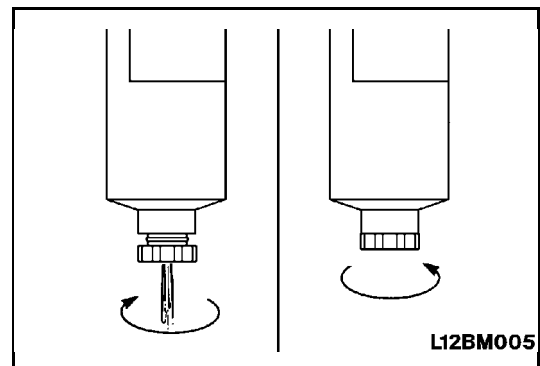
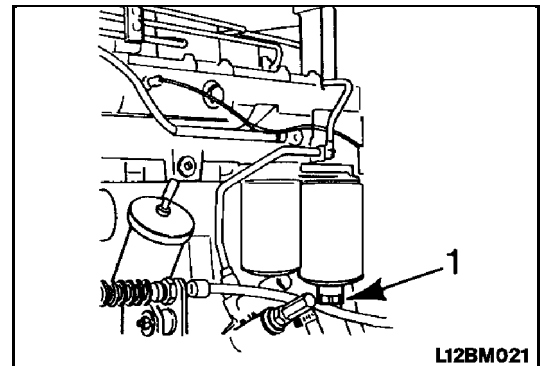
### DRAIN THE WATER FROM THE FUEL-WATER SEPARATOR

With the engine shut-off, open the drain valve (1). Turn the valve counterclockwise approximately 1-1/2 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 1-1/2 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.



**CHECK EFFECT OF PARKING BRAKE****WARNING**

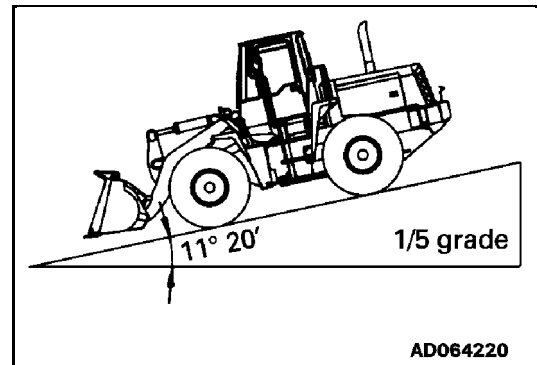
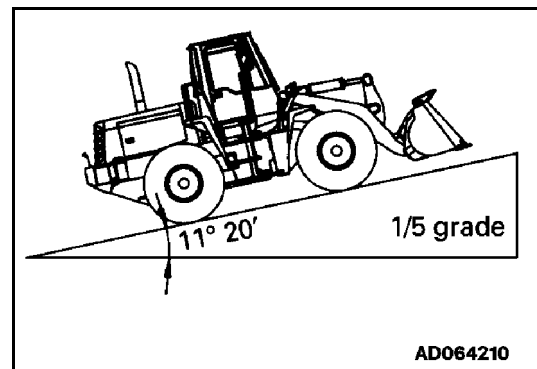
Even if the parking brake switch is turned ON, for safety precaution keep the brake pedal depressed until the parking brake pilot lamp lights up.

**Measurement conditions**

Tire inflation pressure: Specified pressure  
 Road surface: Dry paved surface with 1/5 (11  
 Machine: Operating condition

**Method of measurement**

1. Start the engine, set the machine facing straight to the front then drive the machine up 1/5 grade with the bucket empty.
2. Depress the brake, stop the machine, return the directional lever to the neutral position, then stop the engine.
3. Press the parking brake switch to the ON position, release the brake pedal slowly, and check that the machine is held in position.

**CHECK EFFECT OF WHEEL BRAKES**

Drive the machine at a speed of 20 km/h (12.4 mph) on a dry flat concrete road surface, and check that the stopping distance is less than 5 m (16.4 ft).

**CHECK SOUND OF HORN AND BACKUP ALARM****CHECK FLASHING OF LAMPS, CHECK FOR DIRT AND DAMAGE****CHECK ENGINE EXHAUST COLOR AND SOUND****CHECK OPERATIONS OF GAUGES****CHECK PLAY OF STEERING WHEEL, CHECK OPERATION OF STEERING****CHECK DIRECTION OF REAR VIEW MIRROR, CHECK FOR DIRT OR DAMAGE**

## OPERATION

### 12.1.3 ADJUSTMENT BEFORE OPERATION OPERATOR'S SEAT



#### WARNING

Park the machine in a safe place and stop the engine before adjusting seat. Adjust the seat before starting operations or when changing operators. Check that you can depress the brake pedal fully with your back against the seat backrest.

#### (1) Forward-backward adjustment

Pull lever (1) up, and move the seat to the desired position, then release the lever to lock in place.

Fore-and-aft adjustment: 120 mm (4.7 in)

#### (2) Adjusting seat angle

Pull lever (2) up and push down on the rear of the seat to tilt it backward. Push lever (2) down and push down on the front of the seat to tilt it forward.

Range of adjustment: 13

#### (3) Adjusting seat weight

Turn grip (3) to adjust the strength of the suspension.

Adjustment range: (Target) 50 kg - 120 kg (110.3 - 264.6 lb)

#### (4) Adjusting backrest angle

Move lever (4) and move the backrest to the front or rear.

Adjustment range: Front 24

#### (5) Seat height adjustment

Move lever (5) up/down, then move seat up or down as desired. Since the lever also is used for adjusting seat angle, set the seat to the desired height while adjusting the angle.

Adjustment range: 50 mm (2.36 in)

#### (6) Adjusting height of headrest

Move the headrest up and down to the desired height.

Adjustment range: 50 mm (1.96 in)

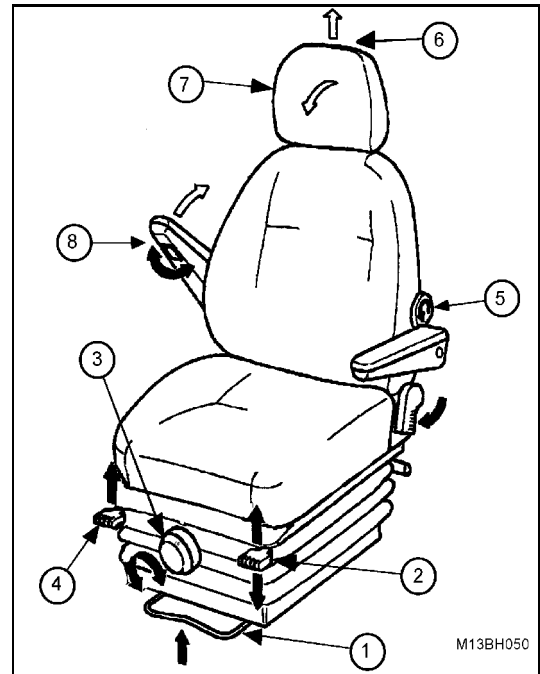
#### (7) Adjusting headrest angle

The headrest is adjustable through 60

#### (8) Angle of armrest

Adjust angle of armrest by rotating knob (5) (left side only).

Adjustment range: 30



M13BH050

## AIR RIDE SUSPENSION SEAT

The optional Air Ride Seat adds to the seat a suspension system with a built-in air compressor for added comfort over uneven terrain. Controls resemble those of the standard seat with a few exceptions.

### (1) Forward-backward adjustment

Pull lever (1) to release the seat and then slide the seat to a position that provides comfort and accessibility to controls.

### (2) Seat angle adjustment

Pull lever (2) up and push down on the rear of the seat to tilt it backwards. Push lever (2) down and push down on the front of the seat to tilt it forward. The settings can be changed independently to suit an operator's preference.

### (3) Weight adjustment

Knob (3) controls the air suspension system's air valve. Push or pull the knob to adjust the suspension's strength and compensate for operator weight and/or preference.

Adjustment range fore and aft: 120 mm (4.7 in.)

### (4) Height adjustment

Move lever (4) up/down, then move seat up or down as desired. The lever also is used for adjusting seat angle, so set the seat to the desired height while adjusting the angle: move lever 4 and tilt the backrest to the front or rear.

Height adjustment range: 60 mm (2.36 in.)

Backrest angle adjustment range: front (24

### (5) Lumbar support adjustment

Rotate knob (9) to increase or decrease support in the lumbar (lower back) area.

### (6) Adjusting height of headrest

Move the headrest up and down to the desired height.

Adjustment range: 50 mm (1.96 in)

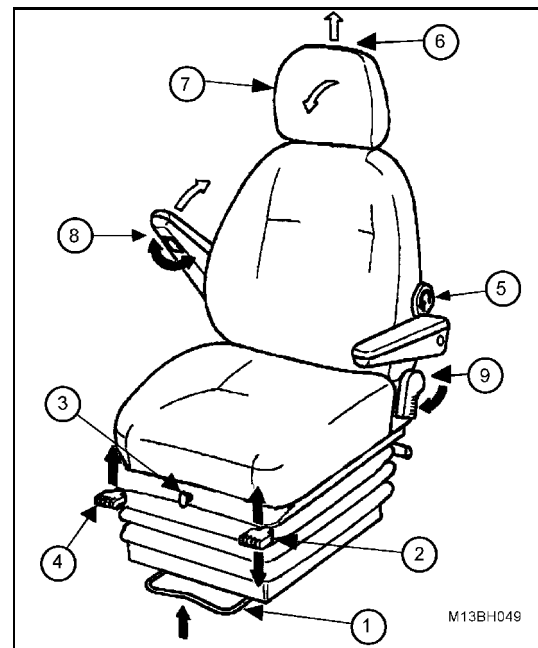
### (7) Adjusting headrest angle

The headrest is adjustable through 60

### (8) Armrest angle

Release the armrest with control (8) (left side) and move to the desired position. Armrest can be moved to vertical if necessary.

Adjustment range: 30



M13BH049

## OPERATION

### ADJUST SEAT BELT



#### WARNING

Before fitting the seat belt, check that there is no abnormality in the mounting bracket and mounting of the belt. If the belt is worn or damaged, replace it. Always fasten the seat belt before operations.

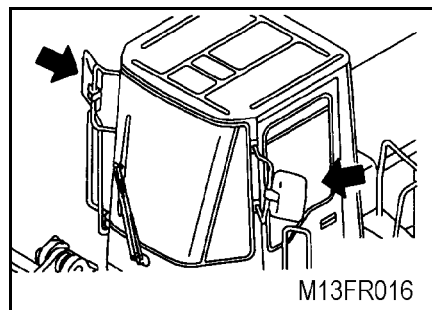
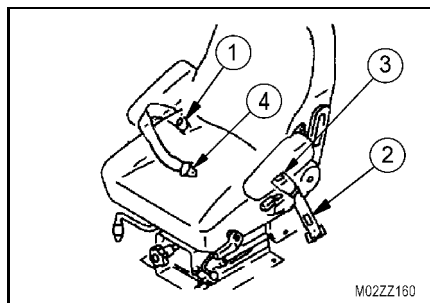
Always install a seat belt on machines equipped with ROPS.

#### Fastening and removing belt

1. Sit on the seat, depress the brake pedal fully, and adjust the seat so that your back is pressed against the backrest.
2. Sit on the seat, pull the tongue end of the seat belt from the retractor (1). Insert the tongue (4) into the buckle (3). Pull the belt to make sure it is securely locked.
3. To release the belt, press the release button on the buckle (3), and guide the tongue end of the belt into the retractor.

### ADJUST REAR VIEW MIRROR

Sit in the operator's seat and adjust the rear view mirror so that you can see properly to the rear.

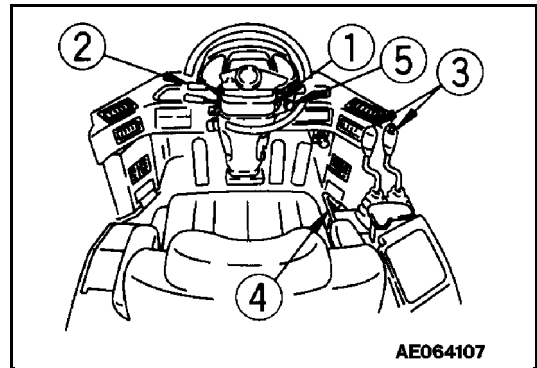


### 12.1.4 OPERATIONS AND CHECKS BEFORE STARTING ENGINE

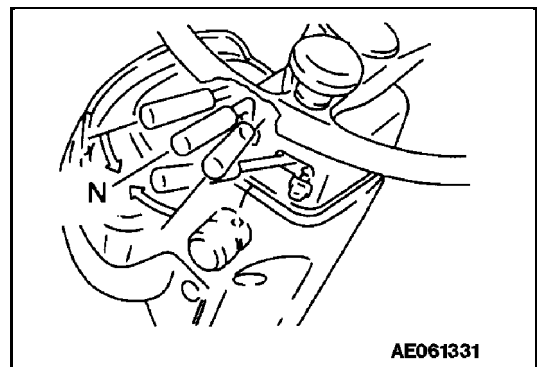
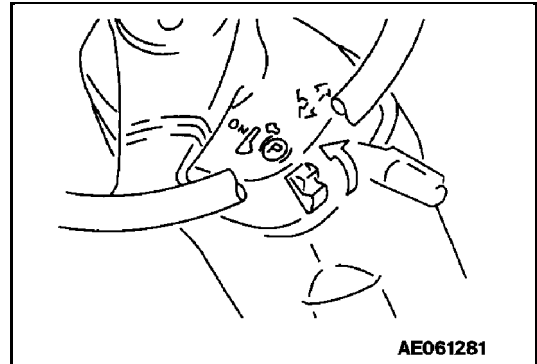
#### WARNING

If the control levers are touched by accident, the work equipment could move suddenly. When leaving the operators compartment, always set the safety lever securely to the LOCK position. Before starting the engine, use a damp cloth to wipe off the dust accumulated on the top surface of the battery or on the starting motor and alternator.

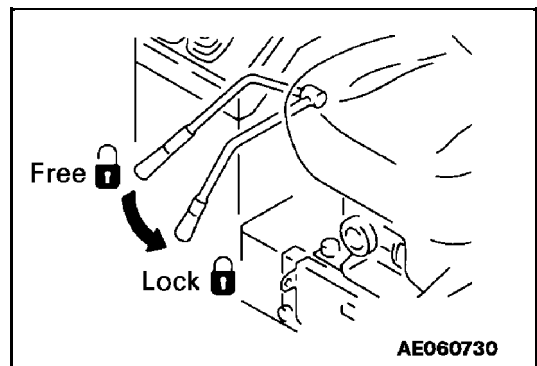
1. Check that parking brake switch (1) is at the ON position.



2. Check that directional lever (2) is at N position. The engine will not start if directional lever (2) is not at the N position.



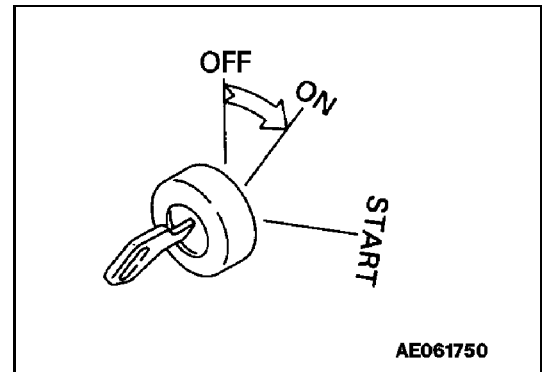
3. Lower the bucket to the ground, then check that work equipment control lever (3) is locked by safety lock (4).



## OPERATION

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4. Insert the key in starting switch (5), turn the key to the  $\text{ON}$  position, and check that the pilot lamp lights up.





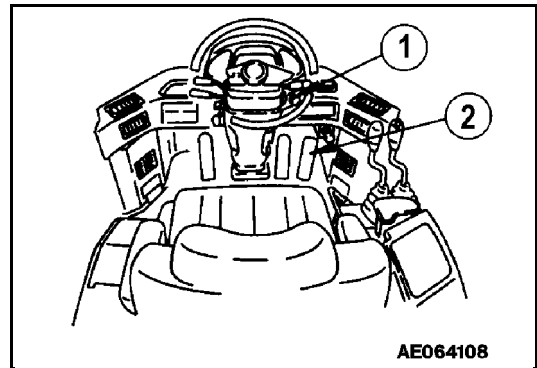
## 12.2 STARTING ENGINE

**WARNING**

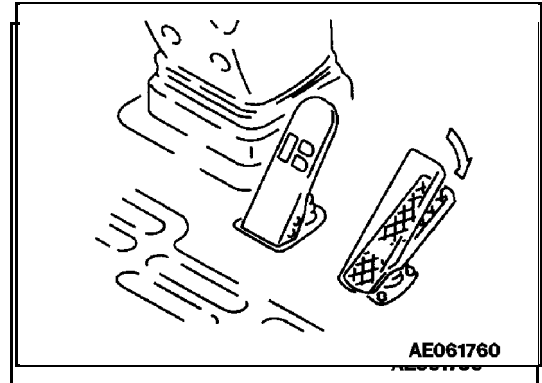
Check that there are no persons or obstacles in the surrounding area, then sound the horn and start the engine.

**NOTE:** Do not operate the starting motor continuously for more than 20 seconds.  
If the engine will not start, wait for at least two minutes before trying to start the engine again.

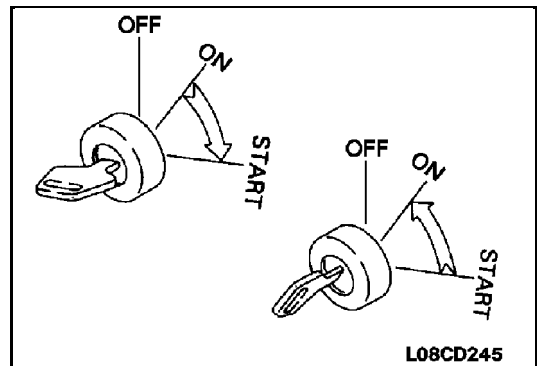
1. Turn the key in the starting switch (1) to the ON position.



2. Depress accelerator pedal (2) lightly.



3. Turn the key in starting switch (1) to the START position to start the engine.
4. When engine starts, release the starting switch key and the switch will return automatically to ON.



## OPERATION

### 12.2.1 COLD WEATHER STARTING

#### **WARNING**

Use the ether start switch only when starting engine.  
Keep sparks and flames away from the ether cylinder. Never throw a cylinder in fire.  
Never drill a hole in the cylinder.  
Do not store a cylinder where temperature rises over 40 (104 F).  
Avoid personal contact with ether gas.  
Keep cylinder out of reach of children.  
**NEVER** use ether together with air intake preheating device.

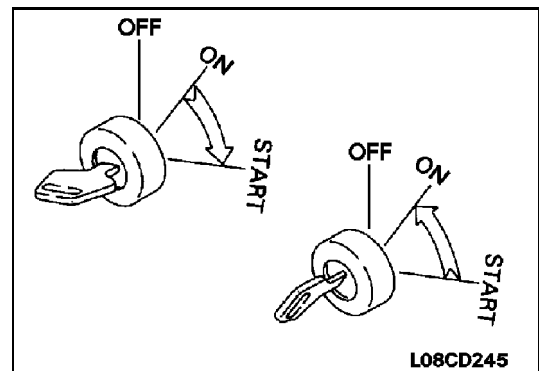
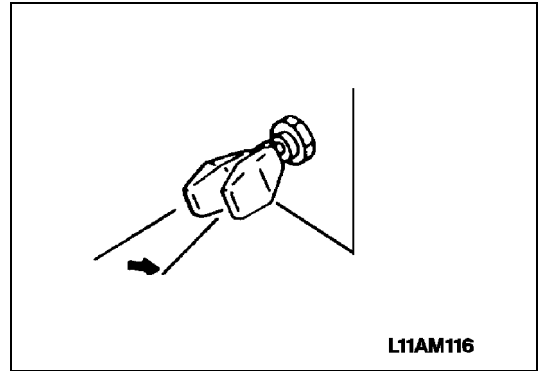
**NOTE:** The ether cylinder holds enough for about 230 uses.  
(Amount of ether injected: 3 cc, total capacity for one cylinder: 710 cc)

Remove the ether cylinder when it is unnecessary (warm weather) and store in a safe place. When ambient temperature is below -25 (-13 e temperature is normal.

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

1. Turn the key in the starting switch (1) to the ON position.
2. Do not depress accelerator pedal. (Keep your foot off the throttle.)
3. Turn key to the START position to start the engine.
4. Move ether start switch (2) to the ON position, then release it immediately. **DO NOT** hold it at the on position for more than five seconds. This will cause failure of the ether start valve solenoid.

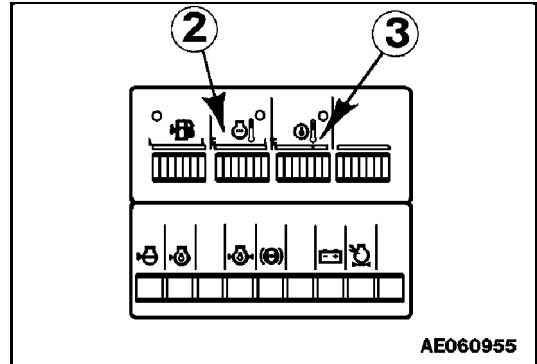
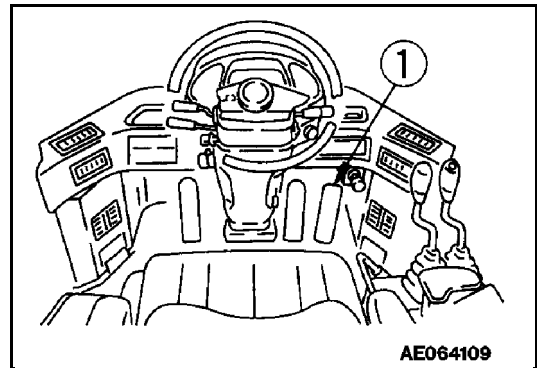
**NOTE:** If the engine does not start, repeat this 2-3 times. Then if it doesn't start wait 2 minutes before trying again.



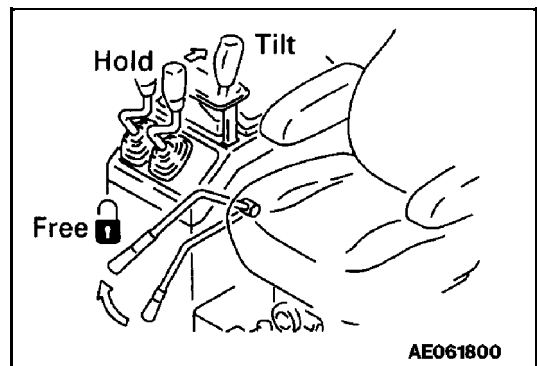
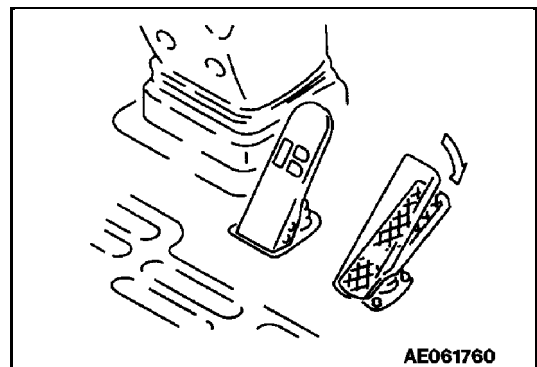
### 12.3 OPERATIONS AND CHECKS AFTER STARTING ENGINE

After starting the engine, do not immediately start work. Carry out the following operations and checks.

**NOTE:** Do not suddenly accelerate the engine before the warming-up operation is completed.  
Do not run the engine at low idle or high idle continuously for more than 20 minutes. If running the engine at idle can't be avoided, apply load from time to time or run the engine at mid-range speed.



1. Depress accelerator pedal lightly and run the engine with no load at mid-range for about 5 minutes.
2. To warm up the hydraulic oil in cold areas, do as follows. During the warming-up operation, check that the engine rotation is smooth, then set the safety lock of the work equipment control lever to the FREE position and move the bucket control lever in and out of TILT position to warm up the hydraulic oil. The relief time at the tilt position should be a maximum of 10 seconds. With this operation, the oil will reach the relief pressure and will warm up more quickly.
3. After the warming-up operation, check for normal gauge and caution lamps readings. If there is any abnormality, carry out repair. Run the engine under a light load until engine water temperature gauge (2) and the torque converter oil gauge (3) are in the green range.
4. Check that there is no abnormality in the exhaust color, sound or vibration. If there is any abnormality, carry out repairs.



## OPERATION

### 12.4 MOVING MACHINE

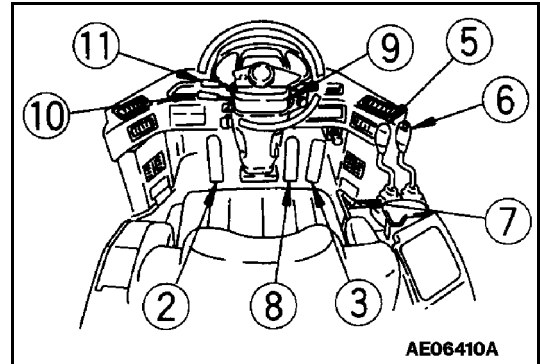
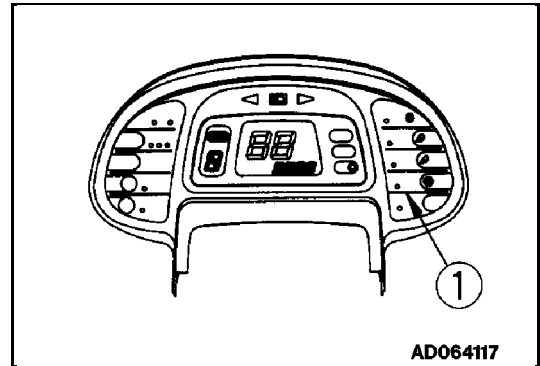
#### WARNING

When moving the machine, check that the area around the machine is safe, then sound the horn before starting. Do not allow people near the machine.

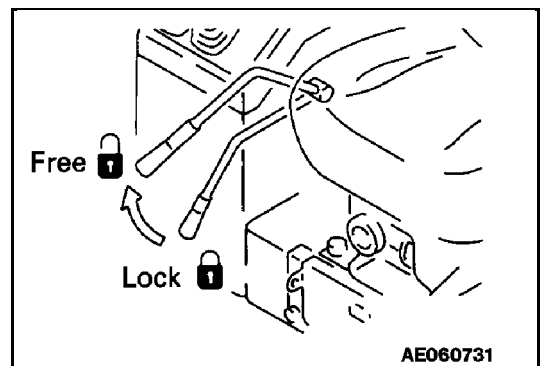
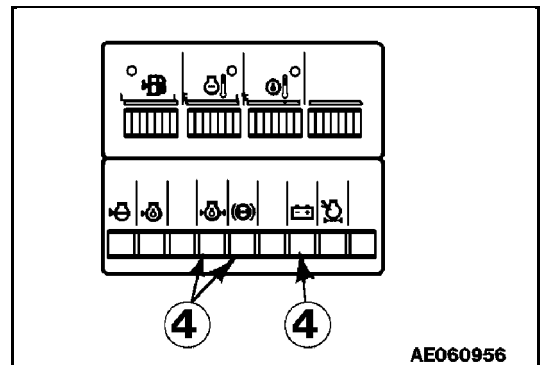
The engine cover partially obscures view to the rear, so be particularly careful when traveling in reverse.

When starting the machine on slopes, set transmission cut-off switch (1) to the OFF position, depress left brake pedal (2) while depressing accelerator pedal (3), then gradually release left brake pedal (2) to allow the machine to start.

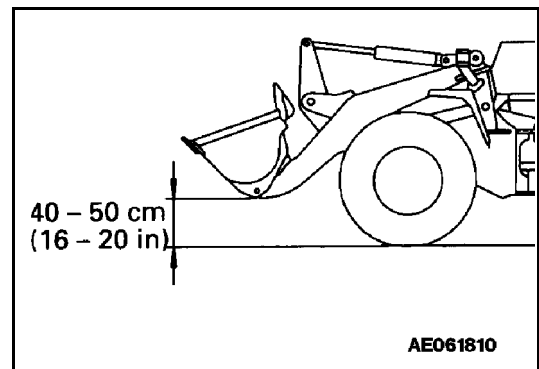
1. Check that caution pilot lamp (4) is not lit.



2. Set safety lock (7) of bucket control lever (5) and lift arm control lever (6) to the FREE position.



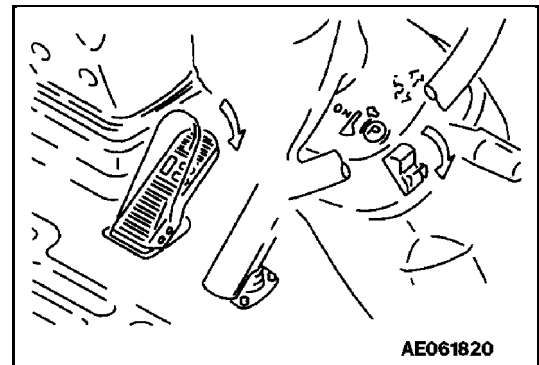
- Operate lift arm control lever (6) to set the work equipment to the travel posture shown in the diagram.



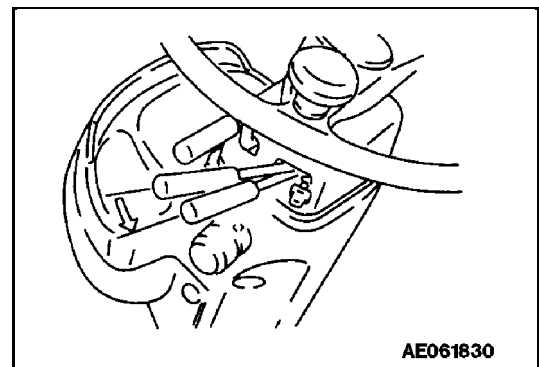
- Depress right brake pedal (8) and turn parking switch (9) to the OFF (RELEASE) position to release the parking brake. Keep right brake pedal (8) depressed.

**REMARKS:**

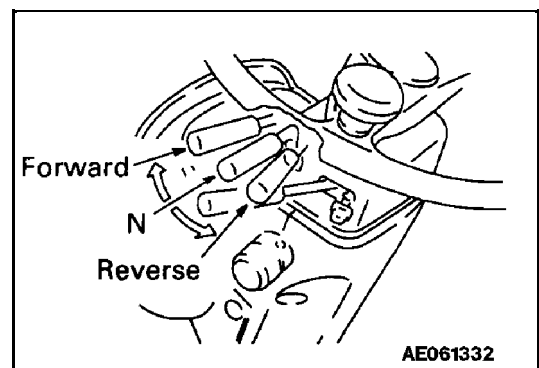
If the parking brake is still actuated when parking brake switch (9) is at the OFF (RELEASE) position, turn the parking brake ON, then turn it OFF again.



- Set speed control lever (10) to the desired position.



- Set directional lever (11) to the desired position.
- Release right brake pedal (8) then depress accelerator pedal (3) to move the machine.



## OPERATION

### 12.5 CHANGING GEARS

#### WARNING

When traveling at high speed, do not change the gear speed suddenly. When shifting gears, use the brake to reduce the travel speed, then shift gears.

Shift gears as follows.

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

Only 1st or 2nd speeds are used for digging and loading operations, so actuate speed control lever stopper.

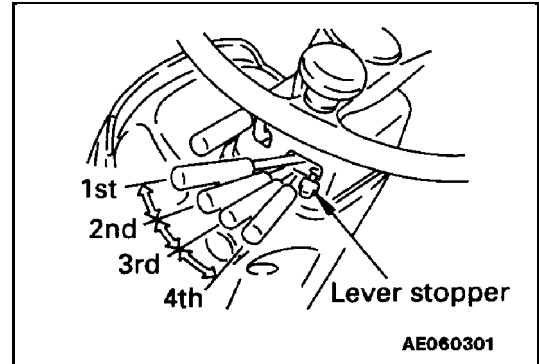
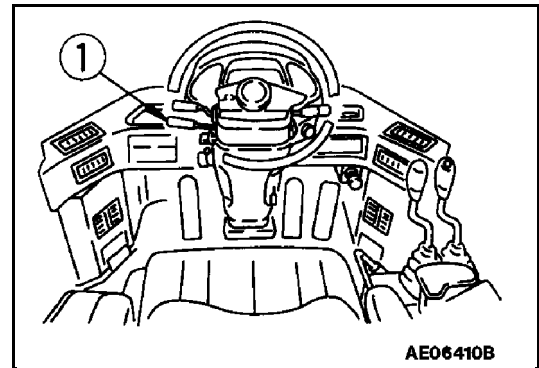
#### REMARKS:

This machine is equipped with a kickdown switch that shifts the gear down to 1st if the button at the tip of the lift arm control lever is pushed when the machine is traveling in 2nd gear.

We recommend the use of the kickdown switch when digging or loading in 1st or 2nd gear.

For details, see “? EXPLANATION OF COMPONENTS” on page ?-?.

**NOTE:** The system allows two seconds for a typical shift lever movement. The main monitor will display “E03+CALL” error message if the shift lever has been positioned between detent positions or moved too slowly.



### 12.6 CHANGING DIRECTION

#### WARNING

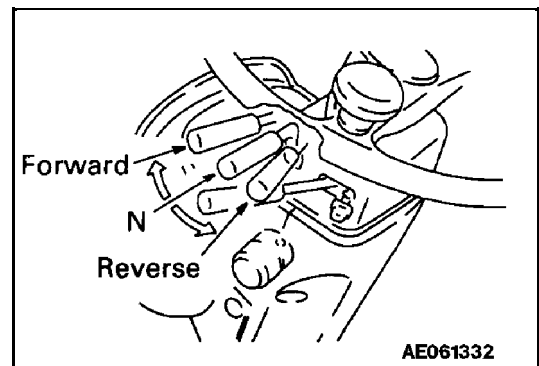
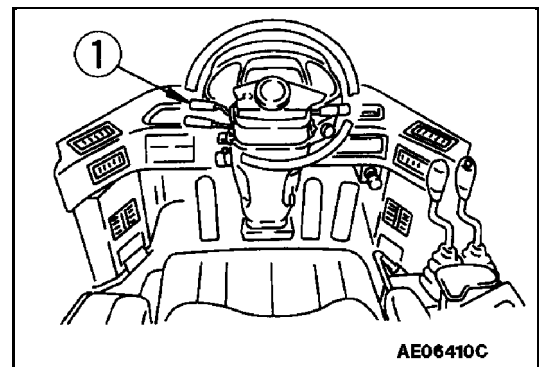
When changing direction between FORWARD and REVERSE, check that the new direction of travel is safe. There is a blind spot behind the machine, so be particularly careful when changing direction to travel in reverse. Do not switch between FORWARD and REVERSE when traveling at high speed.

When switching between FORWARD and REVERSE, depress the brake to reduce the travel speed sufficiently, then change the direction of travel.

(Max. speed for changing direction: 12 km/h (7.5 mph))

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

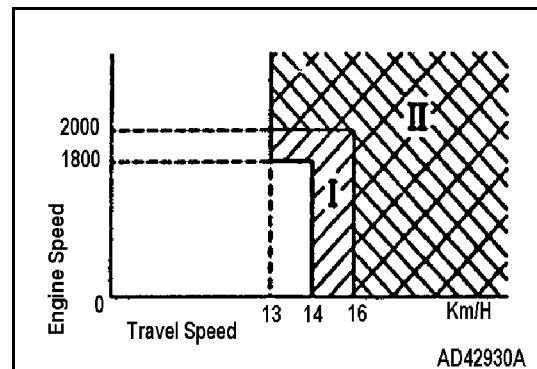
Place directional lever (1) in the desired position.



## AUTO-SHIFT TRANSMISSION

An alarm sounds when changing direction with the machine moving. Depress the brake pedal to reduce travel speed before changing direction.

The warning alarm will sound if engine and travel speed are as shown in "Area II" on the chart. The alarm sounds for three seconds if the engine speed and travel speed are as shown in "Area I" on the chart. Direction changes for this condition are F3 to R3, F4 to R4, R3 to F3 and R4 to F4.



## 12.7 TURNING

### WARNING

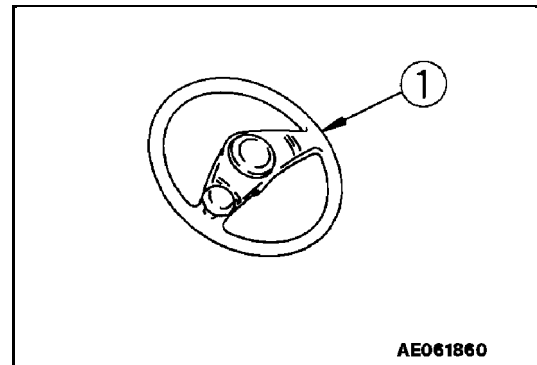
**Turning the machine suddenly at high speed or on a steep hill can cause loss of control.**

**If the engine quits while the machine is traveling, the steering wheel becomes heavy and hard to turn, so avoid killing the engine. This is particularly dangerous on hills, so never stop the engine while the machine is traveling. If the engine quits, stop the machine immediately at a safe place.**

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

With the articulated chassis, the front frame is joined to the rear frame at the center of the machine by the center pin. The front and rear frames pivot 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 force it beyond the end of the stroke.



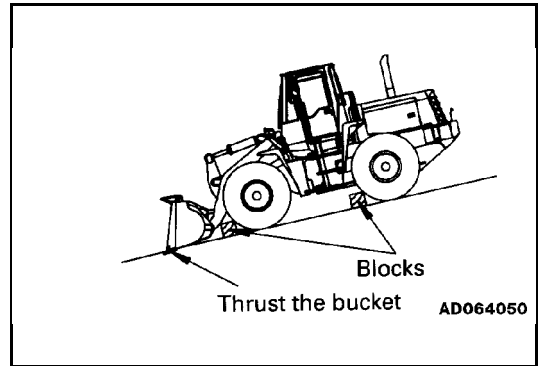
## OPERATION

### 12.8 STOPPING MACHINE

#### WARNING

Avoid stopping suddenly. Allow ample room when stopping.

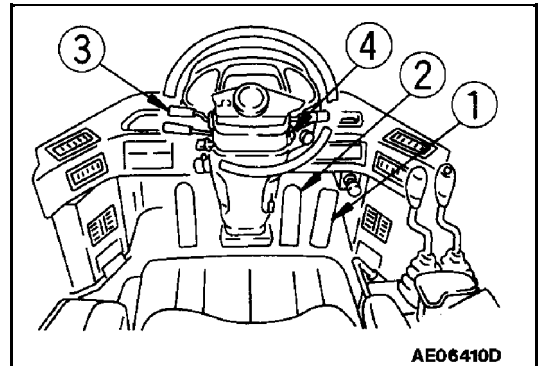
Do not park the machine on slopes. If the machine has to be parked on a slope, set it facing directly down the slope, then dig the bucket into the ground and put blocks under the tires to prevent the machine from moving.



#### WARNING

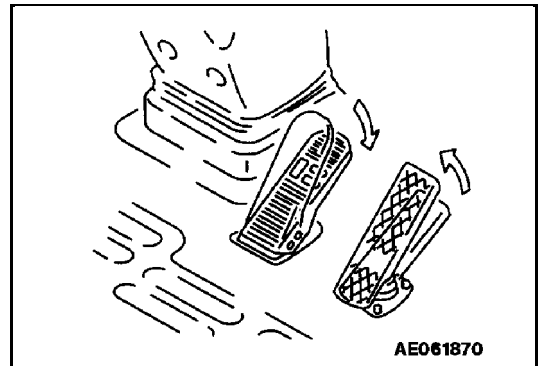
If the control lever is touched by accident, the work equipment or the machine could move suddenly, and cause a serious accident. Before leaving the operators seat always set the safety lock lever securely to the LOCK position.

Even if the parking brake switch is turned ON, for safety precaution keep the brake pedal depressed until the pilot lamps lights up.

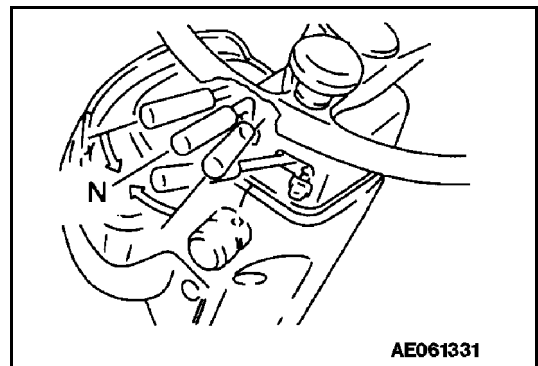


**NOTE:** Never use the parking brake switch to brake the machine when traveling except in an emergency. Apply the parking brake only after the machine has stopped.

1. Release accelerator pedal (1), and depress brake pedal (2) to stop the machine.



2. Place directional lever (3) in N (neutral).

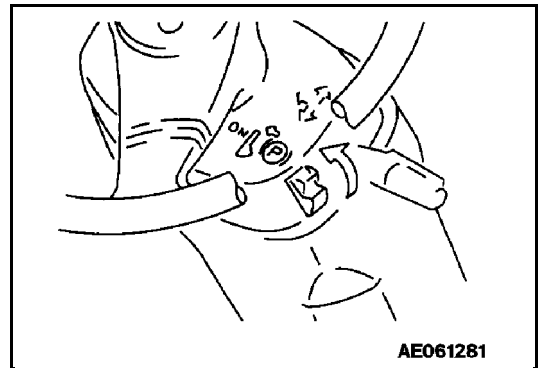




3. Turn parking brake switch (4) to ON to apply the parking brake.

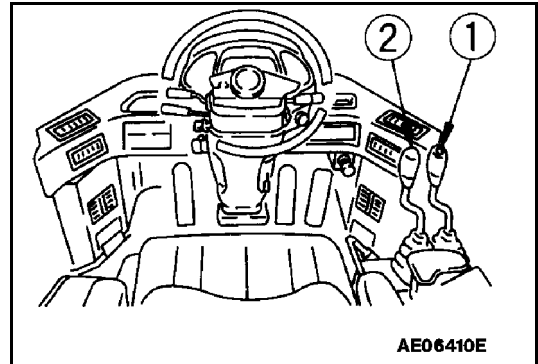
**REMARKS:**

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



**12.9 OPERATION OF WORK EQUIPMENT**  
**12.9.1 STANDARD WORK EQUIPMENT CONTROLS**

Lift arm control lever (1) and bucket control lever (2) can be used to operate the lift arm and bucket as follows.

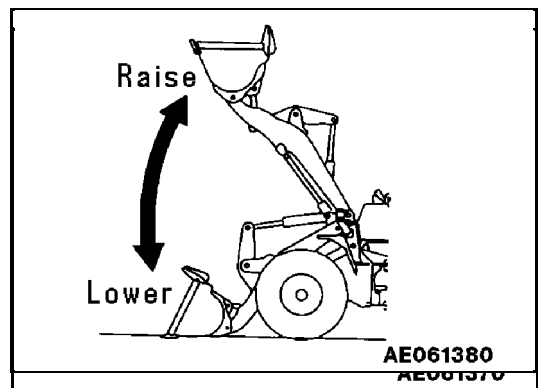


**LIFT ARM OPERATION (LEVER (1))**

- (1) RAISE ( ): The lift arm is raised.
- (2) HOLD ( ): The lift arm is kept in the same position.
- (3) LOWER ( )
- (4) FLOAT ( ): The lift arm moves freely under external force.




When the lift arm control lever is pulled further from the raise position, the lever is stopped in this position until the lift arm reaches the preset kick-out position, and the lever is returned to hold position.

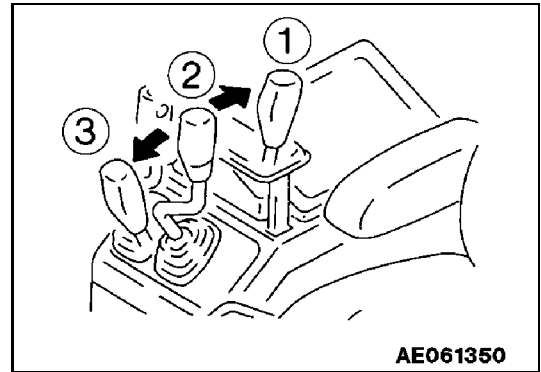
**NOTE: Do not use the FLOAT position when lowering the bucket.**



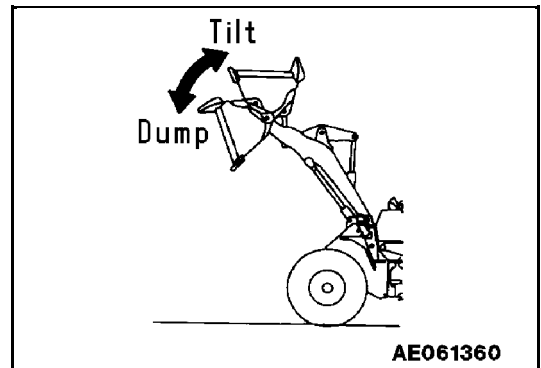
## OPERATION

### BUCKET OPERATION (LEVER (2))

- (1) TILT (  ):
- (2) HOLD (  ): The bucket is kept in the same position.
- (3) DUMP (  )

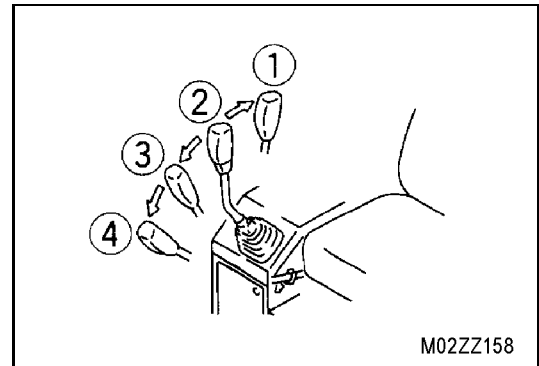


When the bucket control lever is pulled further from the tilt position, the lever is stopped in this position until the bucket reaches the preset position of the positioner, and the lever is returned to the hold position.







### 12.9.2 MONO LEVER WORK EQUIPMENT CONTROLS

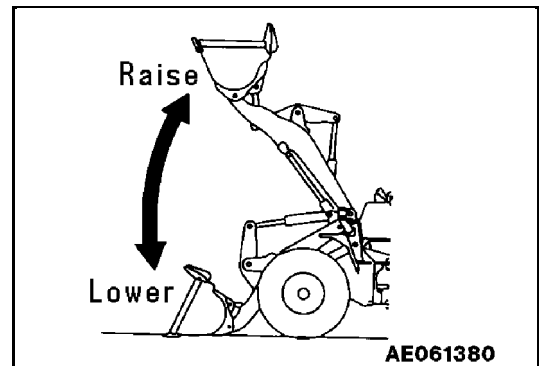
With the optional mono lever controls, work equipment lever (1) can be used to operate the lift arm and bucket as follows.



M02ZZ158

#### LIFT ARM OPERATION (LEVER (1))

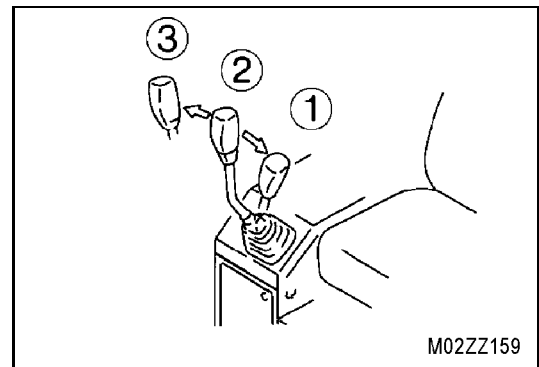
- (1) RAISE (  ): The lift arm is raised.
- (2) HOLD (  ): The lift arm is kept in the same position.
- (3) LOWER (  )
- (4) FLOAT (  ): The lift arm moves freely under external force.



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


When the lift arm control lever is pulled further from the raise position, the lever is stopped in this position until the lift arm reaches the preset kick-out position, and the lever is returned to the hold position.

**NOTE: Do not use the FLOAT position when lowering the bucket.**

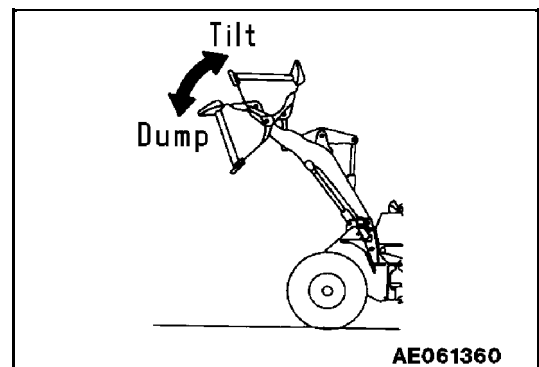


M02ZZ159

#### BUCKET OPERATION (LEVER (2))

- (1) TILT (  ):
- (2) HOLD (  ): The bucket is kept in the same position.
- (3) DUMP (  )

When the bucket control lever is pulled further from the tilt position, the lever is stopped in this position until the bucket reaches the preset position of the positioner, and the lever is returned to the hold position.



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## OPERATION

### 12.10 WORK POSSIBLE USING WHEEL LOADER

In addition to the following, it is possible to further increase the range of applications by using various attachments.

#### 12.10.1 DIGGING OPERATIONS



#### WARNING

Always set the machine facing directly to the front when carrying out digging or scooping operations. Never carry out these operations with the machine articulated.

**NOTE:** If the tires slip, the life of the tire will be reduced, so avoid slipping or spinning the tires when operating the machine.

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

Always keep the job site flat, and remove fallen rocks.

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

1. When driving forward and lowering the bucket, stop the bucket about 30 cm (12 in) from the ground, then lower it slowly.

#### REMARKS:

If the bucket hits the ground, the front wheels will raise up, and the tires will slip.

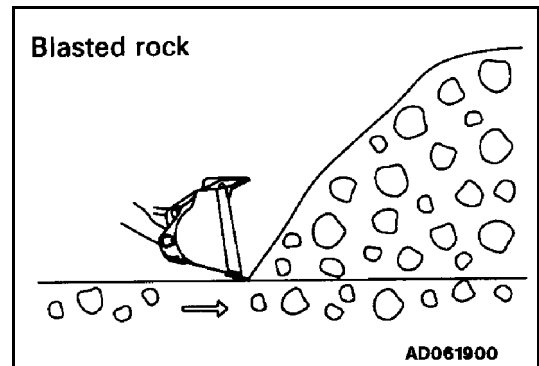
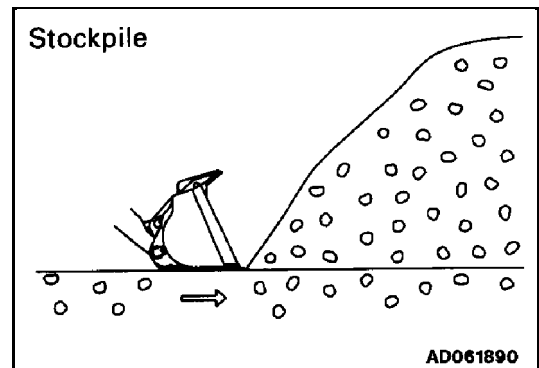
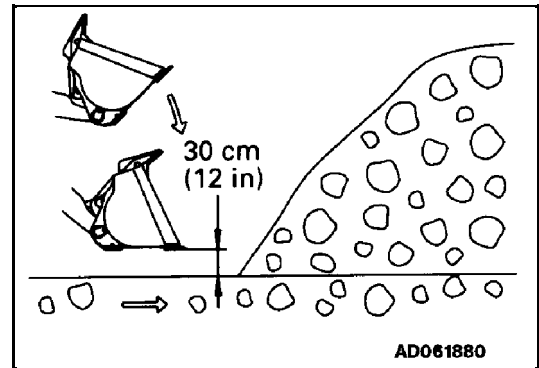
2. Shift down immediately in front of the material to be loaded. When completing the shift down, depress the accelerator pedal at the same time and thrust the bucket into the load.

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

Be careful not to get blasted rock under the bucket. The front tires can lift off the ground and slip.

Try to keep the load balanced in the center of the bucket.

4. When thrusting the bucket into the material, also 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.

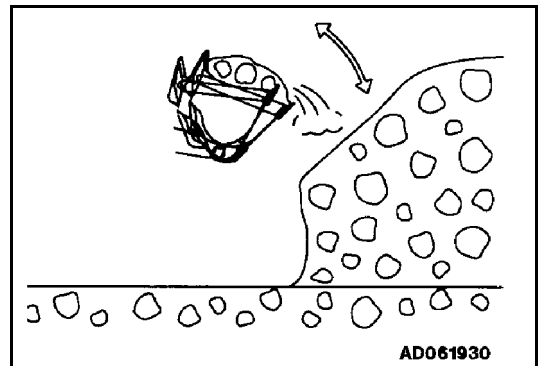
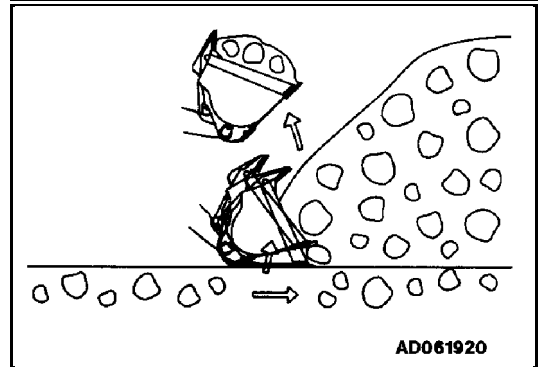
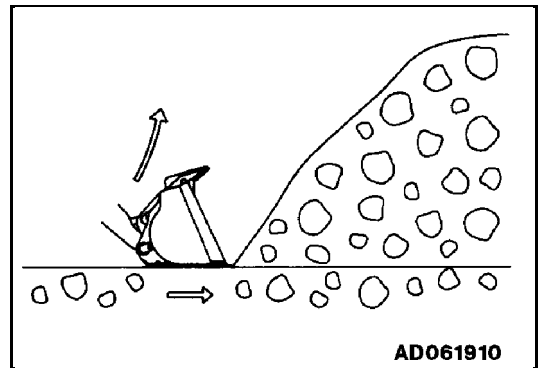


5. Check that there is enough material loaded into the bucket, then operate the bucket control lever to tilt the bucket and load the bucket fully.

**REMARKS:**

If the bucket edge is moved up and down while pushing in the bucket and digging, the front wheels could raise up and allow the tires to slip.

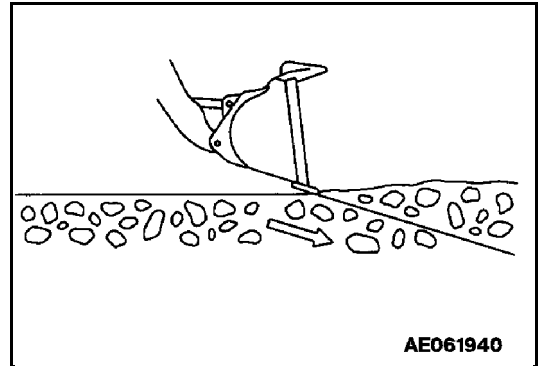
6. If there is too much material loaded in the bucket, tilt and dump the bucket quickly to remove excessive load. This prevents spillage of the load during hauling.



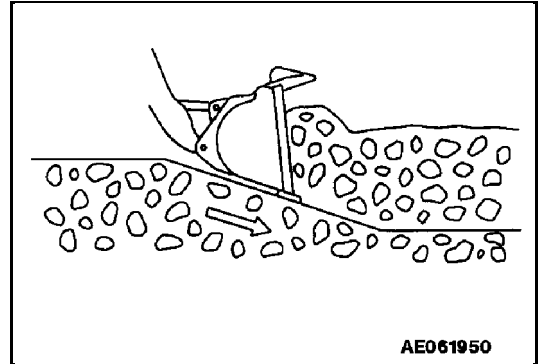
## OPERATION

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 unbalance load. This operation should be carried out in first gear.

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

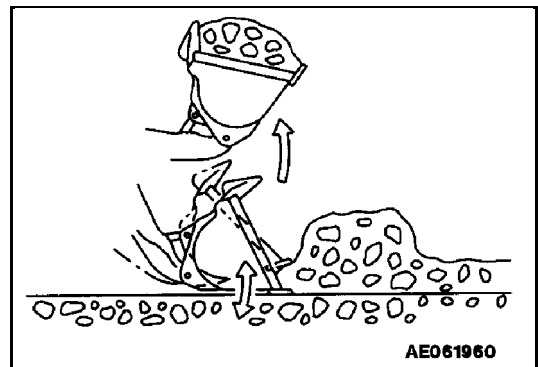


2. Drive the machine forward and operate the lift arm control lever forward to cut a thin layer of the surface each time when excavating soil.



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

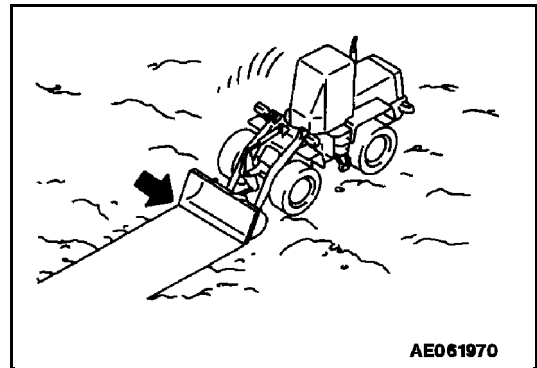
When digging with the bucket, avoid imposing the digging force onto only one side of the bucket.



### 12.10.2 LEVELING OPERATIONS

**NOTE:** Always operate the machine in reverse when carrying out leveling operations.  
If it is necessary to carry out leveling operations when traveling forward, do not set the bucket dumping angle to more than 20 degrees.

1. Scoop soil into 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 backwards.



### 12.10.3 PUSHING OPERATION

**NOTE:** Never set the bucket to the DUMP position when carrying out pushing operation.

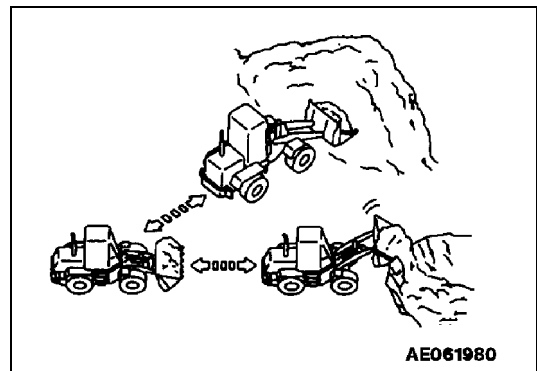
When carrying out pushing operations, set the bottom of the bucket parallel to the ground surface.

### 12.10.4 LOAD AND CARRY OPERATIONS

#### **WARNING**

**When carrying a load, lower the bucket to lower the center of gravity when traveling.**

The load and carry method for wheel loaders consist of a cycle of scooping - hauling - loading (into a hopper, pit etc.) Always keep the travel path maintained.  
When using the load and carry method, SEE "12.18 HANDLING TIRES" on page 2-70.



## OPERATION

### 12.10.5 LOADING OPERATIONS

Select the method of operation which will give the minimum amount of turning and travel and provide the most efficient method for the job site.

#### WARNING

Always keep the working area flat.  
Turning or applying the brake suddenly when traveling with a raised load can lead to loss of control.  
It is also dangerous to drive the bucket at high speed into a stockpile or pile of rocks.

**NOTE:** If the tires slip, the tire life will be reduced, so avoid slipping or spinning of the tires during operation.  
Avoid excessive shaking of the bucket.

#### CROSS DRIVE LOADING

Always set the wheel loader facing at a right angle to the stock pile. After digging in and scooping up the load, drive the machine straight back in reverse, then bring the dump truck in between the stock pile and the wheel loader.

This method requires the least time for loading, and is extremely effective in reducing the cycle time.

#### V-SHAPE LOADING

Position the dump truck so that the direction of approach of the wheel loader is approximately 60° the stockpile. After loading the bucket, drive the wheel loader in reverse, then turn it to face the dump truck and travel forward to load the dump truck.

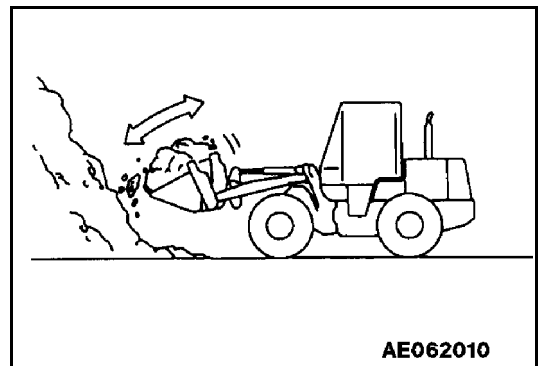
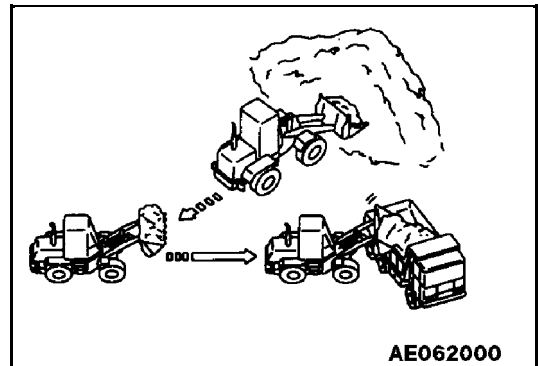
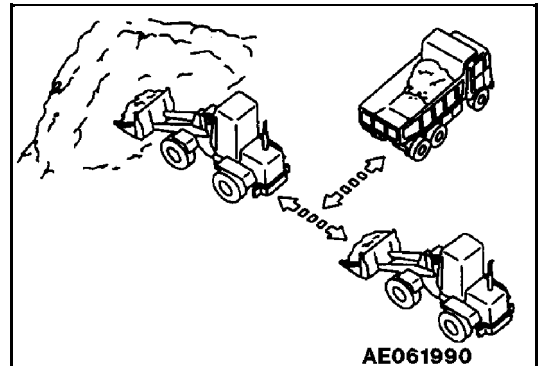
The smaller the turning angle of the wheel loader is, the more efficient the operation becomes.

When loading a full bucket and raising it to maximum height, first shake the bucket to stabilize the load before raising the bucket. This will prevent the load from spilling to the rear.

#### Precautions when piling up loads

When forming products into a pile, be careful not to let the rear counterweight come into contact with the ground.

Do not set the bucket to the DUMP position when carrying out piling-up operations.





## 12.11 PRECAUTIONS FOR OPERATION

### 12.11.1 PERMISSIBLE WATER DEPTH

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.

### 12.11.2 IF WHEEL BRAKE DOES NOT WORK

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

**NOTE:** If the parking brake has been used as an emergency brake, contact your distributor to have the parking brake checked for any abnormality.

### 12.11.3 PRECAUTIONS WHEN DRIVING UP OR DOWN SLOPES

#### LOWER THE CENTER OF GRAVITY BEFORE 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

The brakes may overheat and be damaged if used too frequently when traveling downhill. Shift down to a lower range and make full use of the braking force of the engine.

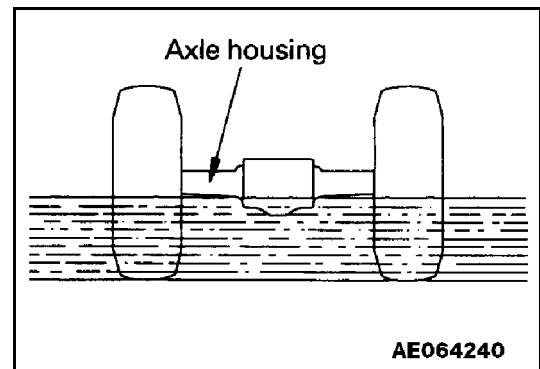
When braking use the right brake pedal.

The torque converter oil may overheat if the speed control lever is not placed in a proper speed position. 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.)



## OPERATION

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### 12.11.4 PRECAUTIONS WHEN DRIVING MACHINE

Traveling at high speed for a long distance causes the tires to become extremely hot, accelerating wear. Avoid high speeds as much as possible. If the machine must be driven for a long distance, take the following precautions.

Follow the applicable government regulations relating to this machine, and drive carefully.

Before driving the machine, carry out the checks before starting.

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 and rear): 2.8 kg/cm<sup>2</sup> (39.8 psi)

Speed: 14 km/h (8.7 mph)

Check the tire pressure before starting, when the tires are 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 bucket empty.

Never put dry ballast in tires when traveling.

## 12.12 ADJUSTING WORK EQUIPMENT POSTURE

### WARNING

Stop the machine on flat ground and put blocks in front and behind the wheels.  
 Apply the parking brake.  
 Secure the front and rear frames with safety bar.  
 Never go under the work equipment when the arm is raised.

The boom kickout allows setting the bucket to automatically stop at the desired lifting height (lift arm higher than horizontal) and the bucket positioner sets the bucket to stop automatically at the desired digging angle.

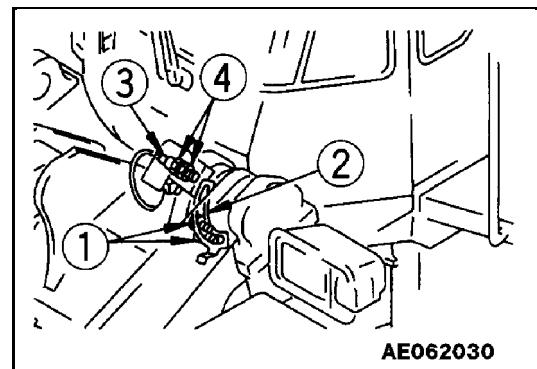
The setting can be adjusted to match the working conditions.

### 12.12.1 ADJUSTING BOOM KICKOUT

1. Raise the bucket to the desired height, set the lift arm 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 nuts to the plate in position.
3. Loosen two nuts (4) to make clearance of 3 to 5 mm (0.12 to 0.20 in) between plate (2) and the sensing surface of proximity switch (3). Then tighten the nuts to hold in position.

Tightening torque:  $17.2 \pm 2.5$  N

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.



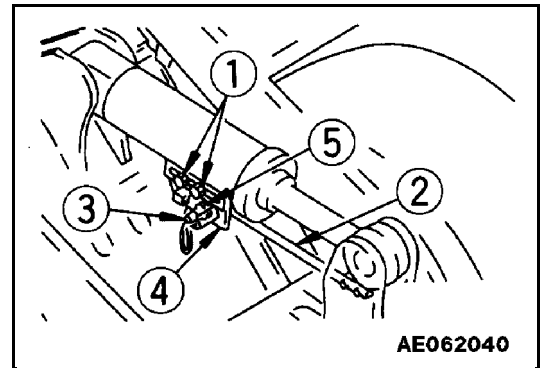
## OPERATION

### 12.12.2 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 the proximity switch (3). Then tighten the bolts to hold the bracket in position.
3. Loosen two nuts (5) and adjust to make a clearance of 3 to 5 mm (0.12 to 0.20 in) between bar (2) and the sensing surface of the proximity switch (3). Then tighten the nuts to hold in position.

Tightening torque:  $17.2 \pm 2.5$  N

4. 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.

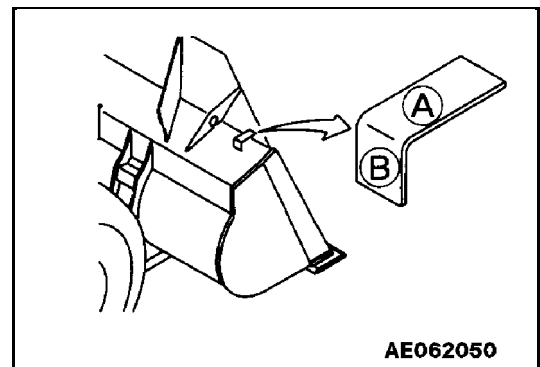


### 12.12.3 BUCKET LEVEL INDICATOR

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

(A): Parallel with cutting edge

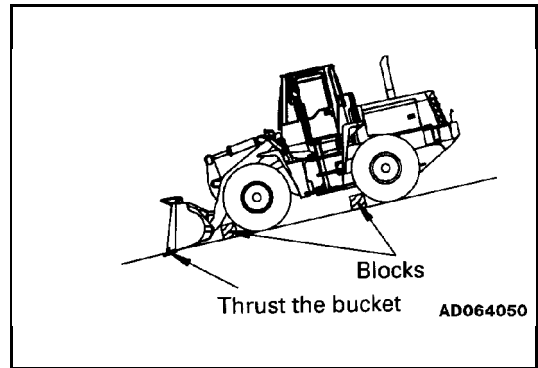
(B): 90



### 12.13 PARKING MACHINE

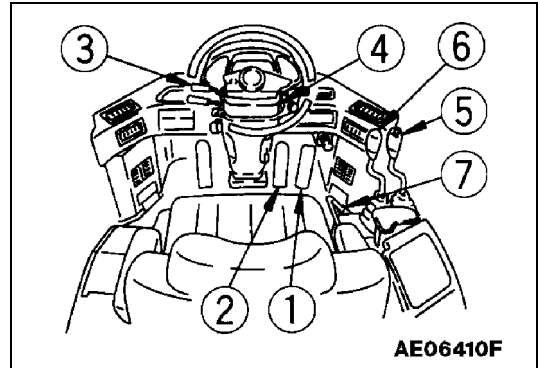
**⚠ WARNING**

Avoid stopping suddenly. Allow ample room when stopping.  
 Do not park the machine on slopes. If the machine has to be parked on a slope, set it facing directly down the slope, then dig the bucket into the ground and put blocks under the tires to prevent the machine from moving.



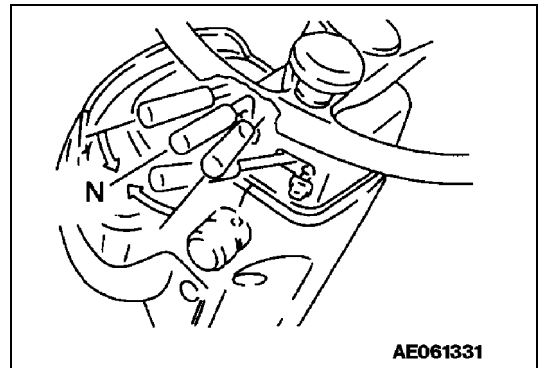
**⚠ WARNING**

If a control lever is touched by accident, the work equipment or the machine could move suddenly, and cause a serious accident. Before leaving the operators seat always set the safety lock lever securely to the LOCK position.  
 Even if the parking brake switch is turned ON, for safety precaution keep the brake pedal depressed until the pilot lamps lights up.



**NOTE:** Never use the parking brake switch to brake the machine when traveling except in an emergency. Apply the parking only after the machine has stopped.

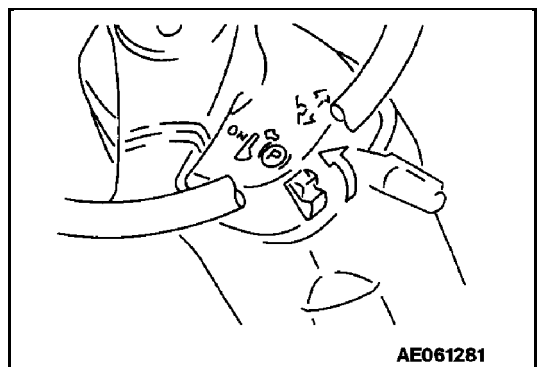
1. Release accelerator pedal (1), and depress brake pedal (2) to stop the machine.
2. Place directional lever (3) in N (neutral).



3. Turn parking brake switch (4) to ON to apply the parking brake.

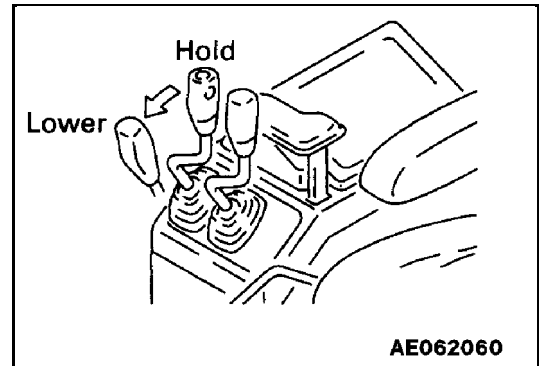
**REMARKS:**

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

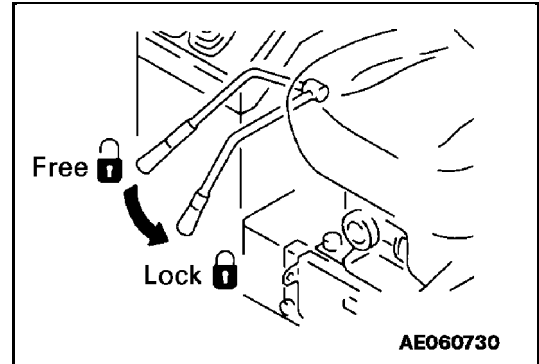


## OPERATION

- Operate lift arm control lever (5) to lower the bucket to the ground.



- Lock lift arm control lever (5) and bucket control lever (6) with safety lock (7).



### 12.14 CHECKS AFTER COMPLETION OF OPERATION

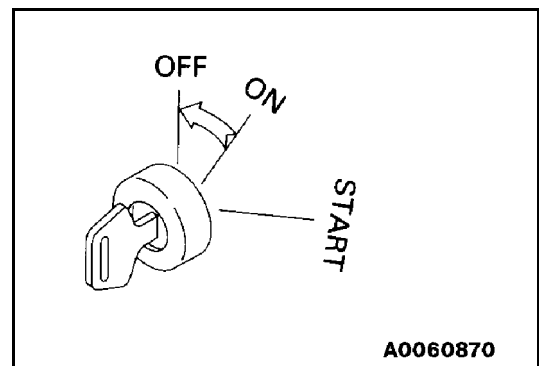
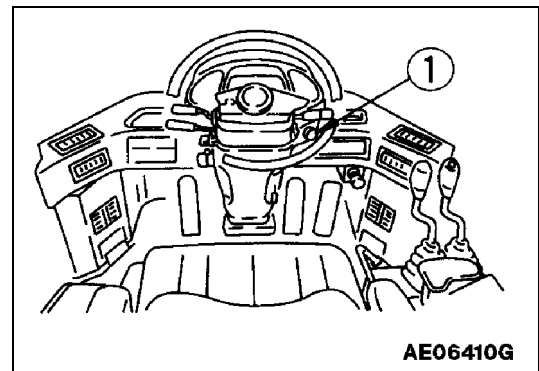
Check the engine water temperature, engine oil pressure, torque converter oil temperature, and fuel level with the meter and lamps. If the engine has overheated, do not stop suddenly. Run the engine at a mid-range speed to allow the engine to cool down before stopping it.

### 12.15 STOPPING ENGINE

**NOTE:** 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.

- Run the engine at low idle for about five minutes to allow it to gradually cool down.
- Turn key in starting switch (1) to the OFF position and stop the engine.
- Remove the key from starting switch (1).



### 12.16 CHECK AFTER STOPPING ENGINE

- Walk around the machine and check the work equipment, body work, and undercarriage, and check for oil and water

leaks. If there are any leaks or abnormalities found, carry out repairs.

2. Fill the fuel tank.
3. Remove any waste paper or leaves from inside the engine compartment. They could cause a fire.
4. Remove any mud from the undercarriage.

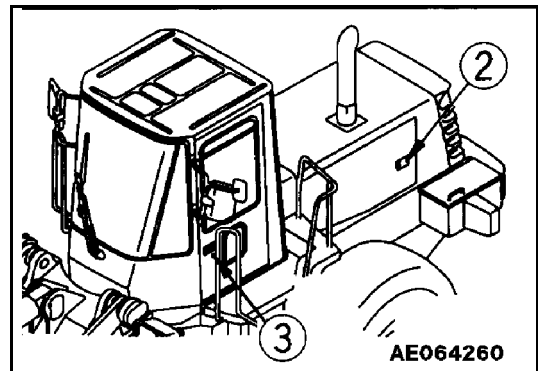
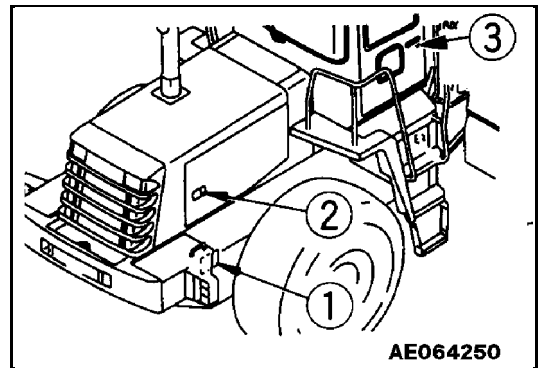
**12.17 LOCKING**

Always lock the following places.

- (1) Fuel tank filler cap
- (2) Engine side panel (left, right)
- (3) Cab door

**REMARKS:**

The starting switch key is used also for locks (1), (2), and (3).



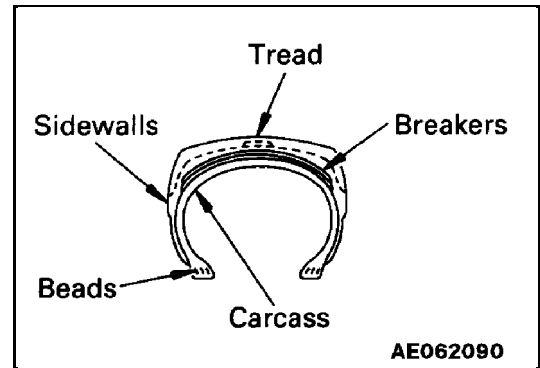
## OPERATION

### 12.18 HANDLING THE TIRES

#### 12.18.1 PRECAUTIONS WHEN HANDLING TIRES

Replace tires that show one or more of these defects.

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.

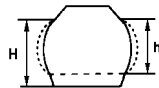


#### 12.18.2 TIRE PRESSURE

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

If the tire inflation pressure is too low, the tire will be overloaded; if it is too high, it will cause tire cuts and shock burst. To prevent these problems, adjust the tire inflation pressure according to the table on the next page.

$$\text{Deflection ratio} = \frac{H-h}{H} \times 100$$



As a guideline that can be checked visibly, the deflection ratio of the front tire (deflection/free height) is as follows.

When carrying normal load (lift arm horizontal): Approximately 15 - 25 %

When digging (rear wheels off ground): Approximately 25 - 35 %

When checking the tire inflation pressure, check also for small scratches or peeling of the tire, for nails or pieces of metal which may cause punctures, and for any abnormal wear.

Clearing fallen stones and rocks from the operating area and maintaining the surface will extend the life of the tires.

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 (operation 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 this table to give a suitable deflection (see deflection ratio).

Tire size (pattern)	Ply rating	Inflation pressure (kg/cm <sup>2</sup> )			
		Soft ground (sandy ground)	Normal road		When shipped from factory
			Stockpile	Digging	
20.5 - 25 (L3 Rock)	12	1.9 - 3.3	1.9 - 3.3	2.1 - 3.5	Front tire: 2.8
20.5 - 25 (L2 Traction)	12	1.9 - 3.3	1.9 - 3.3	2.1 - 3.5	Rear tire: 2.8
17.5 - 25 (L3 Rock)	12	2.4 - 3.5	2.4 - 3.5	2.9 - 3.5	Front tire: 3.0
17.5 - 25 (L2 Traction)	12	2.4 - 3.5	2.4 - 3.5	2.9 - 3.5	Rear tire: 3.0

Stockpile operations means the loading of sand and other loose materials.

**PRECAUTION WITH LOAD AND CARRY METHOD**

When traveling continuously with load and carry operations, choose the correct tires to match the operating conditions, or choose the operating conditions to match the tires. If this is not done, the tires could be damaged, so contact your distributor or tire dealer when selecting tires.

### 13. TRANSPORTATION

When transporting the machine, observe all the related laws and regulations, and always assure safety.

#### 13.1 LOADING, UNLOADING WORK



#### WARNING

Make sure the ramp has sufficient width, length and thickness to enable the machine to be safely loaded and unloaded.

When loading and unloading the machine, park the trailer on a flat firm roadbed. Keep a reasonable distance between the road shoulder and the machine.

Remove mud from the undercarriage and ramps to prevent the machine from slipping to the side on slopes.

Be sure the ramp surface is clean and free of grease, oil, ice and loose materials.

Never change the direction of travel when on the ramps. If it is necessary to change direction, drive off the ramp and correct the direction, then drive onto the ramp again.

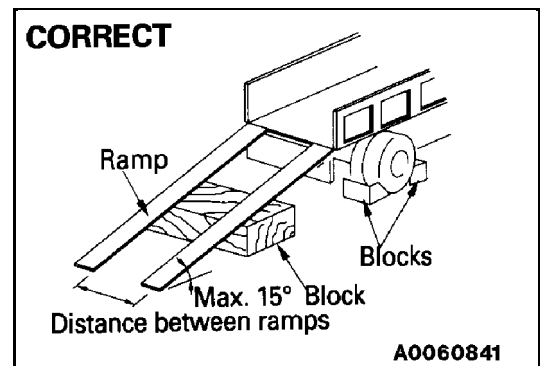
When loading or unloading, always use ramps or a platform and carry out the operation as follows.

1. Properly apply the brakes on the trailer and insert the blocks beneath the tires to ensure that it does not move. Then fix the ramps in line with the centers of the trailer and the machine. Be sure that the two sides are at the same level as one another.  
If the ramp sags appreciably, reinforce it with blocks etc.
2. Determine the direction of ramp, then slowly load or unload the machine.

#### REMARKS:

When transmission cut-off switch is set to Off, the left brake pedal and accelerator pedal are operated at the same time.

3. Correctly load the machine onto the specified part of the trailer.



### 13.2 PRECAUTIONS FOR LOADING

After loading the machine, secure it in place as follows.

1. Lower the work equipment slowly.
2. Apply the safety lock to lock all the control levers.
3. Turn the starting switch to the OFF position and stop the engine. Remove the key from the starting switch.
4. Lock front frame and rear frame with safety bar.
5. Block the wheels, and secure the machine with chains or rope to hold it stationary during transportation.
6. Fully retract the cab radio antenna.

### 13.3 PRECAUTIONS FOR TRANSPORTATION



#### WARNING

Consider the width, height and weight of the machine when choosing a route for transporting it.

Obey all the state and local laws governing the weight, width and length of the load. Observe all regulations governing wide loads and traffic.

### 13.4 LIFTING MACHINE



#### WARNING

Wire rope used to lift the machine must be fitted correctly or the machine may fall and cause death or serious injury to personnel and/or damage to equipment. Stop after a short lift (100-20 mm (3.9 - 7.9 in.)) and check that the machine is horizontal with no slack in the wire rope, then continue to lift the machine.

Before lifting the machine, stop the engine and lock the brakes.



#### WARNING

Lifting operations using a crane must be carried out by a qualified operator.

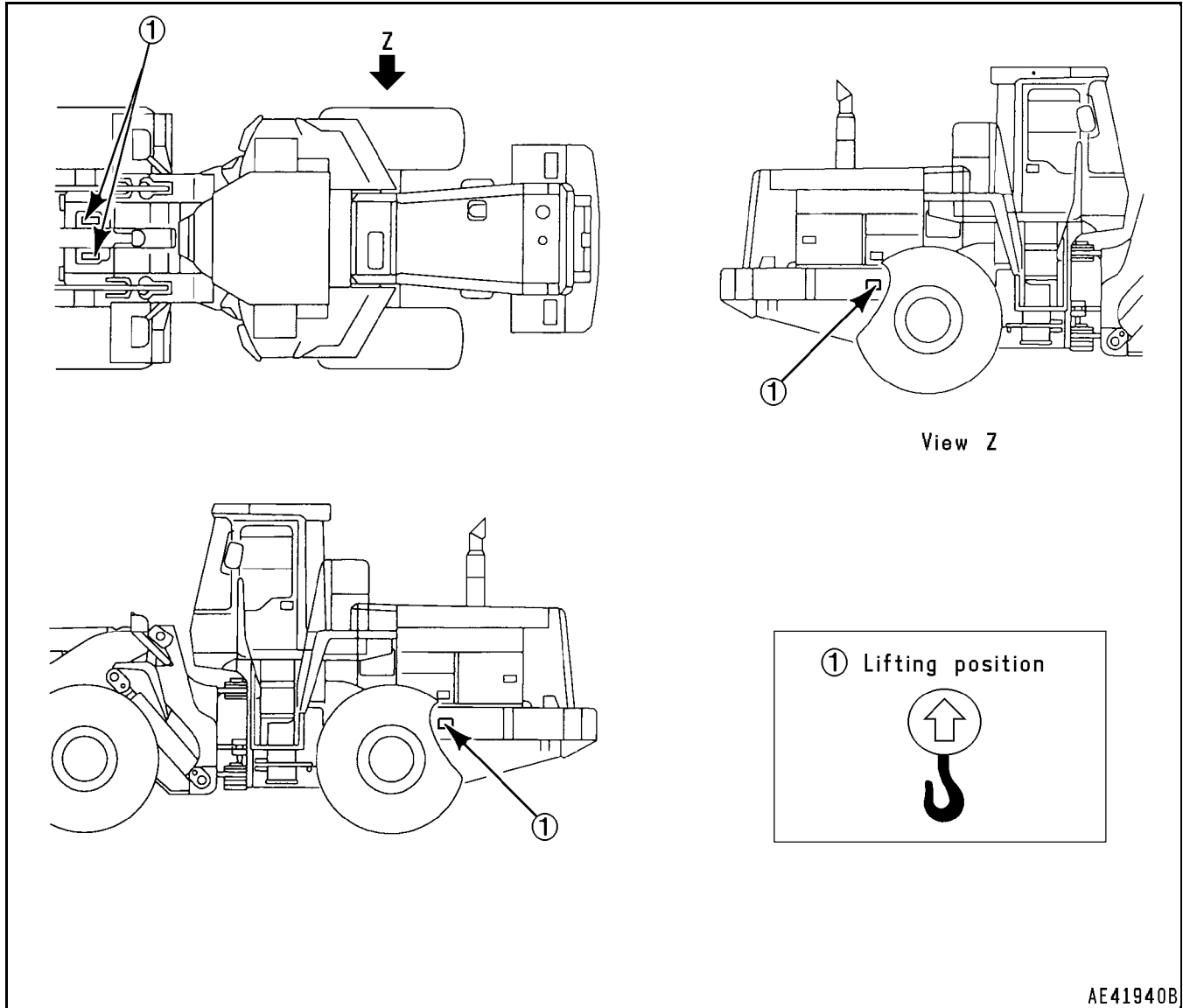
Never raise the machine with a worker on it.

Make sure the equipment used for lifting is adequate in capacity and design for the load.

Use only the procedures and positions given in this publication to lift the machine.

# OPERATION

## 13.3.1 LOCATION FOR LIFTING POSITION DECALS



Operating weight	Front wheel load	Rear wheel load	Center of gravity (from front axle)
14120 kg (31135 lb)	5700 kg (12569 lb)	8420 kg (18566 lb)	1806 mm (5 ft, 11 in.)

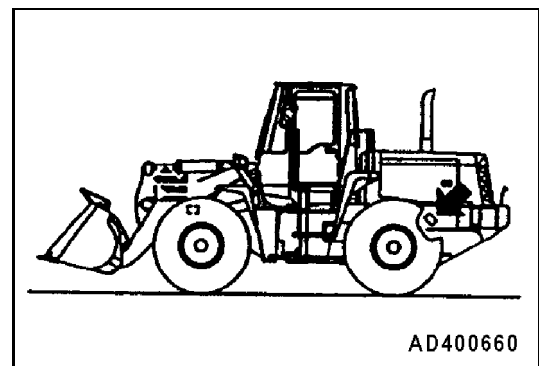
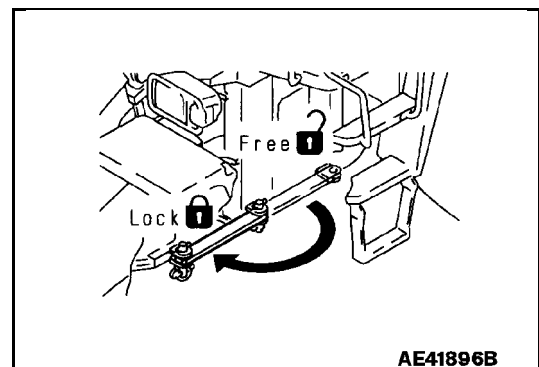
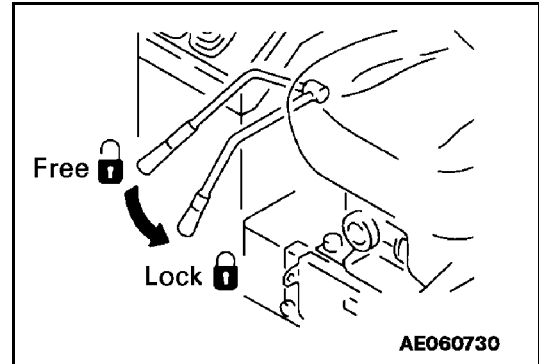
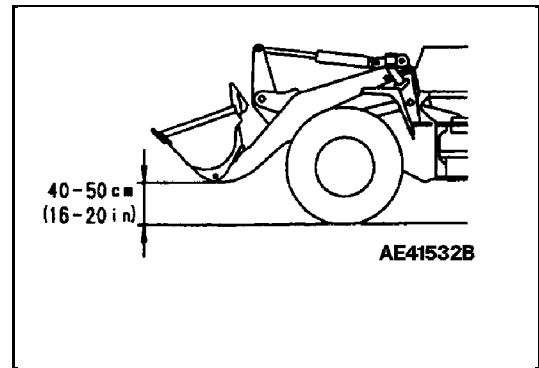
## 13.3.3 LIFTING PROCEDURE

**NOTE:** The lifting procedure applies only to machines with lifting lugs. Stop the machine on a horizontal surface.

1. Start the engine, make sure the machine is horizontal, and then move the work equipment to the travel position. See "12-4 MOVING MACHINE" on page 2-50.
2. Move the work equipment safety lock lever to the LOCK position.
3. Stop the engine, check that the area around the operator's compartment is safe, then install the safety bar to lock the front frame to the rear frame so they do not articulate.
4. Fit the lifting equipment to the lifting hooks (identified by lifting marks) at the front of the front frame and the rear of the rear frame.
5. When the machine leaves the ground, stop lifting long enough for the machine's movements to stabilize. After swinging, swaying, etc. have subsided continue the lifting process slowly.

**WARNING**

Fluids may leak from the machine, causing a health and safety hazard. Check for leakage from the hydraulic circuit or other parts; clean up spilled fluids promptly.



## **14. COLD WEATHER OPERATION**

### **14.1 PRECAUTIONS FOR LOW TEMPERATURE**

Extremely low temperatures may make the engine difficult to start, and cause the coolant to freeze, so do as follows.

#### **14.1.1 FUEL AND LUBRICANTS**

Use fuel and oil with low viscosity for all components. For details see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-11.

#### **14.1.2 COOLANT**



#### **WARNING**

**Keep antifreeze fluid away from open flame. Never smoke when using antifreeze.**

#### **NOTE:**

**Never use methanol-, ethanol- or propanol-based antifreeze.**

**Absolutely avoid using any water-leak-preventing agent either independently or mixed with an antifreeze**

**Do not mix one antifreeze brand with a different brand.**

For details of the antifreeze mixture requirements, see "20.3 COOLANT SPECIFICATIONS" on page 3-14.

#### **14.1.3 BATTERY**



#### **WARNING**

**Keep batteries away from sparks and open flame.**

**Battery electrolyte is acidic and will cause injury if allowed to contact skin or eyes. If it contacts skin or eyes, immediately flush it away with large amounts of water and consult medical help.**

Battery capacity drops as the ambient temperature falls. And if the battery charge is low enough, the electrolyte may freeze. Maintain the charge as high as possible and protect batteries from cold.

Rate of charge	Temperature of fluid				
	20 (68)	0 (32)	-10 (14)	-20 (-4)	-30 (-22 F)
100%	1.28	1.29	1.31	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

## **14.2 PRECAUTIONS AFTER COMPLETION OF WORK**

Protect the machine from mud and water, which can freeze overnight, preventing movement the following morning. Observe the following precautions.

Mud and water in and on the machine should be completely removed.

Park the machine on hard, dry ground. If this is not possible, park the machine on wooden boards. The boards will help protect the machine from freezing to the soil.

Drain water from the fuel system, to prevent it from freezing.

Because the battery capacity drops in low temperatures cover the battery or remove it from the machine for storage in a warmer place, and install it again the next morning.

## **14.3 AFTER COLD WEATHER**

Proceed as follows when resuming warm weather operation.

Replace the fuel and oil, use oil of the viscosity specified. For details, see **"20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE"** on page 3-11.

If for any reason permanent antifreeze cannot be used, and ethyl glycol base antifreeze (winter, one-season type) is used instead, or if no antifreeze is used, drain the cooling system completely, then clean out the inside of the cooling system thoroughly, and fill with fresh water.

# 15. LONG TERM STORAGE

## 15.1 BEFORE STORAGE

Prepare the machine for long term storage as follows.

Wash and dry every part and move the machine into a dry building. If the machine must be left outdoors, park on well drained concrete and cover with canvas, etc.

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

Apply a thin coat of grease to the metal surface of the hydraulic piston rods.

Disconnect the negative terminal of the batteries and cover it, or remove it from the machine and store it separately.

If the ambient temperature is expected to drop below 0 (32

Apply the safety locks to the bucket control lever, lift arm control lever, and directional lever, then apply the parking brake.

## 15.2 DURING STORAGE



### WARNING

**Provide necessary ventilation if the machine is operated indoors to prevent gas poisoning.**

Operate the engine and move the machine for a short distance once a month so that a new film of oil will be coated over movable parts and component surfaces. At the same time, also charge the batteries.

Before operating the work equipment, wipe grease from the hydraulic piston rod.

## 15.3 AFTER STORAGE

**NOTE: Special procedures are necessary if the machine is stored without the monthly rust prevention operation. Consult your distributor for service.**

Carry out the following procedures when taking the machine out of storage.

Wipe grease from the hydraulic cylinder rods

Add oil and grease at all lubrication points.



## 16. TROUBLESHOOTING

### 16.1 WHEN MACHINE RUNS OUT OF FUEL



#### WARNING

The engine will start, so check carefully that the area around the engine is safe before cranking the engine.

If the machine has run out of fuel, add fuel then bleed the air from the fuel system before starting the engine.

#### PROCEDURE FOR BLEEDING AIR

Turn the key in the starting switch to the start positions and crank the engine for 15 - 20 seconds. Repeat this procedure 2-3 times to bleed air.

**NOTE: Do not operate the starting motor continuously for more than 20 seconds. After 20 seconds, stop and wait for two minutes.**

The air can be bled quickly if the fuel tank is completely filled with fuel.

### 16.2 TOWING THE MACHINE



#### WARNING

**Improper towing could lead to serious injury or damage.**

**If the brakes cannot be used, be extremely careful when towing.**

#### NOTE:

**Limit towing to emergencies -- moving the machine to a place where inspection and maintenance can be carried out. The machine must not be towed for long distances.**

**For details of the procedures for towing a machine when it is broken down, contact your distributor.**

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

Block the wheels before attaching the tow cable to prevent the machine from moving unexpectedly.

The machine should be towed only in emergencies, such as to a place where repairs can be carried out. Limit speeds to less than 2 km/h (1.24 mph), and limit distance to a few meters.

If the machine must be moved for a long distance, use a transporter.

Fit a guard plate to the machine being towed to protect the operator if the tow rope or bar should break.

Never let anyone sit on the machine being towed if its steering and brakes cannot be operated.

Check that the tow rope or bar is of ample strength for the weight of the machine being towed. If the machine being towed must travel through mud or up hills, use a tow rope or bar of a strength of at least 1.5 times the weight being of the machine being towed.

Keep the angle of the tow rope as small as possible. Keep the angle between the center lines of the two machines to within 30

If the machine is moved suddenly, an excessive load will be applied to the tow rope or bar, and it could break. Always move the machine slowly at a steady speed.

The towing machine should normally be of the same class as the machine being towed. Check that the towing machine has ample braking power, weight, and rimpull to allow it to control both machines while on a slope.

When towing the machine downhill, use a larger machine for towing to provide ample rimpull and braking power, or connect another machine to the rear of the machine being towed, in order to prevent either machine from losing control and turning over.

Towing may be necessary under many different conditions, therefore it is impossible to determine beforehand all the requirements for towing. Towing on flat horizontal roads will require minimum rimpull, while towing on slopes or uneven road surfaces will require maximum rimpull.

### **16.2.1 WITH THE ENGINE RUNNING**

If the transmission and steering wheel can be operated, and the engine is running, it is possible to tow the machine a short distance, such as out of the mud or to the edge of a road.

The operator should sit on the machine being towed and operate the steering in the direction that the machine is being towed.

### **16.2.2 WITH THE ENGINE STOPPED**

When towing a machine with the engine stopped, use the following procedure.

1. The transmission oil does not lubricate the system, therefore remove the front and rear drive shafts. If necessary, block the tires to prevent the machine from moving.
2. The steering cannot be operated, therefore remove the steering cylinder. Even if the brakes are in good condition, there is no change in operating force to the brake pedal, but the braking force is reduced each time the pedal is depressed.
3. Connect the towing equipment securely. When carrying out towing operations, use two machines of the same class as the machine being towed. Connect one machine to the front and one to the rear of the machine being towed, then remove the blocks from the tires and tow the machine.

## OPERATION

### 16.2.3 RELEASING PARKING BRAKE

#### WARNING

Stop the machine on a flat surface when releasing the parking brake, and check that the surroundings are safe. In emergencies or when the parking brake must be released on a hill, block the tires carefully before releasing the brake.

When the parking brake is released, no braking force can be applied, so check carefully that the situation is safe when moving the machine.

If the engine will not run, use the following method to release the parking brake and tow the machine.

#### 1. RELEASING BRAKE WITH EMERGENCY PARKING BRAKE CANCEL SWITCH

If the pressure in the brake accumulator is high, do as follows.

1. Turn the starting switch to the on position.
2. Turn the emergency parking brake switch to the CANCEL position. While doing this, check that the parking brake caution lamp goes out. When the switch is set to the CANCEL position, the alarm buzzer will sound continuously.

#### REMARKS:

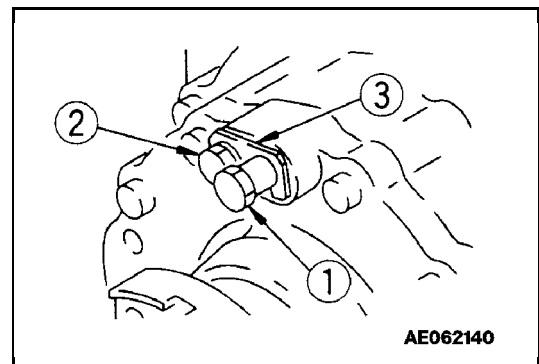
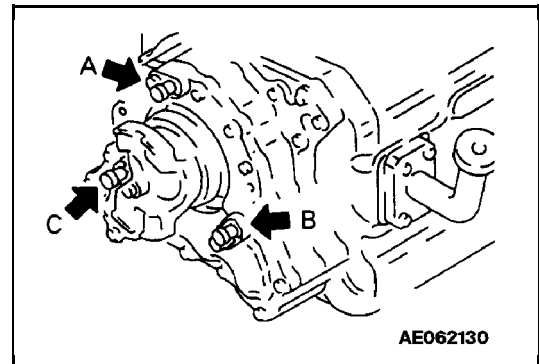
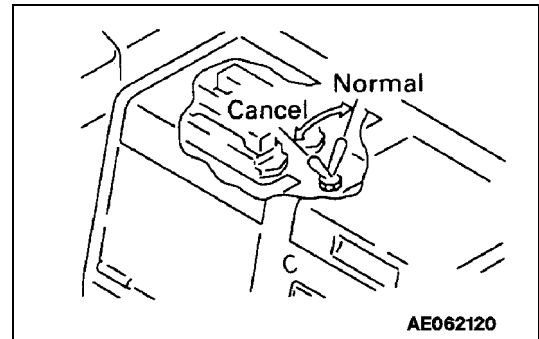
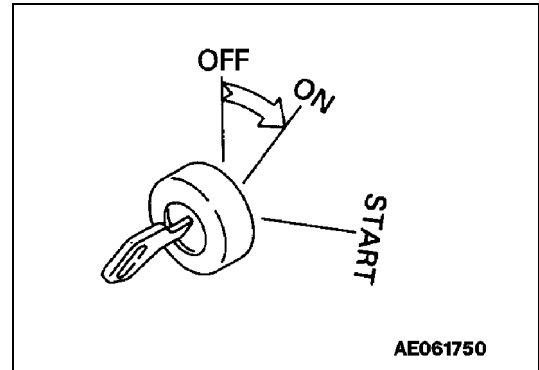
Normally, keep the switch at the NORMAL position to actuate it.

If the pressure in the brake accumulator is low, the parking brake caution lamp will not go out, or the alarm buzzer will sound with a continuous beep. If this happens follow the instructions in CANCELING WITH ADJUSTMENT SCREW to release the brake.

#### 2. CANCELING WITH ADJUSTMENT SCREW

If the pressure in the brake is low, do as follows.

1. Loosen adjustment screws (1) and bolts (2) at A, B, C (three places) at the front of the transmission case.
2. Rotate lock plate (3) to release the lock, then tighten the adjustment screw (1) until it stops.
3. If this is done simultaneously for all three places (A, B, C), the parking brake can be released.



## 16.2.4 EMERGENCY TRAVEL OPERATION

The normal gear shift operation is carried out by electric signals. If there should be a failure in the electrical system and the machine does not move, it is possible to move the machine by using the following procedure.

### WARNING

**When carrying out this operation, always keep the engine stopped except when starting the machine.**

**When starting the engine, always depress the brake pedal and check that the surrounding area is safe.**

**This operation is to enable the machine to drive under its own power to the nearest repair shop when there is a failure in the electrical system. This operation must not be used for any other purpose.**

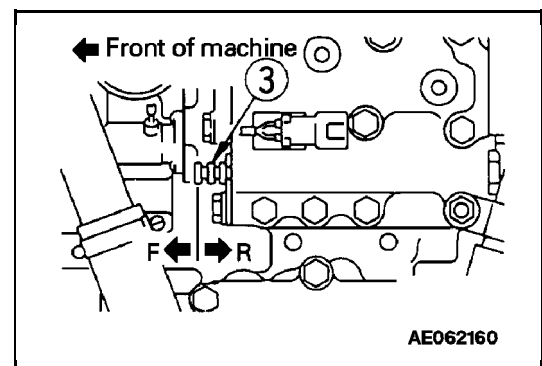
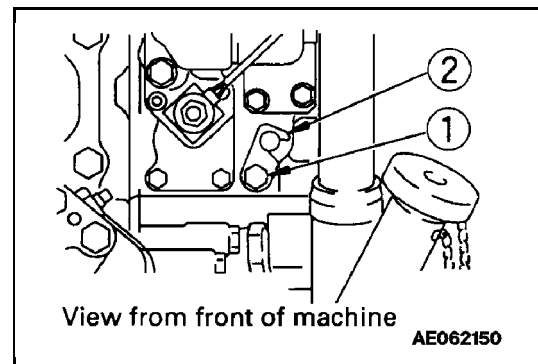
**Always keep the speed lever at the normal position**

**Install plate (2) securely to ensure that the spool does not come out when traveling.**

### NOTE:

**Always request your distributor to carry out the emergency travel operation, or consult your distributor before carrying it out yourself.**

1. Set the parking brake switch to the ON position and set the speed lever to the neutral position.
2. Loosen bolt (1), then remove plate (2).
3. Pull out spool to the F position or push it into R position. The transmission range for this operation is 2nd.
4. After resetting, set the spool to the neutral position, then install plate (2) and bolt (1) to hold it into position.
5. Depress the brake pedal, start the engine, then release the parking brake and let the brake pedal out slowly to allow the machine to start.



## OPERATION

### 16.3 IF BATTERY IS DISCHARGED

#### WARNING

When checking or handling the battery, stop the engine and turn the starting switch key to the OFF position before starting.

Before starting the engine, use a damp cloth to wipe dust and debris from the top surface of the battery.

The battery generates hydrogen gas, so there is danger of explosion. Keep flames, sparks and lighted cigarettes away from the battery.

Battery electrolyte is dilute sulfuric acid, and it will damage clothes and skin. If it gets on your clothes or on your skin, wash it immediately off with lots of water. If it gets in your eyes, wash it out with fresh water, and consult a doctor.

When handling battery, always wear protective goggles.

When removing the battery, first disconnect the cable from the ground terminal (normally, the negative (-) terminal). When installing, install the positive (+) terminal first. If a tool touches the cable connecting the positive terminal and the chassis, there is danger that it will cause sparks.

If the terminals are loose, the defective contact may generate sparks that will cause an explosion. Make sure the terminals are installed tightly.

When removing or installing, check which is the positive (+) terminal and negative (-) terminal.

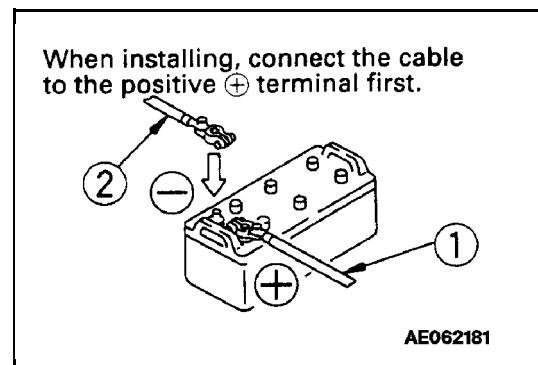
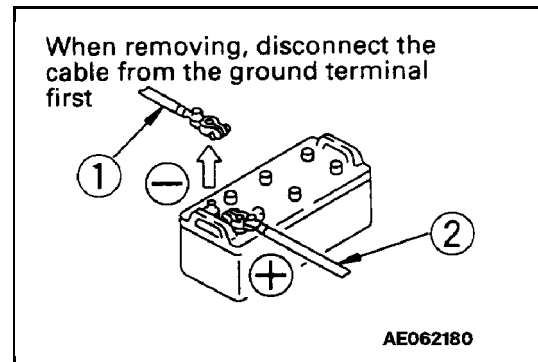
#### 16.3.1 REMOVAL AND INSTALLATION OF BATTERY

When removing the battery, first disconnect the cable from the ground terminal (normally, from the negative (-) terminal). If a tool touches a cable and connects positive terminal and the chassis, there is danger of sparks.

When installing battery, the ground cable should be connected to the ground terminal as the last step.

#### REMARKS:

The batteries are on both sides of the rear of the machine. The battery used for the ground is on the left side on the machine.



### **16.3.2 PRECAUTION FOR CHARGING BATTERY**

#### **CHARGING BATTERY ON MACHINE**

Before charging, disconnect the cable from the negative (-) terminal of the battery. Otherwise, an unusually high voltage could damage the alternator.

While charging the battery, remove all battery plugs for satisfactory ventilation. To avoid gas explosions, do not bring fire or sparks near the battery.

If the electrolyte temperature exceeds 45 until the electrolyte cools.

Turn off the charger as soon as the battery is charged. Over charging the battery may cause the following:

- 1) Overheating the battery
- 2) Decreasing the quantity of electrolyte
- 3) Damaging the electrode plate(s)

Do not mix the cables ( positive (+) to negative (-) or negative (-) to positive (+) ), as this could damage the alternator.

When performing any service to the battery besides checking the electrolyte level or measuring the specific gravity, disconnect cables from the battery.

#### **REMARKS:**

Batteries are located on both sides at the rear of the machine. The battery used for the ground is on the left side of the machine.

## OPERATION

### 16.3.3 STARTING ENGINE WITH BOOSTER CABLE

When starting the engine with a booster cable, do as follows:

Precautions when connecting and disconnecting booster cable.



#### WARNING

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

When starting the engine with a booster cable, always wear safety glasses.

Be careful not to let the normal machine and problem machine contact each other. This prevents sparks from generating near the battery which could ignite the hydrogen gas given off by the battery. If hydrogen gas explodes, it could cause serious injury.

Make sure there is no mistake in the booster cable connections. The final connection is to the engine block of the problem machine, sparks could be generated when this is done, so connect to a place as far as possible from the battery. (However, avoid connecting the cable to the work equipment, as conduction is poor.)

Use care when removing the cables from the machine that has been started. Do not allow the cable ends to contact each other or the machine, to avoid hydrogen explosion.

#### NOTE:

The size of the booster cables and clips should be suitable for the battery size.

The battery of the normal machine must be the same capacity as that of the engine to be started.

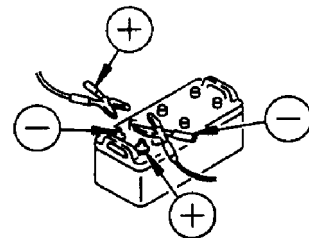
Check the cables and clips for damage or corrosion.

Make sure that the cables and clips are firmly connected.

#### REMARKS:

The batteries are on both sides at the rear of the machine. The battery used for the ground is on the left side of the machine.

#### INCORRECT



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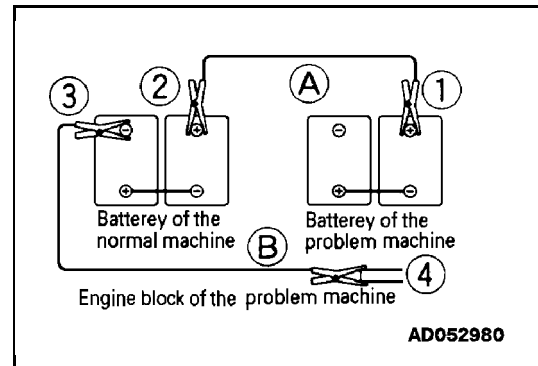


### CONNECTING THE BOOSTER CABLES

Keep the starting switch at the OFF position.

Connect the booster cable as follows, in the order of the numbers marked in the diagram.

1. Make sure that the starting switches of the normal machine and problem machine are both at the OFF position.
2. Connect one clip of booster cable (A) to the positive (+) terminal of the problem machine.
3. Connect the other clip of booster cable (A) to the positive (+) terminal of the normal machine.
4. Connect one clip of booster cable (B) to the negative (-) terminal of the normal machine.
5. Connect the other clip of booster cable (B) to the engine block of the problem machine.



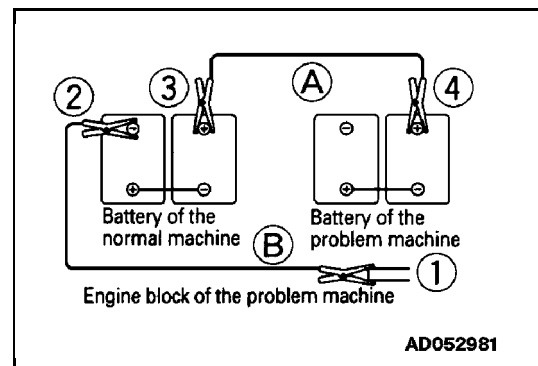
### STARTING THE ENGINE

1. Make sure the clips are firmly connected to the battery terminals.
2. Start the engine of the normal machine and run it at high idle speed.
3. Turn the starting switch of the problem machine to the START position and start the engine. If the engine doesn't start at first, try again after two minutes or so.

### DISCONNECTING THE BOOSTER CABLE

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

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



## OPERATION

### 16.4 OTHER TROUBLE

#### 16.4.1 ELECTRICAL SYSTEM

( ): Always contact your distributor when dealing with these items.

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

Problem	Main causes	Remedy
Lamp does not glow brightly even when the engine runs at high speed	belt tension	( Check, repair loose terminals, disconnections) Adjust fan belt tension For details, see " <b>24.6 EVERY 250 HOURS SERVICE</b> " on page 3-51.
Lamp flickers while engine is running		
Even when the engine is running, the charge caution pilot lamp does not go out	tension	( Replace) ( Check, repair) Adjust fan belt tension. See " <b>24.6 EVERY 250 HOURS SERVICE</b> " on page 3-51.
Abnormal noise is generated from alternator		( Replace)
Starting motor does not turn when starting switch is turned to ON		( Check, repair) Charge ( Replace)
Pinion of starting motor keeps going in and out		Charge
Starting motor turns engine sluggishly		Charge ( Replace)
Starting motor disengages before engine starts		( Check, repair) Charge
Pre-heating monitor does not light	water temperature sensor	( Check, repair) ( Replace) ( Replace)
Even when engine is stopped, charge caution pilot lamp does not light up (starting switch at ON position)		( Check, repair) ( Replace)

**16.4.2 CHASSIS**

( ): Always contact your distributor when dealing with these items.

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

Problem	Main causes	Remedy
<b>TRANSMISSION</b>		
Engine is running but machine does not move	Parking brake is applied Directional lever is not shifted properly Lack of oil in transmission	Release parking brake Shift lever properly  Add oil to specified level. <b>See "24.2 WHEN REQUIRED" on page 3-38.</b>
Even when the engine is running at full power, the machine only moves slowly and lacks power.	Lack of oil in the transmission case  Screen is clogged	Add oil to specified level. <b>See "24.2 WHEN REQUIRED" on page 3-38.</b> ( Disassemble and clean)
Oil overheats	Too much oil or not enough oil  Machine is not traveling in the correct speed range Torque converter is stalled for long periods Engine is overheating	Add or drain oil to specified level. <b>See "24.2 WHEN REQUIRED" on page 3-38.</b> Place in correct speed range Reduce stall time ( Check engine)
Noise	Lack of oil	Add oil to specified level. <b>See "24.2 WHEN REQUIRED" on page 3-38.</b>
<b>AXLE</b>		
Noise generated	Lack of oil	Add oil to specified level. <b>See "24.2 WHEN REQUIRED" on page 3-38.</b>

## OPERATION

### CHASSIS (continued)

Problem	Main causes	Remedy
<b>BRAKE</b>		
Brake is not applied when pedal is depressed	Disc has reach wear limit Defective hydraulic system Lack of oil  Air in brake line	( Replace disc)  Add oil to specified level. <b>See "24.5 EVERY 100 HOURS SERVICE" on page 3-46.</b> Bleed air. <b>See "24.2 WHEN REQUIRED" on page 3-31.</b>
Brake drags or remains applied	Vent hole of brake valve is clogged	Clean
Brakes squeal	Disc is worn Large amount of water in axle oil Deteriorated axle oil due to overuse of brake	( Replace disc) Change axle oil  Change axle oil
<b>PARKING BRAKE</b>		
Braking effect is poor	Disc is worn	( Replace disc)
Brake drags or remains applied	Lack of oil in transmission case Screen is clogged	Add oil to specified level. <b>See "24.2 WHEN REQUIRED" on page 3-31.</b> ( Disassemble and clean)
<b>STEERING</b>		
Steering wheel is heavy	Defective hydraulic system Lack of oil	Add oil to specified level. <b>See "24.5 EVERY 100 HOURS SERVICE" on page 3-46.</b>
Steering wheel is loose	Play in steering cylinder pin  Defective hydraulic system Lack of oil	Grease bearing or replace pin and bushing where there is play Add oil to specified level. <b>See "24.5 EVERY 100 HOURS SERVICE" on page 3-46.</b>

## CHASSIS (continued)

Problem	Main causes	Remedy
<b>HYDRAULIC SYSTEM</b>		
Lack of lifting power for bucket Bucket takes time to raise	Lack of oil  Clogged hydraulic tank filter	Add oil to specified level. <b>See “24.5 EVERY 100 HOURS SERVICE” on page 3-46.</b> Replace filter. <b>See “24.9 EVERY 2000 HOURS SERVICE” on page 3-65.</b>
Excessive bubbles in oil	Low quality oil being used Oil level is low  Air in oil line	Replace with good quality oil Add oil to specified level. <b>See “24.5 EVERY 100 HOURS SERVICE” on page 3-46.</b> Bleed air. <b>See “24.9 EVERY 2000 HOURS SERVICE” on page 3-65.</b>
Hydraulic pressure is low	Oil level is low and pump is sucking in air	Add oil to specified level. <b>See “24.5 EVERY 100 HOURS SERVICE” on page 3-46.</b> Then bleed air. <b>See “24.9 EVERY 2000 HOURS SERVICE” on page 3-65.</b>
Movement of cylinder is irregular	Oil level is low	Add oil to specified level. <b>See “24.5 EVERY 100 HOURS SERVICE” on page 3-46.</b>

## OPERATION

### 16.4.3 ENGINE

( ): Always contact your distributor when dealing with these items.

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

Problem	Main causes	Remedy
Engine oil pressure caution pilot lamp lights up	Engine oil pan oil level is low (sucking in air) Clogged air filter cartridge Defective tightening of oil pipe joint, oil leakage from damage parts Defective eng. oil pressure sensor	Add oil to specified level, see <b>"12.1.2 CHECK BEFORE STARTING"</b> on page 2-42. Replace cartridge, see <b>"24.6, 24.6 EVERY 250 HOURS SERVICE"</b> on page 3, 3-48. ( Check, repair) ( Replace sensor)
Steam is emitted from top part of radiator (pressure valve) Water temperature gauge is in red range Coolant temperature monitor lights up	Cooling water level low, water leakage Loosen fan belt  Dirt or scale accumulated in cooling system  Clogged radiator fin or damaged fin  Defective thermostat Loose radiator filler cap (high altitude operation) Defective water level sensor	Add cooling water, repair, see <b>"12.1.2 CHECK BEFORE STARTING"</b> on page 2-42. Adjust fan belt tension, see <b>"24.6 EVERY 250 HOURS SERVICE"</b> on page 3-48. Change cooling water, clean inside of cooling system, see <b>"24.2 WHEN REQUIRED"</b> on page 3-31. Clean or repair, see <b>"24.2 WHEN REQUIRED"</b> on page 3-31. ( Replace thermostat) Tighten cap or replace packing ( Replace sensor)
Water temperature gauge is in the white range on left	Defective thermostat Defective monitor	( Replace thermostat) ( Replace)
Engine does not start when starting motor is turned	Lack of fuel  Air in fuel system  Defective fuel injection pump or nozzle Starting motor cranks sluggishly Preheating pilot lamp does light up  Defective compression Defective valve clearance	Add fuel, see <b>"12.1.2 CHECK BEFORE STARTING"</b> on page 2-42. Repair place where air is sucked in, see <b>"24.7 EVERY 500 HOURS SERVICE"</b> on page 3-54. ( Replace pump or nozzle) See <b>18-2 OUTLINE OF ELECTRICAL SYSTEM</b> on page 3-8. ( Adjust valve clearance)

## CHASSIS continued (16.4.3)

Problem	Main causes	Remedy
Exhaust is white or blue	Too much oil in oil pan Improper fuel	Add oil to specified level. <b>See "12.1.2 CHECK BEFORE STARTING" on page 2-42."</b> Change to specified fuel
Exhaust gas occasionally turns black	Clogged air cleaner element Defective nozzle Defective compression Defective turbocharger	Clean or replace, <b>see "24.2 WHEN REQUIRED" on page 3-31.</b> ( Replace nozzle) ( See defective compression above) ( Clean or replace turbocharger)
Combustion noise occasionally makes abnormal (breathing) sound	Defective nozzle	( Replace nozzle)
Abnormal noise generated (combustion or mechanical)	Low grade fuel being used Overheating  Damage inside muffler Excessive valve clearance	Change to specified fuel Refer to "Water temperature gauge is in red range" as above ( Replace muffler) ( Adjust valve clearance)

# **MAINTENANCE**



### 17. GUIDES TO MAINTENANCE

Do not carry out any inspection and maintenance operation that is not given in this manual.

Perform maintenance work on hard, flat ground.

Set to the inspection and maintenance posture.

Always carry out inspection with the machine in the following posture unless otherwise specified.

Lower the work equipment to the ground and set in the posture shown in the diagram on the right.

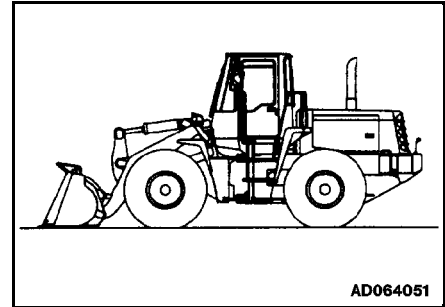
Set all control levers to the neutral or HOLD position.

Set the safety levers to the LOCK position.

Press the parking brake switch to apply the parking brake.

Put blocks in front and behind the tires.

Lock the front and rear frames with the safety bar.



#### **Check service meter:**

Check the service meter reading every day to see if it is time for any necessary maintenance to be carried out.

#### **Komatsu genuine replacement parts:**

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

#### **Komatsu genuine oils:**

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

#### **Always use clean washer fluid:**

Use automobile window washer fluid and be careful not to let any dirt get into it.

#### **Always use clean oil and grease:**

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

#### **Keeping the machine clean:**

Always keep the machine clean. Parts causing problems will be easier to find. In particular keep grease fittings, breathers and oil level gauges clean and prevent foreign matter from getting inside.

#### **Be careful of hot water and oil:**

Draining hot oils and coolants and removing their filters immediately after the engine stops is hazardous. Allow the engine to cool.

However, if the oil has to be drained when it is cold, warm up the oil to a suitable temperature (approx. 20 - 40

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**Check for foreign materials in drained oil and on filter:**

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:**

If your machine is equipped with a fuel strainer, do not remove it while fueling.

**Oil change:**

Check or change oils in 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.

The warning tag is supplied together with the tools.

**Obey precautions:**

During machine operation, always obey the precautions on the safety label attached to the machine.

**Welding instructions:**

- Turn off the engine starting switch.

- Do not apply more than 200 V continuously.

- Connect the grounding cable within 1 m from the area to be welded.

- Avoid seals or bearings from being between the area to be welded and the position of grounding point.

- Do not use the area around the work equipment pins or the hydraulic cylinders as the grounding point.

- Never weld any pipe or tube containing fuel or oil.

**Fire prevention:**

Use nonflammable cleaner or light oil for cleaning parts. Keep flame or lighted cigarette away from light oil.

**Clamp faces:**

When O-rings or gaskets are removed, clean the clamp faces and replace the O-rings and gaskets with new ones. Be sure to carefully install 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.

**Checking underneath machine:**

When working in rocky areas, check for damage underneath the machine, wear and damaged bolts and nuts.

**Precautions when washing machine:**

- Never spray steam or water directly at the radiator.

- Do not allow water to get on any electrical component

**Pre-and post-work checks:**

Before starting work in mud, rain, snow or at seashore, check plugs and valves for tightness.

Wash the machine immediately after working 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.

On job sites where heavy-duty operations are common, reduce the maintenance intervals and grease the machine more frequently.

## **MAINTENANCE**

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### **Dusty work sites:**

When working at dusty work sites, do as follows:

Inspect the air cleaner clogging pilot lamp to see whether the air cleaner is plugged up. Clean the air cleaner at shorter intervals than specified.

Clean the radiator core frequently to avoid clogging.

Clean and replace the fuel filter frequently.

Clean electrical components, especially the starting motor and alternator, to avoid accumulation of dust.

### **Avoid mixing oils:**

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

## 18. OUTLINES OF SERVICE

Use genuine Komatsu parts for replacement.

When changing or adding oil, do not use a different type of oil.

Unless otherwise specified, the oil and coolant used at the time of shipment from the factory are as shown in the table below.

Item	Kind of fluid
Engine oil pan	SAE 15W-40 API classification CF4 or CF-4/SG
Transmission case	SAE 10W API classification CD
Axle (Front and rear)	AX075
Hydraulic tank	SAE 10W API classification CD
Linkage Pins	Lithium base grease No. 2
Fuel	ASTM D975 No. 2 (However, ASTM D975 No. 1 is used for the winter season (October to March))
Radiator	50/50 Mixture of Komatsu Super Coolant and water

### 18.1 OUTLINE OF OIL, FUEL, COOLANT

#### 18.1.1 OIL

Oil is used in the engine and work equipment under extremely severe conditions (high temperature, high pressure), and it deteriorates with use.

Always use oil that matches the grade and temperature for specified in the Operation and Maintenance Manual. Even if the oil is not dirty, always replace the oil after the specified interval.

Oil corresponds to blood in the human body, so always be careful when handling it to prevent any impurities (water, metal particles, dirt, etc.) from entering the system.

The majority of problems with machines are caused by the entry of such impurities.

Take particular care not to let any impurities get in when storing or adding oil.

Never mix oils of different grades or brands.

Always maintain oil at specified levels.

Having too much oil or too little oil are both causes of problems.

If the oil in the work equipment is not clear, there is probably water or air entering the circuit.

In such cases, please contact your distributor.

When changing the oil, always replace the related filters at the same time.

It is recommended that an analysis be made of the oil periodically to check the condition of the machine. For those who wish to use this service, please contact your distributor.

## MAINTENANCE

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### 18.1.2 FUEL

The fuel pump is a precision instrument, and if fuel containing water or dirt is used, it cannot work properly.

Be extremely careful not to let impurities get in when storing or adding fuel.

Always use the fuel specified in the Operation and Maintenance Manual.

Fuel may congeal depending on the temperature when it is used (particularly in low temperatures below-15 C (5

To prevent the moisture in the air from condensing and forming water inside the fuel tank, always fill the fuel tank after completing the day's work.

Before starting the engine, or when 10 minutes have passed after adding fuel, drain the sediment and water from the fuel tank.

If the engine runs out of fuel, or if the filters have been replaced, it is necessary to bleed the air from the circuit.

### 18.1.3 COOLANT

River water contains large amounts of calcium and other impurities, so if it is used, scale will stick to the engine and radiator. This will prevent proper heat exchange and cause overheating.

**For specific requirements of the water, See "20.3 COOLANT SPECIFICATIONS on page 3-14**

When using anti-freeze, always observe the precautions given in the Operation and Maintenance Manual.

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

All cooling system inhibitors, including those in anti-freeze solutions, become depleted through normal operation. If the inhibitors in antifreeze are allowed to become depleted, the anti-freeze 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.

Anti-freeze is inflammable, so be extremely careful not to expose it to flame or fire.

The proportion of anti-freeze to water differs according to the ambient temperature.

For details of the mixing proportions, see "20.3 COOLANT SPECIFICATIONS on page 3-14.

If the engine overheats, wait for the engine to cool before adding coolant.

If the coolant level is low, it will cause overheating and will also cause problems with corrosion from the air in the coolant.

### 18.1.4 GREASE

Grease is used to reduce friction and help prevent wear, twisting and noise at the joints.

Grease fittings that were not referred to in the maintenance schedule do not require any scheduled greasing. Add grease to these areas only if something becomes stiff or squeaky.

Always wipe off all of the old grease that is pushed out when greasing. Be particularly careful to wipe off the old grease in places where sand or dirt sticking in the grease would cause wear of the rotating parts.

### 18.1.5 STORING OIL AND FUEL

Keep indoors to prevent any water, dirt, or other impurities from getting into storage containers.

When keeping drums for a long period, put the drum on its side so that the filler port of the drum is at the side (to prevent moisture from being sucked in). Periodically inspect drums for leakage.

If drums have to be stored outside, cover them with a waterproof sheet or take other measures to protect them.

To prevent any change in quality during long-term storage, be sure to use in the order of first in - first out (use the oldest oil or fuel first).

### 18.1.6 FILTERS

Filters are extremely important safety parts. They prevent impurities in the fluid and air circuits from entering important equipment and causing problems.

Replace all filters periodically. For details, see "23. MAINTENANCE SCHEDULE CHART" on page 3-26.

However, when working in severe conditions, it is necessary to consider replacing the filters at shorter interval according to the oil and fuel (sulfur content) being used.

Never try to clean the filters (cartridge type) and use them again. Always replace with new filters.

When replacing oil filters, check if any metal particles are stuck to the old filter. If any metal particles are found, please contact your distributor.

Do not open packs of spare filters until just before they are to be used.

Always use genuine Komatsu filters.

## FUEL INJECTION PUMP

### DO NOT ATTEMPT TO ADJUST THE FUEL INJECTION PUMP

Unsatisfactory operation of the engine may not be due to the fuel injection pump. If unsatisfactory operation persists after servicing the filters, consult your distributor to service the fuel injection pump. Special equipment and knowledge are required for proper injection pump service. These are available at your distributor.

### 18.2 OUTLINE OF ELECTRIC SYSTEM

If the wiring gets wet or the insulation is damaged, the electric system leaks and this could result in hazardous malfunction of the machine.

Services relating to the electric system are (1) check of fan belt tension, (2) check of damage or wear in the fan belt and (3) check of battery fluid level.

Never remove or disassemble any electric components installed in the machine.

Never install any electric components other than those specified by Komatsu.

Be careful to keep the electric system free of water when washing the machine or when it rains.

When working on the seashore or any corrosive environment, carefully clean the electric system to prevent corrosion.

When installing a cab cooler or any other electrical equipment, connect it to an independent power source connector. The optional power source must never be connected to the fuse, starting switch, or battery relay.

## 19. WEAR PARTS LIST

Wear parts such as filter elements, bucket teeth, etc. are to be replaced at the time of periodic maintenance or before their abrasion limits.

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

For part replacement, genuine Komatsu parts of excellent quality should be used.

**Find the current part numbers in the Parts Book provided with your equipment and write them in the Part Number column.**

**The parts in parentheses are to be replaced at the same time.**

Item	Part Number	Part Name	Qty	Replacement frequency
Engine oil filter		Cartridge	1	Every 250 Hours Service
Coolant corrosion resistor cartridge		Cartridge	1	Every 250 Hours Service
Fuel filter		Cartridge	1	Every 500 Hours Service
Transmission oil filter		Element (O-ring) (O-ring) (O-ring) (Gasket)	1 (1) (1) (1) (1)	Every 500 Hours Service
Transmission strainer		O-ring	1	Every 1000 Hours Service
Hydraulic oil filter		Element (O-ring)	1 (1)	Every 2000 Hours Service
Hydraulic tank breather		Element	1	Every 2000 Hours Service
Air cleaner		Element assembly Outer element assembly	1 1	When required
Air conditioner air filter		Element	2	Every 100 Hours Service
Bucket cutting edges and mounting bolts		Center edge side edge (Bolt) (Nut) (Washer)	1 2 (8) (8) (8)	When required



## MAINTENANCE

# 20. FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE

## 20.1 PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

The responsibility for the quality of the fuel, coolant and lubricant must remain with the supplier. When in doubt, consult your Komatsu distributor. The specified fuel, coolant and lubricants recommended for this machine are as shown in the following table.

RESERVOIR	FLUID TYPE	AMBIENT TEMPERATURE								CAPACITY	
		-22	-4	14	32	50	68	86	104	Specified	Refill
		-30	-20	-10	0	10	20	30	40		
Engine with filter(s)	Engine oil	SAE 5W-30								22 5.9 gal	19 5 gal
		SAE 10W-30									
		SAE 15W-40									
Torque converter, transmission, transfer case & oil cooler	Engine oil	SAE 10W								42 11.1 gal	40
		SAE 30W									
		SAE 10W									
		SAE 10W									
Drive axles - Front & rear (each)	Axle oil	See 20.4 DRIVE AXLE OIL SPECIFICATIONS on page 3-13.								24 6.34 gal	24 6.34 gal
Hydraulic system	Engine oil	SAE 10W								165 43.6 gal	116 30.6 gal
		SAE 15W-40									
		SAE 10W-30									
Fuel tank	Diesel fuel	ASTM D975 No. 2								248 65.5 gal	
		ASTM D975 No. 1									
All lubrication fittings	Grease	Komatsu Super Grease or NLGI No.2 Multi-purpose lithium grease with 3% molybdenum disulfide								Fill as instructed	
Cooling system	Coolant	See 20.6 COOLANT SPECIFICATIONS on page 3-14.								30 7.9 gal	

API: American Petroleum Institute  
 ASTM: American Society of Testing and Materials  
 NLGI: National Lubricating Grease Institute  
 SAE: Society of Automotive Engineers

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

Other equipment may be necessary when operating the machine at temperatures below -20 consult your Komatsu distributor for your specific needs. e

When operating the machine at temperatures below -20 distributor.

**NOTE:**

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: MOBILAND SUPER UNIVERSAL

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

ASTM: American Society of Testing and Material

SAE: Society of Automotive Engineers

API: American Petroleum Institute

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.

## MAINTENANCE

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### 20.2 ENGINE OIL SPECIFICATIONS

#### 20.2.1 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. Komatsu Engine Oil or multi-viscosity engine oil meeting American Petroleum Institute (API) performance classification CF-4, CG-4, CF-4/SG or CG-4/SH or MIL-L-2104D or E is recommended.

**NOTE:**

**Classification CD, CE, CD/SF or CE/SF oils may be used in areas where CF-4, CG-4, CF-4/SG or CG-4/SH oil is not yet available. If API classification CC or CC/CD is used, reduce the engine oil change interval by half.**

A sulfated ash limit of 1.0 to 1.5 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-grade 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 table for oil viscosity recommendations for extreme climates.

**NOTE:**

**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 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 Automotive and Industrial Engines." The data book may be ordered from the Engine Manufacturers Association, 401 North Michigan Ave., Chicago, IL U.S.A. 60611. Telephone: (312) 644-6610.

#### 20.2.2 ARCTIC OPERATION

If an engine is operated in ambient temperatures consistently below -23 provisions to keep the engine warm when it is **not** in operation, use a synthetic engine oil API performance classification CF-4, CG-4, CF-4/SG or CG-4/SH 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.

**NOTE:**

**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.**

### **20.3 TRANSMISSION, TORQUE CONVERTER, TRANSFER CASE AND OIL COOLER, SERVICE BRAKES AND HYDRAULIC SYSTEM OIL SPECIFICATIONS**

Komatsu Engine Oil or engine oil meeting American Petroleum Institute (API) performance classification CF-4, CG-4, CF-4/SG or CG-4/SH or MIL-L-2104D or E is recommended.

**NOTICE:**

**Classification CD, CE, CD/SF or CE/SF oils may be used in areas where CF-4, CG-4, CF-4/SG or CG-4/SH oil is not yet available.**

### **20.4 DRIVE AXLE OIL SPECIFICATIONS**

For drive 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 424

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

### **20.5 DIESEL FUEL SPECIFICATIONS**

**⚠ WARNING**

**Possible fire hazard - never mix gasoline, gasohol and/or alcohol with diesel fuel. This practice creates an extreme fire hazard and under certain conditions an explosion which could result in personal injury or death.**

**⚠ WARNING**

**Never remove the fuel tank filler cap or refill the fuel tank while the engine is running or when hot or when the machine is indoors. Fumes are dangerous, a spark or flame could result in a fire or explosion.**

**NOTE:**

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

## MAINTENANCE

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### REMARK

Below -12  
the fuel filters. For best results use Grade No. 1-D diesel fuel in cold weather.

For normal service above -10 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 -10  
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 responsibility 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.

Optionally, the equivalent grades of recognized Federal Government specifications may be used; the latest revisions of VV-F-800a.

## 20.6 COOLANT SPECIFICATIONS

### 20.6.1 GENERAL

Selection and maintenance of the engine coolant is important to long engine life. The following information provides recommendations for selecting engine coolant and maintaining supplemental coolant additives (SCA).

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 20.6.3 on page 3-16. The coolant mixture **must** be drained and replaced at the specified service interval shown in **23.1 on page 3-26**, or every two years of operation, whichever comes first.

### 20.6.2 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 rust, scale deposits and corrosion will occur.**

**20.6.3 ANTIFREEZE**

In climates where the temperature is above -34  
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.

Ethylene glycol, low silicate 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.**

**⚠ WARNING**

**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.**

Check the solution periodically and at normal operating temperature, to be sure the cooling system has sufficient  
protection against freezing. An antifreeze concentration greater than 68% will adversely affect antifreeze 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.

**REMARK**

Do not use a 100% antifreeze solution for freezing protection, This will cause severe corrosion in the cooling  
system and if not detected will cause radiator and oil cooler core damage. Use a water/antifreeze solution as  
described in the following table.

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

## MAINTENANCE

Approximate Freezing Point	Percentage of Antifreeze Concentration by Volume	Specific Gravity at 16
0 (+32)	0	1.000
-7 (+20)	15	1.025
-12	25	1.040
-18	33	1.053
-23 (-10)	40	1.062
-29 (-20)	45	1.070
-34 (-30)	48	1.074
-40 (-40)	53	1.080
-46 (-50)	56	1.083
-51 (-60)	59	1.088
-57 (-70)	62	1.092
-62 (-80)	65	1.095
-68 (-90)	67	1.097
-69 (-92)	68	1.098

In tropical climates where antifreeze availability may be limited, use a corrosion inhibitor or supplemental coolant additive (SCA), to protect the engine cooling system.

### 20.6.4 SUPPLEMENTAL COOLANT ADDITIVES

- All supplemental cooling system additives, including those in antifreeze solutions, become depleted through normal operation. If the coolant additives 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 additives must be added to maintain corrosion protection.
- SOLUBLE OIL IS NOT RECOMMENDED for use in this engine as its use will reduce heat transfer and allow internal engine damage.
- There are no miracle additives that will increase heat transfer or prevent overheating. Conditioned water is still the best coolant.
- A corrosion inhibitor/conditioner 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 several areas:

- Solder corrosion/bloom
- Oil fouling
- Aluminum cavitation corrosion
- Copper corrosion/erosion/stress cracking
- Cylinder liner cavitation corrosion
- Seal and gasket degradation

### Maintenance of Supplemental Coolant Additives

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 a regular scheduled interval specified in **23.1 on page 3-26**, with a replacement coolant filter.

Each time the coolant is drained and replaced, the coolant must be recharged with supplemental coolant additives. New coolant can be correctly charged with coolant additives by using a replacement coolant filter and/or concentrate.

If coolant is added between drain intervals, additional coolant additives may be required.

### Coolant Testing for Conditioner Concentration

When the cooling system is maintained as recommended, the conditioner concentration should be satisfactory. The SCA concentration must not fall below 1.0 unit per 3.8 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 **23.1 on page 3-26**.

**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" coolant filter when the coolant is changed or a significant (more than 50%) coolant loss occurs. Install a service coolant filter as specified in? **On page ?-?**. When antifreeze is added, add coolant conditioner equal to 1.0 unit per 3.8

**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.**

### Supplemental Coolant Additive 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 SCA unit per liter [one unit per U.S. gallon] of coolant (initial charge). Maintain the correct SCA concentration by changing the service coolant filter at each engine oil and filter change interval.

Each time the coolant is drained and replaced, the coolant **must** be recharged with supplemental coolant additives. Use the appropriate replacement coolant filter listed in following tables. The coolant mixture **must** be drained and replaced as defined under "General."

The amount of a 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 SCA. If coolant is added between drain intervals, additional SCA will be required. Check the coolant DCA concentration level anytime make up coolant is added to the system. The SCA 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].



## MAINTENANCE

DCA4 UNIT GUIDE	
Fleetguard Part No.	DCA4 Units
<b>DCA4 Coolant Filter</b>	
WF-2070	2
WF-2071	4
WF-2072	6
WF-2073	8
WF-2074	12
WF-2075	15
WF-2076	23
WF-2077	0
<b>DCA4 Liquid</b>	
DCA60L	4 (1 pt)
DCA80L	1760 (55 gal)
<b>DCA4 Powder</b>	
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 SCA concentration between 1.0 and 2.0 units per 3.8

**REMARK:**

**When performing service which requires draining the cooling system, discard the coolant. Reusing coolant can introduce contaminants or over concentrated chemicals, resulting in premature failure of cooling system components.**

**NOTE 2 -**

To precharge cooling systems larger than 114

Install appropriate service filter listed in the above table based on cooling system capacity.

Example:

95 gal (360

-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 SCA 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 SCA concentration of 1.0 unit per 3.8 per 3.8 indicates an over-concentrated coolant solution.

To check the SCA concentration level, use coolant test kit, CC-2626. Instructions are included with the test kit.

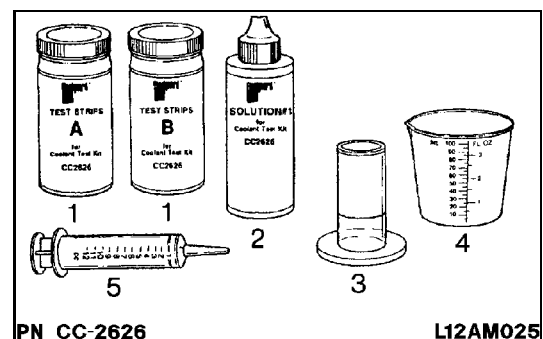
SCA Unit Concentration Guide		
Number of Solution A Drops to Cause Color Change	Coolant Condition	Action Required
0 - 10 Drops	Extremely under-concentrated - less than 0.4 SCA units per 3.8 (1 US gal)	Initially charge the system to a minimum of 1.0 SCA unit per 3.8
11 - 16 Drops	Marginally under-concentrated - 0.45 to 0.8 SCA units per 3.8 US gal)	Add SCA liquid units to maintain 1.0 SCA unit per 3.8 minimum or change the DCA 4 coolant filter.
17 - 25 Drops	Acceptable - 0.85 to 1.3 SCA units per 3.8	None.
26 - 35 Drops	Highly acceptable - 1.35 to 2.0 SCA units per 3.8	None.
36 - 55 Drops	Marginally over-concentrated - 2.1 to 3.3 SCA units per 3.8 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 SCA unit concentration.

**Cooling System Test Kit**

The following cooling system test kit may be purchased from your Komatsu America International Company distributor.

This Fleetguard® coolant test kit, part number CC-2626 is used to check the concentration of coolant additives in the cooling system.

1. Test strip bottles
2. Solution #1 bottle
3. Small plastic container
4. Large plastic cup
5. Syringe

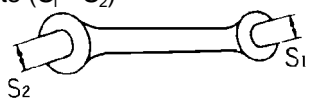


## MAINTENANCE

### 21. STANDARD TIGHTENING TORQUE FOR NUTS AND BOLTS

#### 21.1 INTRODUCTION OF NECESSARY TOOLS

The following tools are needed when carrying out maintenance.

No.	Name of tool	Part No.	Remarks
1	Wrench set	09000-30006	Applicable width across flats ( $S_1 - S_2$ ) 8 mm - 10 mm 12 mm - 14 mm 13 mm - 17 mm 19 mm - 22 mm 24 mm - 27 mm 30 mm - 32 mm 
2	Socket wrench set	09020-10284	
3	Screwdriver	09033-00190	Crosshead/flat head interchangeable type
4	Wrench	09014-10200	
5	Pliers	09036-00150	
6	Wrench	09001-03600	36jaw
7	Tire wrench	417-98-11121	
8	Filter wrench	09019-08035	For filter cartridge
9	Bar	417-98-11110	
10	Tire gauge	09289-00000	
11	Grease pump	07952-70004	For greasing work
12	Nozzle	07951-41017	Hose nozzle for grease pump
13	Grease cartridge	07950-90403	(Lithium base grease: 400 g)
14	Thickness gauge	09054-00009	
15	Hammer	09039-00150	
16	Plate	09963-03000	Warning tag

If any of the above tools are broken, please order replacements from your distributor.

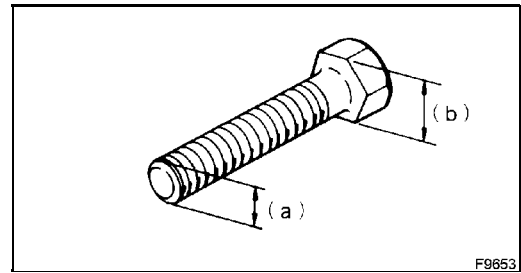
## 21.2 TORQUE LIST



Unless otherwise specified, tighten the metric bolts and nuts to the torque shown in the table.

The tightening torque is determined by the width across the flats (b) of the nut and bolt.

If it is necessary to replace any nut or bolt, always use a genuine Komatsu part of the same size as the part that was replaced.

N



Thread diameter of bolt (mm) (a)	Width across flat (mm) (b)		
		N	lbft
6	10	13.2 ± 1.4	97.3 ± 1.03
8	13	31.4 ± 2.9	23.2 ± 2.1
10	17	65.7 ± 6.8	48.5 ± 5.0
12	19	112 ± 9.8	82.6 ± 7.2
14	22	177 ± 19	131 ± 14
16	24	279 ± 29	206 ± 21
18	27	383 ± 39	282 ± 29
20	30	549 ± 58	405 ± 43
22	32	745 ± 78	549 ± 58
24	36	927 ± 98	684 ± 72
27	41	1320 ± 140	973 ± 100
30	46	1720 ± 190	1270 ± 140
33	50	2210 ± 240	1630 ± 180
36	55	2750 ± 290	2030 ± 210
39	60	3280 ± 340	2420 ± 250

**NOTE:**

Use caution and proceed slowly when tightening panels or other parts having tightening fixtures made of plastic, as excessive tightening torque will damage the plastic parts.

### 22. PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

To ensure safety at all times when operating or driving the machine, the user is responsible for periodic maintenance. In addition, to further improve safety, the user should also replace at regular intervals the parts given in the table. These parts are particularly closely connected to safety and fire prevention.

With these parts, the material changes as time passes, or they easily wear or deteriorate. However, it is difficult to judge the condition of the parts simply by periodic inspection, so they should always be replaced after a fixed time has passed, regardless of their condition. This is necessary to ensure that they always maintain their function completely.

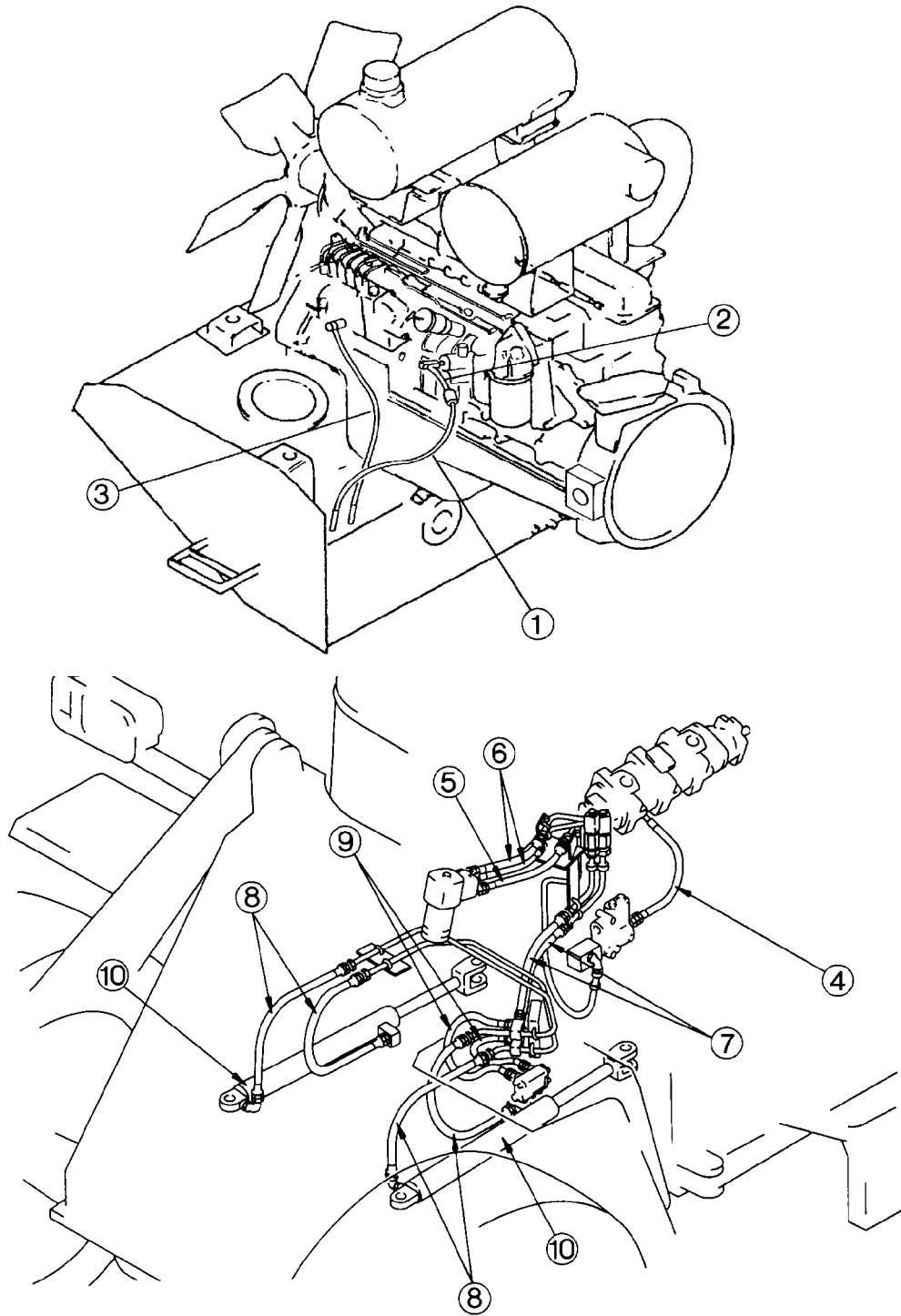
However, if these parts show any abnormality before the replacement interval has passed, they should be repaired or replaced immediately.

If the hoses show any deterioration, such as deformation or cracking, replace the clamps at the same time as the hoses. When replacing the hoses, always replace the O-rings, gaskets, and other such parts at the same time.

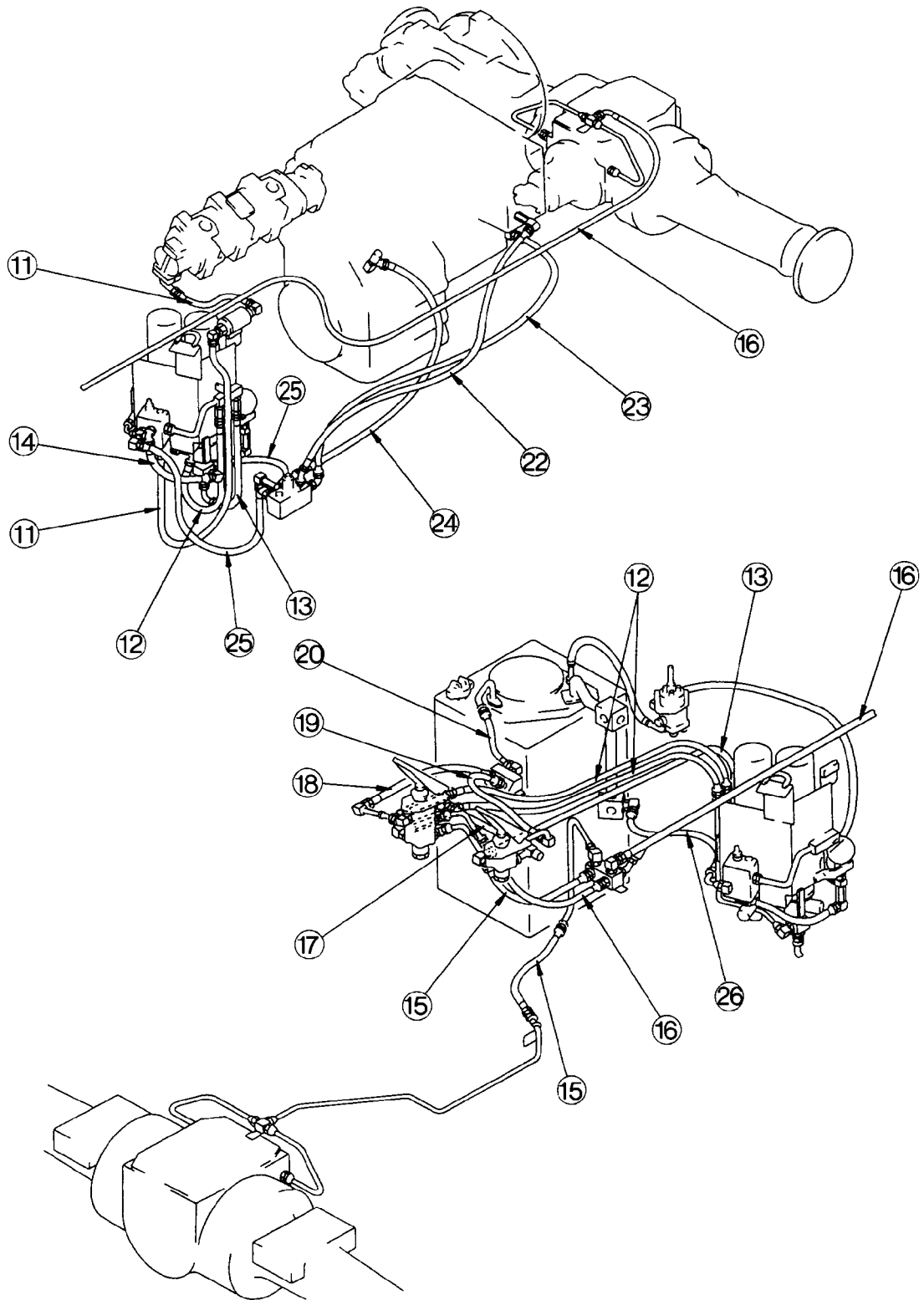
Ask your distributor to replace the safety critical parts.

**SAFETY CRITICAL PARTS**

No.	Safety critical parts for periodic replacement	Replacement interval	Qty.
1	Fuel hose (fuel tank - strainer)	Every 2 years or 4000 hours, whichever comes first	1
2	Fuel return hose (strainer - injection pump)		1
3	Fuel return hose (injection pump - fuel tank)		1
4	Steering hose (pump - priority valve)		1
5	Steering hose (priority valve - orbitrol valve)		1
6	Steering hose (orbitrol valve - steering valve)		2
7	Steering hose (orbitrol valve - steering valve)		2
8	Steering hose (orbitrol valve - steering valve)		4
9	Steering hose (steering cyl. line - cushion valve)		2
10	Packings, seals, O-rings of steering cylinder		2
11	Brake hose (pump - accumulator charge valve)		2
12	Brake hose (check valve - tandem valve)		3
13	Brake hose (check valve - single valve)		2
14	Brake hose (check valve - accumulator port)		1
15	Brake hose (Tandem valve - front brake)		2
16	Brake hose (Tandem valve - rear brake)		2
17	Brake hose (single valve - tandem valve)		1
18	Brake hose (tandem valve - drain block)		1
19	Brake hose (single valve - drain block)		1
20	Brake hose (drain block - hydraulic tank)		1
21	Brake hose (accumulator - reduction valve)		1
22	Brake hose (transmission valve - reduction valve)		1
23	Brake hose (reduction valve - parking brake chamber)		1
24	Brake hose (Parking - reduction valve)		1
25	Brake hose (reduction valve - charge valve drain)		1
26	Brake hose (charge valve drain - hydraulic tank)		1
27	Seat belt	Every 3 years	1



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## MAINTENANCE

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### 23. MAINTENANCE SCHEDULE

#### 23.1 SCHEDULED MAINTENANCE CHART

SERVICE ITEM	PAGE
<b>INITIAL 250 HOURS SERVICE (only after the first 250 hours)</b>	
Replace fuel filter cartridge	3-30
Replace transmission oil filter element	3-30
Replace hydraulic tank filter element	3-30
<b>WHEN REQUIRED</b>	
Check, clean and replace air cleaner element	3-31
Check transmission oil level, add oil	3-33
Check axle oil level, add oil	3-34
Clean axle case breather	3-35
Clean radiator fins	3-35
Replace bolt on cutting edge	3-36
Replace bucket teeth	3-37
Check air conditioner	3-38
Clean the air conditioner condenser	3-39
Check window washer fluid level, add fluid	3-39
Lubricate work equipment control valve linkage (2 points)	3-39
<b>CHECK BEFORE STARTING</b>	
Check monitor panel	2-37
Check coolant level, add coolant	2-37
Check fuel level, add fuel	2-38
Check oil level in engine oil pan, add oil	2-39
Check electric wiring	2-36
Drain water from the fuel water separator	2-40

<b>SERVICE ITEM</b>	<b>PAGE</b>
<b>CHECKS BEFORE STARTING (continued)</b>	
Check effect of parking brake	2-41
Check effect of wheel brakes	2-41
Check sound of horn and backup alarm	2-41
Check flashing of lamps, check for dirt or damage	2-41
Check engine exhaust color and sound	2-41
Check operation of gauges	2-41
Check play of steering wheel, check operation of steering	2-41
Check direction of rear view mirror, check for dirt or damage	2-41
<b>EVERY 50 HOURS SERVICE</b>	
Check tire inflation pressure	3-46
Drain water, sediment from fuel tank	3-46
<b>EVERY 100 HOURS SERVICE</b>	
Check oil level in hydraulic tank, add oil	3-46
Clean element in air conditioner fresh air filter	3-47
Lubricate rear axle pivot pin (3 points)	3-47
<b>EVERY 250 HOURS SERVICE</b>	
Change oil in engine oil pan, replace engine oil filter cartridge	3-48
Check for loose wheel hub nuts, tighten	3-49
Clean element in air conditioner recirculation filter	3-50
Check air conditioner compressor belt tension, adjust	3-50
Check battery electrolyte level	3-51
Lubricate	3-52
Bucket (2 points)	3-52
Bucket link (2 points)	3-52
Dump cylinder pin (2-points)	3-52
Lift cylinder pin (4 points)	3-52

## MAINTENANCE

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SERVICE ITEM	PAGE
<b>EVERY 250 HOURS SERVICE (continued)</b>	
	3-52
	3-52
	3-52
Replace coolant corrosion resistor cartridge	3-53
<b>EVERY 500 HOURS SERVICE</b>	
Replace fuel filter cartridge	3-54
Replace transmission oil filter element	3-56
Lubricate center drive shaft spline (1 point)	3-60
<b>EVERY 1000 HOURS SERVICE</b>	
Change oil in transmission case, clean strainer	3-57
Clean transmission case breather	3-57
Lubricate	3-58
	3-58
	3-58
	3-58
	3-58
	3-58
Check and adjust engine valves	3-60
Check tension of drive belt	3-63
Check drive belt tensioner bearing and fan hub bearing	3-63
<b>EVERY 2000 HOURS SERVICE</b>	
Cooling system, replace coolant and flush the system	3-70
Change oil in hydraulic tank, replace hydraulic filter element	3-73
Replace hydraulic tank breather element	3-75
Change axle oil	3-76
Change brake disc wear	3-77

frequently or the brakes make noise, change the oil after a shorter interval.

<b>SERVICE ITEM</b>	<b>PAGE</b>
<b>EVERY 2000 HOURS SERVICE (continued)</b>	
Check vibration damper	3-77
Replace element in air conditioner recirculation air filter and fresh air filter	3-77
Clean PPC circuit strainer	3-78
Check accumulator gas pressure	3-78

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## **24. SERVICE PROCEDURE**

### **24.1 INITIAL 250 HOURS SERVICE**

Carry out the following maintenance only after the first 250 hours.

**REPLACE FUEL FILTER CARTRIDGE  
REPLACE TRANSMISSION OIL FILTER ELEMENT  
REPLACE HYDRAULIC TANK FILTER  
ELEMENT**

For details of the method of replacing or maintaining, see the sections on 500 HOURS and 2000 HOURS SERVICE.

## 24.2 WHEN REQUIRED

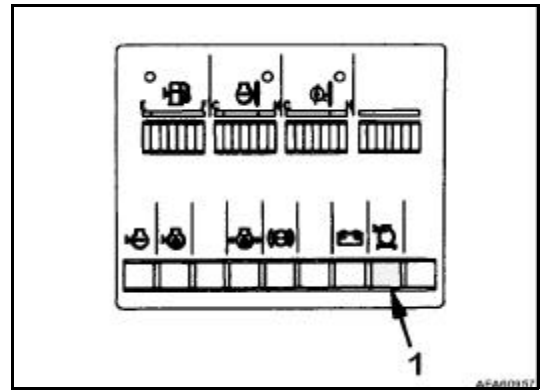
### 24.2.1 CLEAN OR REPLACE AIR CLEANER ELEMENT

**WARNING**

Never clean or replace the air cleaner element with the engine running. When using pressurized air to clean the element wear safety glasses or goggles to protect the eyes.

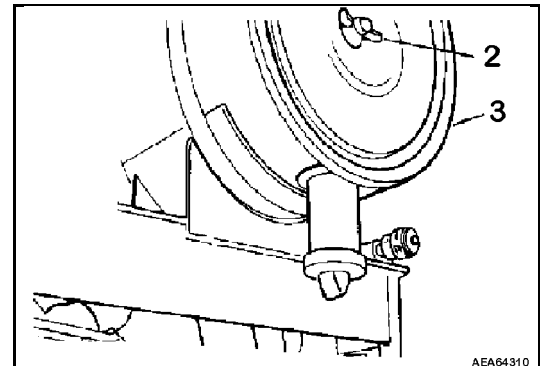
#### Checking

If air cleaner clogging caution lamp (1) on the maintenance monitor flashes, clean the air cleaner element.



#### Cleaning or Replacing Outer Element

1. Remove wing nut (2), and cover (3), take out outer element.
2. Clean the inside of the air cleaner body.
3. Direct dry compressed air, less than 7 kg/cm<sup>2</sup>, (100 psi) to element from inside along its folds, then direct it from outside along its folds and again from inside.

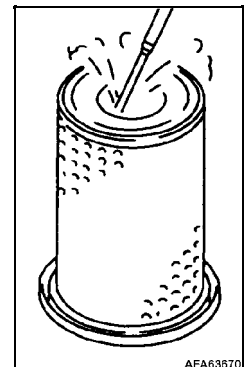
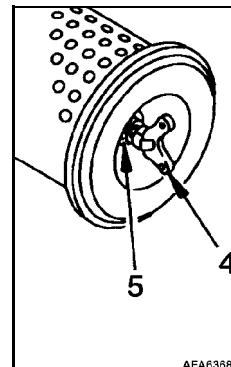


1) Remove one seal from the outer element whenever the outer element has been cleaned.

2) Replace the outer element which has been cleaned six times repeatedly or used throughout a year. Replace the inner element at the same time.

3) If the dust indicator display red immediately after the outer element has been cleaned, replace both inner and outer elements, even if the outer element has not been cleaned six times.

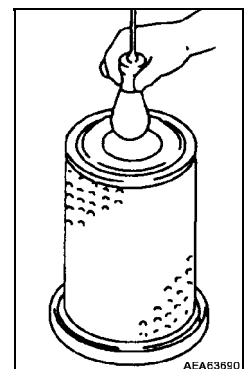
4) Check inner element mounting nuts for looseness and, if necessary, retighten. Replace seal washer (5) or wing nut (4) with new parts if they are broken.



#### NOTE:

After cleaning and drying the element, check it by shining a light through it. If small holes or thin cracks are found, replace the element. When cleaning the element, do not hit it or beat it against anything. Do not use an element that has any damaged folds, gaskets or seals.

5) After cleaning, reinstall.



## **MAINTENANCE**

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### **Replacing Inner Element**

1. First remove the cover and the outer element, and then remove the inner element.
2. To prevent dust from getting in, use a clean cloth or tape to cover the air connector (outlet side).
3. Clean the air cleaner body interior, then remove the cover installed in Step 2.
4. Fit a new inner element to the connector and tighten it with nuts.

#### **NOTE:**

Do not clean and reinstall an inner element.

5. Install the outer element.

### **Using Water**

Wash the element with water at less than 3 kg/cm<sup>2</sup> (43 psi) of pressure, from the inside along the folds, then from the outside and again from the inside. then let the element dry.

### **Using Water with a Cleaning Agent**

To remove oil, grease and carbon etc. clean the element in a lukewarm solution of mild detergent, then rinse in clean water and let it dry.

#### **REMARKS:**

Using warm water about 40°C may also be effective in cleaning the element. To speed up the drying process, blow air with less than 7 kg/cm<sup>2</sup> (100 psi), of force to the inside of the element.

#### **NOTE:**

Do not attempt to heat the element.

24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL

**WARNING**

When checking the oil level, apply the parking brake and lock the front and rear frames with the safety bar and pin. The oil is at a high temperature after the machine has been operated. Always wait for the temperature to go down before carrying out this procedure.

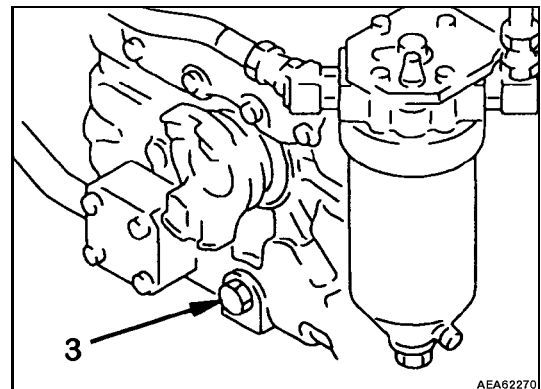
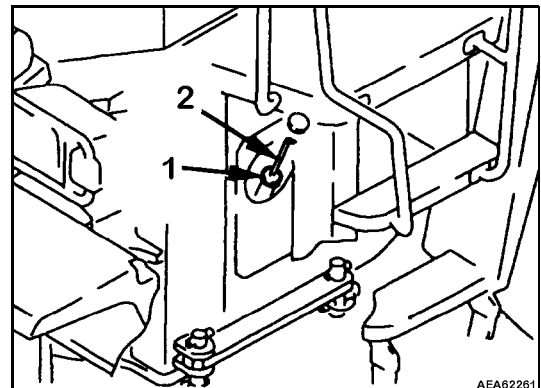
Carry out this procedure if there is any sign of oil on the transmission case, or if there is oil mixed with the cooling water.

1. Start the engine and run it for at least five minutes.
2. Open the cap of oil filler port (1), remove dipstick (2), and wipe the oil off with a cloth.
3. Insert dipstick (2) fully into the oil filler pipe, then remove it.
4. The oil level should be between **H** and **L** on the dipstick

If the oil level is below the **L** mark, then add oil through the oil filler.

For details of the oil to use, see **20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE** on page 3-10.

5. If the oil is above the **H** mark, drain the excessive oil from the drain plug (3) and check the oil level again.
6. If the oil level is correct, insert the dipstick back into the filler and tighten the cap.





## MAINTENANCE

### 24.2.3 CHECK AXLE OIL LEVEL, ADD OIL

#### WARNING

When checking the oil level, apply the parking brake and lock the front and rear frames with the safety bar and pin. The oil is at a high temperature after the machine has been operated. Always wait for the temperature to go down before carrying out this procedure.

Carry out this procedure if there is any sign of oil on the axle.

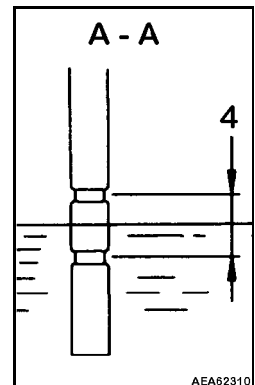
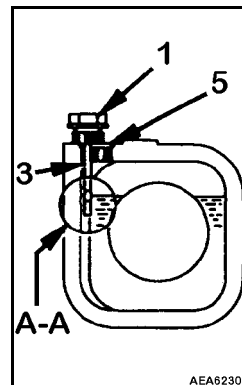
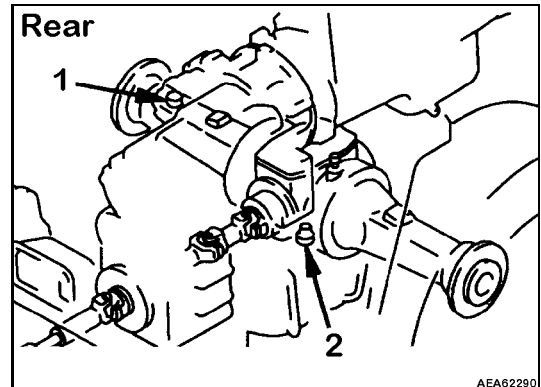
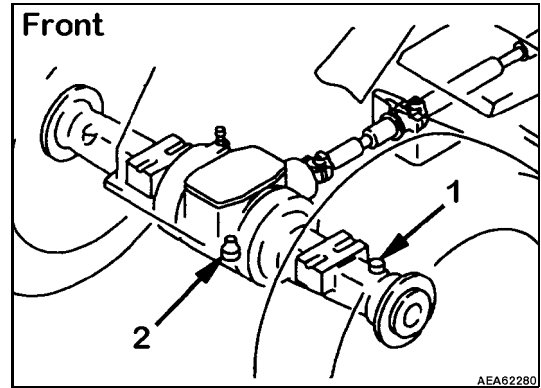
Carry out this inspection with the machine on a horizontal road surface. (If the road is at an angle, the oil level check will not be accurate.)

1. Turn OFF the engine and remove oil level plug (1).
2. Wipe off the gauge attached to the plug with a cloth.
3. Set the oil level gauge (3) as shown in the diagram.
4. The oil level is correct when it is between two lines (4) provided on the oil level gauge. If the oil does not reach the lower line, then add oil through filler port (5).

For details of the oil to use, see **20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE** on page 3-10.

5. If the oil level is above the upper line, then drain off the excess oil through drain plug (2) and check the oil level again.
6. If the oil level is correct then install plug (1).

 Oil level plug . . . . . 132 ± 39 N

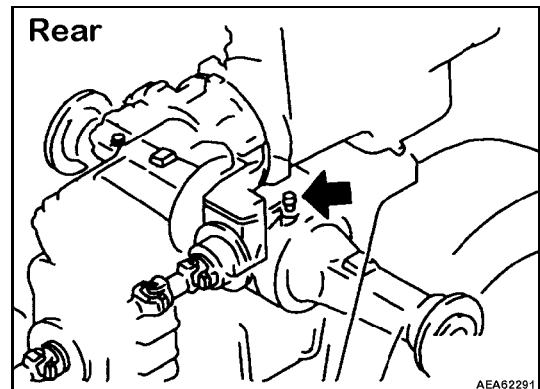
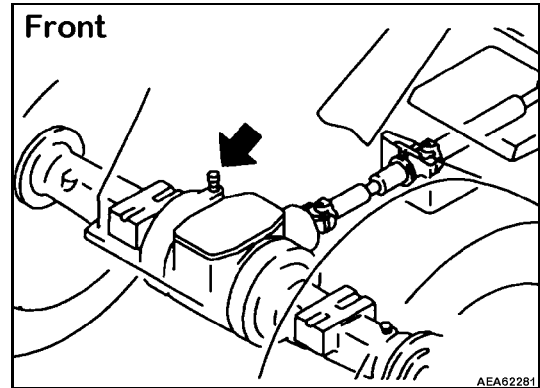


24.2.4 CLEAN THE AXLE CASE BREATHER

**WARNING**

When checking the oil level, apply the parking brake and lock the front and rear frames with the safety bar and pin.

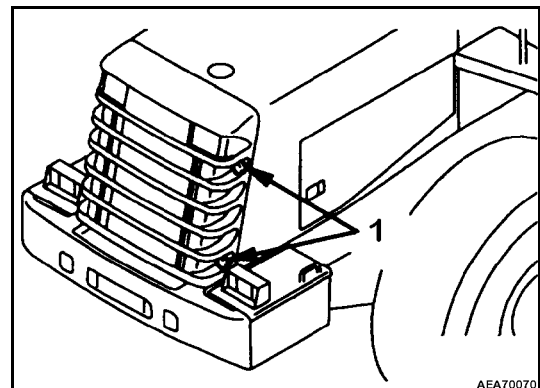
Remove all mud and dirt from around the breather with a brush. When cleaning the breather, clean the breather at two places (front and rear).



24.2.5 CLEAN THE RADIATOR FINS

Carry out this procedure if there is any dirt, mud, leaves etc. stuck to the radiator.

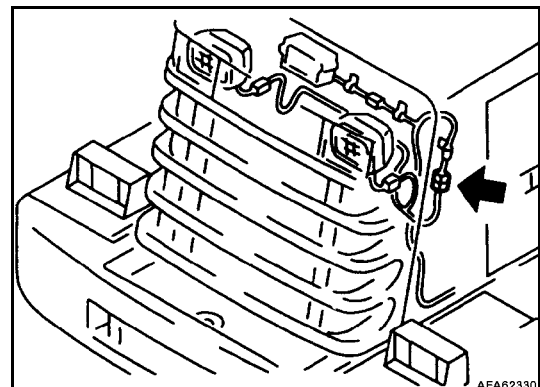
1. Remove bolt (1), then open the rear grill from the rear of the machine. Remove the connector of the rear working lamp at the same time.



2. Use compressed air to clean the dirt, mud, leaves etc. from the radiator fins. Steam or water may also be used.

**NOTE:**

This is a good time to check the hoses. See if any hoses show cracks or hardness due to aging and if any of the clamps are loose.



## MAINTENANCE

### 24.2.6 REPLACE THE BOLT-ON CUTTING EDGES



#### WARNING

It is extremely dangerous if the work equipment moves when performing this procedure. Set the work equipment in a stable position, turn off the engine, then set the safety lock for the work equipment control lever securely to the LOCK position.

Turn or replace the cutting edges before the wear reaches the edge of the bucket.

1. Raise the bucket to a suitable height, and position the bucket so the bottom surface is horizontal. Block the bucket so it doesn't drop.
2. Remove nuts and bolts (1). Remove cutting edge (2).
3. Clean the mounting surface of the cutting edges.
4. Flip the cutting edges (2) over and re-assemble the end edges by placing them to the opposite side (left edge to the right side, right edge to the left side).

Install a new cutting edge if both sides are worn.

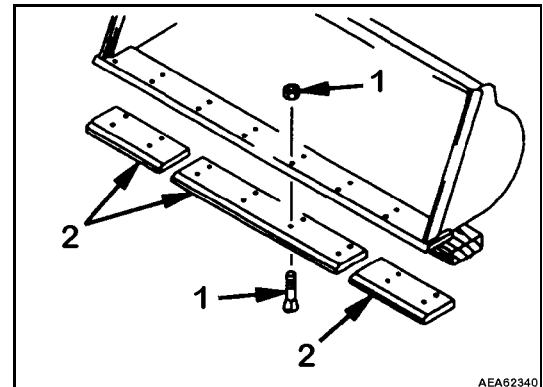
#### NOTE:

If the wear extends to the mounting surface then repair the surface before installing the cutting edge.

5. Tighten nuts and bolts (1) uniformly to prevent any gap from occurring between the bucket and the cutting edge.

 Mounting nuts . . . . . 1040 ± 157 N

6. Retorque the mounting bolts again after operating the equipment for several hours.



24.2.7 REPLACE BUCKET TEETH

**WARNING**

It is extremely dangerous if the work equipment moves when performing this procedure. Set the work equipment in a stable position, turn off the engine, then set the safety lock for the work equipment control lever securely to the LOCK position.

Replace worn bucket teeth as follows.

1. Raise the bucket to a suitable height, then position the bucket so that the bottom surface of the bucket is horizontal and put blocks under it to prevent it from coming down.
2. For one-piece bucket teeth, proceed to step 3. To replace Super V type removable bucket teeth points, proceed as follows.
  - A. Remove clips (4) (special tool has been provided).
  - B. Remove point(s) (3) from the adapter(s). The adapters themselves can be removed after nuts (1) and bolts (2) have been removed.
  - C. Make sure adapter is clean and install the new point(s) (3) on the adapter(s), and secure with the clip(s) (4) removed in step 2A.
  - D. Proceed to step 6.
3. Remove nuts and bolts (1) and (2) then remove the teeth (3).
4. Clean the mounting surface of the bucket teeth.

If the mounting surface is worn then repair and correct it before installing new teeth.

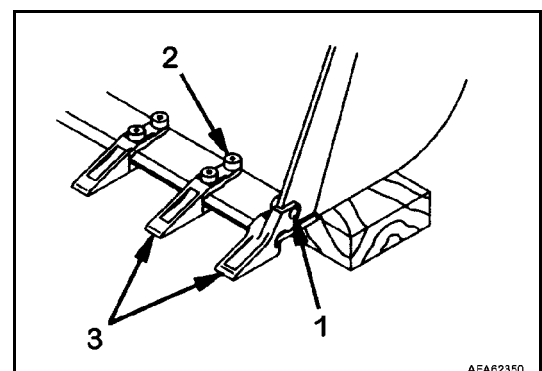
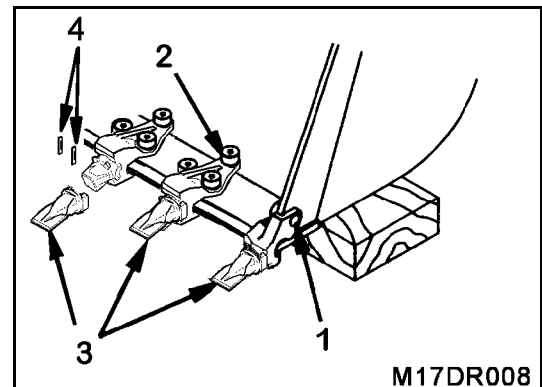
5. Install new teeth and use shims to eliminate any clearance between the teeth and the top surface of the bucket.

 Minimum clearance . . . . . less than 0.5 mm (0.02 in)

6. To prevent any gap from occurring between the tooth and the tip of the bucket, slightly loosen the hardware (temporarily) then hit the tip of the tooth with a hammer. Tighten the mounting hardware.

 Mounting nuts . . . . . 1265 ± 69 N

7. Retorque the mounting bolts again after operating the equipment for several hours.



## MAINTENANCE

### 24.2.8 CHECK AIR CONDITIONER

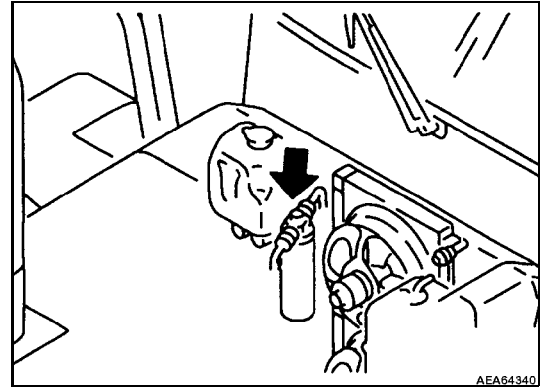
Check twice a year: spring and autumn.

#### Check Levels of Refrigerant (Gas)



#### WARNING

The refrigerant in the system can injure eyes or skin. To avoid blindness and/or frostbite, avoid contact with the substance; NEVER loosen any part of the refrigerant circuit.

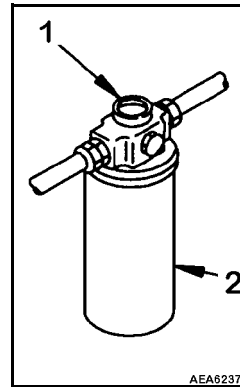


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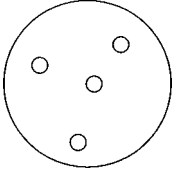
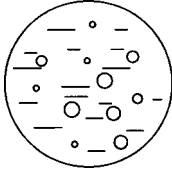
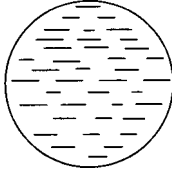
Operate the air conditioner system for 5 to 10 minutes, then touch the high pressure portion and low pressure portion of the compressor (or high pressure hose and low pressure hose joint) by hand. At the same time, inspect the flow of refrigerant gas (R134a) through the sight glass to check the level.

Contact your distributor concerning this inspection.

The sight glass is located on the air conditioner dryer receiver, which is located on the right side of the machine next to the condenser.



AEA62370

COOLER CONDITION	NORMAL	ABNORMAL	
Temperature of high and low pressure pipes	High pressure pipe is hot Low pressure pipe is cold. Clear difference in temperature	High pressure pipe is warm. Low pressure pipe is cold. Little difference in temperature.	Almost no difference in temperature between high and low pressure pipes.
Sight glass	Almost transparent. Any bubbles disappear if the engine speed is raised or lowered. 	Bubbles are always flowing. Sometimes becomes transparent or white bubbles appear. 	Misty substance is flowing. 
System line Connections	Properly connected	Some parts dirty with oil	Some parts very dirty with oil
General condition of air conditioner	Refrigerant level correct, no abnormalities. Ready for use.	Could have a gas leak. Contact your distributor for inspection and repair.	Almost all gas has leaked out. Contact your distributor for inspection and repair.

**24.2.9 CLEAN THE AIR CONDITIONER CONDENSER**

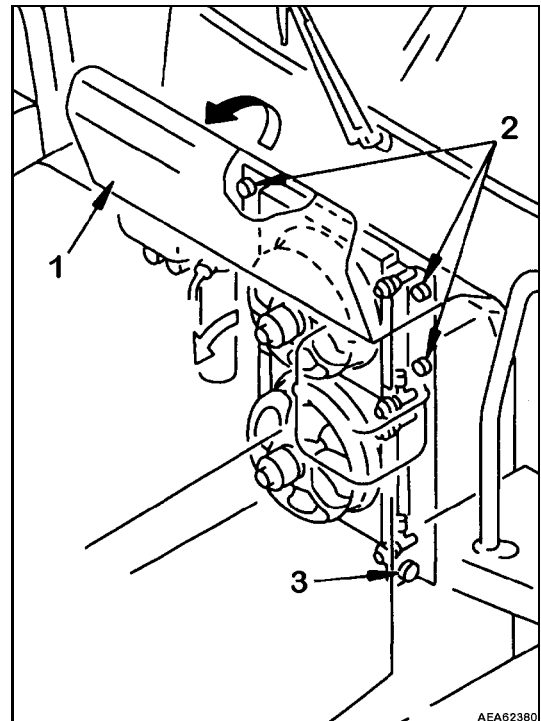
**⚠ WARNING**

**Do not wash the condenser with a steam cleaner. Otherwise, the condenser will get hot and could break down**

If there is mud or dust on the air conditioner condenser, clean it with water. When washing with a high pressure machine, apply the water from a reasonable distance. If the water pressure is too high it could deform the fins.

**Washing Method**

1. Open the top cover (1) at the hood front side.
2. Remove bolts (2) at the condenser upper portion.
3. Push condenser backward on pin (3) at the condenser lower portion.
4. Clean condenser with water to the upper portion.



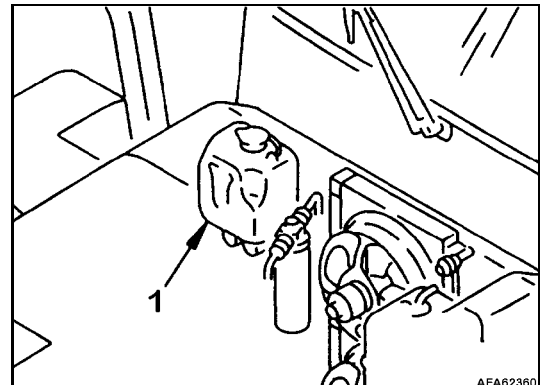
AEA62380

**24.2.10 OPERATE THE AIR CONDITIONER OFF SEASON**

Operate the system for three to five minutes once a month during the off-season, regardless of the weather. Allow the engine to run at low speed idle. This brief operation circulates lubricant through the compressor, necessary for long life.

**24.2.11 CHECK WINDOW WASHING FLUID, ADD FLUID**

Check the washing fluid level in washer tank (1). When the fluid is low, add automotive window washing fluid. To prevent the nozzle from clogging, be careful not to let dust get into the fluid.

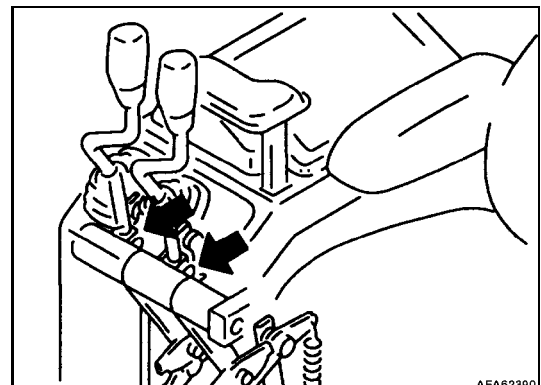


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**24.2.12 LUBRICATE WORK EQUIPMENT CONTROL VALVE LINKAGE (2 PLACES)**

If the work equipment control lever is stiff or does not move smoothly, apply grease.

1. Using a grease pump, pump in grease through the grease fittings shown by the arrows.
2. After greasing, wipe any old grease that was pushed out.



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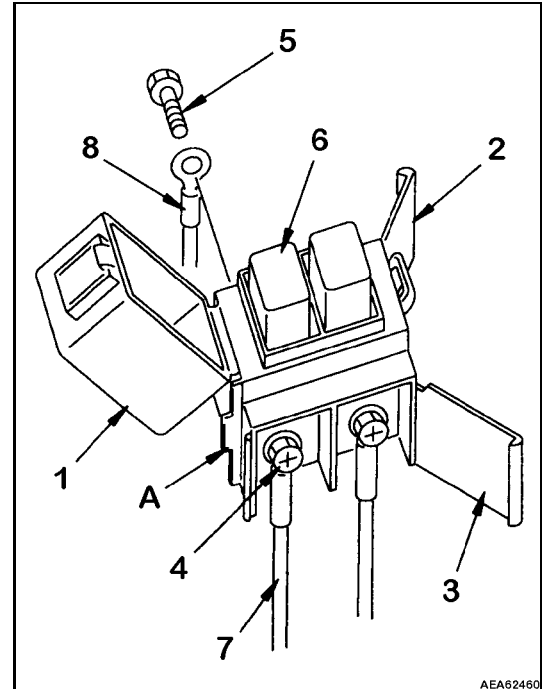
## MAINTENANCE

### 24.2.13 REPLACE SLOW BLOW FUSE

**NOTE:**

**Always turn the power OFF when replacing the slow blow fuse (turn the starting switch to the OFF position). Always replace the slow blow fuse with a fuse of the same capacity.**

1. Turn the starting switch to the OFF position.
2. Remove the slow blow fuse box from the chassis.
3. Open covers (1), (2) and (3) of the slow blow fuse box. Covers (2) and (3) can be removed easily by using protrusion **A** on the body as a fulcrum and levering the catch of the cover with a flat headed screwdriver to release it.
4. Loosen screws (4) and (5) and remove. When screws (4) and (5) are removed, slow blow fuse (6) will also come off together with electric wiring (7) and (8).
5. Using screws (4) and (5), install a new slow blow fuse together with electric wiring (7) and (8) to the slow blow fuse box, then close covers (1), (2) and (3).
6. Install the slow blow fuse box to the chassis.



24.2.14 SELECTION AND INSPECTION OF TIRES

**⚠ WARNING**

If a tire or a rim is handled wrong, the tire may burst or may be damaged and the rim may be broken and scattered, causing serious injury and/or death. Since maintenance, disassembly, repair and assembly of the tires and rims require special equipment and skill, be sure to ask a tire repair shop to carry out the work. Do not heat or weld the rim to which the tire is installed. Do not make a fire near the tire. Select the tires according to the conditions of use and attachments on the machine. Use only specified tires and inflate them to the specified pressure.



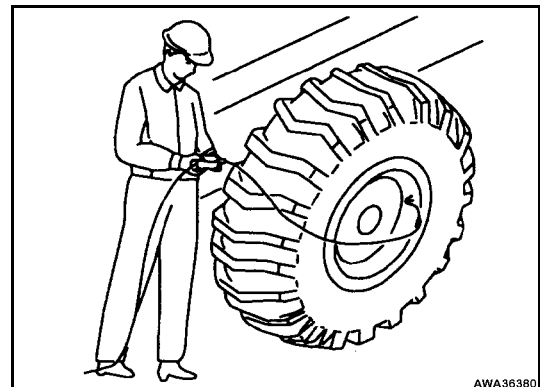
**Selection of Tires**

Select the tires according to the conditions of use and attachments of the machine. Use the following table. Since the indicated speed varies with the tire size, consult your Komatsu distributor when using optional tires.

**Check Tire Pressure and Inflating Tires**

**⚠ WARNING**

When inflating a tire, check that no one will enter the working area and use an air chuck which has a clip and which can be fixed to the air valve. While inflating the tire, check the inflation pressure occasionally so that it will not rise too high. If the rim is not fitted normally, it may be broken and scattered while the tire is inflated. To ensure safety, place a guard around tire and do not work in front of the rim but work on the tread side of the tire. Abnormal drop of inflation pressure and abnormal fitting of the rim indicate a trouble in the tire or rim. In this case, be sure to ask a tire repair shop to carry out repairs. Be sure to observe the specified inflation pressure. Do not adjust the inflation pressure of the tires just after high speed travel or heavy duty work.



**Check**

Measure the inflation pressure with a tire pressure gauge while the tires are cool before starting work.

**Inflation of tires**

Adjust the inflation pressure properly. When inflating a tire, use an air chuck which can be fixed to the valve of the tire. Do not work in front of the rim but work on the tread side of the tire. Standard pressure for 20.5-5.25-12PR (L3 rock) tires is 2.8 kgf/cm<sup>2</sup> (39.8 psi).

**NOTE:**

The appropriate tire inflation pressure differs according to the type of work, so see "12.18 HANDLING THE TIRES" on page 2-70.



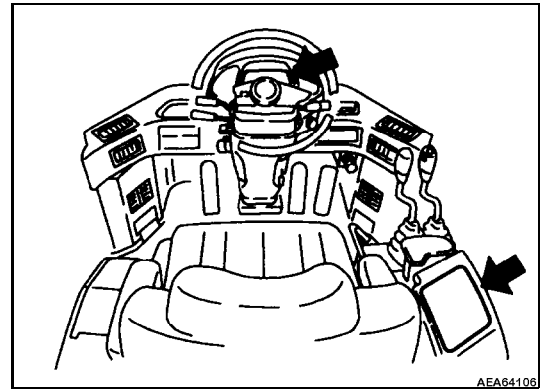
# MAINTENANCE

## 24.3 CHECK BEFORE STARTING

### 24.3.1 CHECK MONITOR PANEL

Check the monitor lamps, the gauges and the warning lamp see “12.1.2 CHECK BEFORE STARTING” on page 2-42.

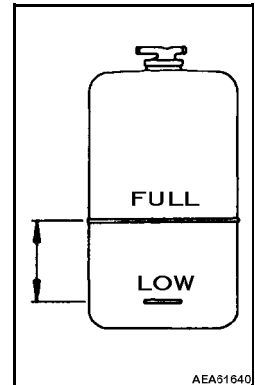
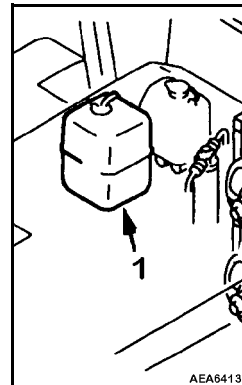
If any monitor lamp does not light up, ask your Komatsu distributor to inspect that monitor lamp. Do not carry out the checks before starting using only the monitor; always carry out also the items specified for the periodic maintenance.



### 24.3.2 CHECK COOLANT LEVEL, ADD WATER

Normally, do not open the radiator cap. Always wait for the engine to cool down before checking the water level, and check using the subtank.

Open the top cover at the front of the engine hood in the middle of the machine, and check that the coolant level is between the FULL and LOW marks on sub-tank (1). If the coolant level is low, add water to the FULL level through the water filler in subtank. After adding water, tighten the cap securely. If subtank (1) is empty, check for water leakage, then add water to the radiator and subtank.

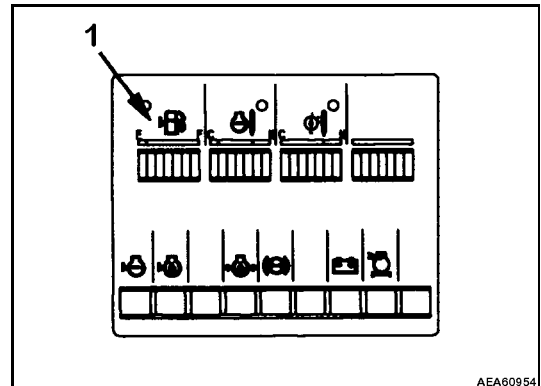


### 24.3.3 CHECK FUEL LEVEL, ADD FUEL

#### **WARNING**

**When adding fuel, never let the it overflow. This may cause a fire. If you spill fuel, thoroughly clean up any spillage.**

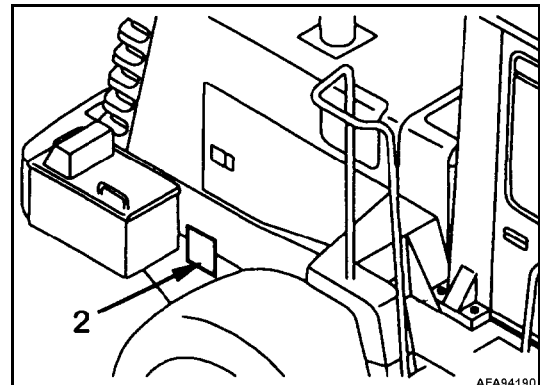
1. Turn the engine starting switch to the ON position, then check the fuel level with fuel gauge (1). After checking, return the starting switch to the OFF position.
2. Upon completion of work, add fuel through filler (2) until the fuel tank is full.



For details of the fuel to use, see **20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE** on page 3-10.

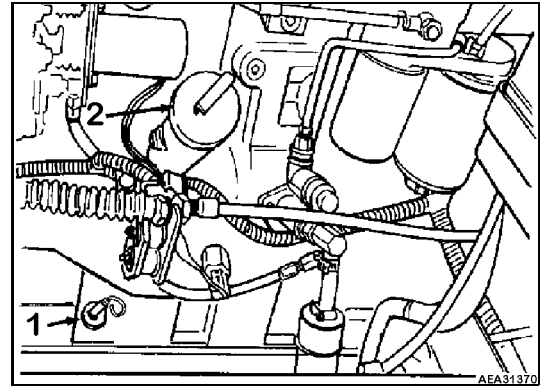
3. After adding fuel, tighten the cap securely.

Fuel capacity ..... 248



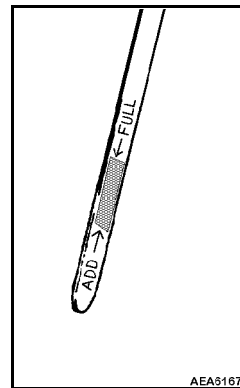
**24.3.4 CHECK OIL LEVEL IN ENGINE OIL PAN, ADD OIL**

1. Open the engine side cover at the rear right side of the machine.
2. Remove dipstick (1) and wipe the oil off with a cloth. Insert dipstick fully in the oil filler pipe, then take it out again.



3. The oil level should be between the **H** and **L** marks on dipstick. If the oil level is below the **L** mark, add engine oil through oil filler.

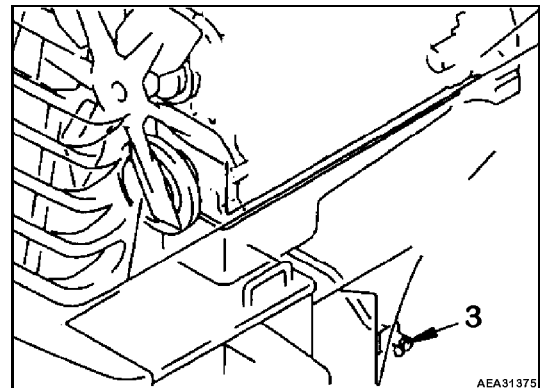
For details of oil to use, see **20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE** on page 3-10.



4. If the oil is above the H mark, drain the excess engine oil from drain plug (3), and check the oil level again.
5. If oil level is correct, tighten the oil filler cap securely, then tighten the engine side cover.

**REMARK**

When checking the oil level after the engine has been operated, wait for at least 15 minutes after stopping the engine before checking. If the machine is at an angle, make it horizontal before checking.



## MAINTENANCE

### 24.3.5 CHECK ELECTRIC WIRING

#### **WARNING**

If fuses are frequently blown or if there are traces of short circuit on the electrical wiring, locate the cause and carry out repair.

Accumulation of flammable material (dead leaves, twigs, grass, etc.) around the battery may cause fire, so always check and remove such material.

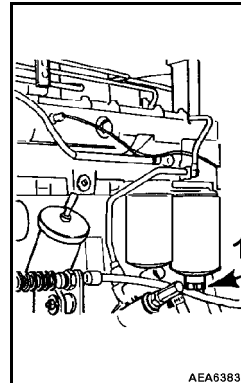
Keep the top surface of the battery clean and check the breather hole in the battery cap. If it is clogged with dirt or dust, wash the battery cap to clear the breather hole.

Check for damage and wrong capacity of the fuse and any sign of disconnection or short circuit in the electric wiring. Check also for loose terminals and tighten and loose parts. Check the wiring of the battery, starting motor and alternator carefully, in particular.

When carrying out walk-around checks or checks before starting, always check if there is any accumulation of flammable material around the battery, and remove such flammable material. Please contact your Komatsu distributor for investigation and correction of the cause.

### 24.3.6 DRAIN WATER FROM FUEL WATER SEPARATOR

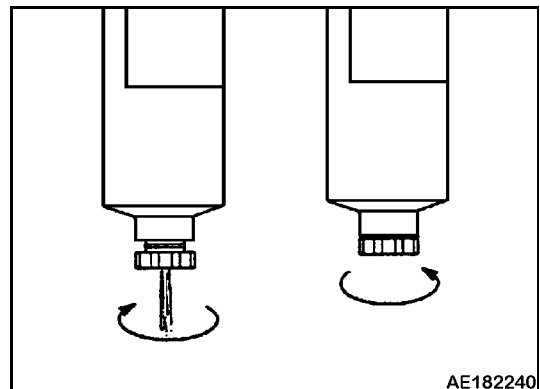
With the engine shut off, open the drain valve (1). Turn the valve counterclockwise approximately 1-½ to 2 turns until draining occurs. Drain the filter sump of water until clear fuel is visible.



Do not overtighten the valve. Overtightening can damage the threads.

Turn the valve clockwise approximately 1-½ to 2 turns to close the drain valve.

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



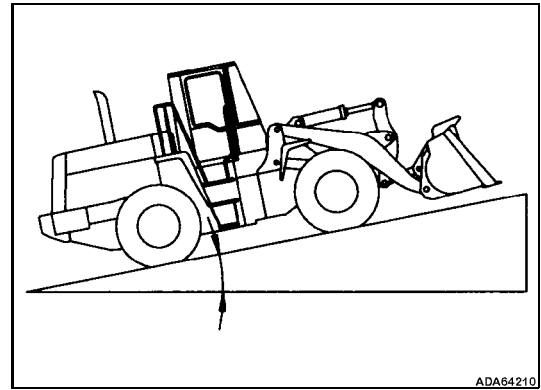
**24.3.7 CHECK EFFECT OF PARKING BRAKE**

**⚠ WARNING**

Even if the parking brake switch is turned ON, there is danger until the parking brake pilot lamp lights up, so keep the brake pedal depressed.

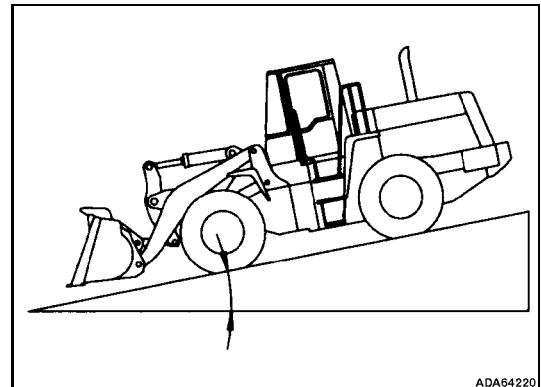
**Measurement Conditions**

Tire inflation pressure . . . . . Specified pressure  
 Road surface . . . . . Dry paved with 1/5 (11  
 Machine . . . . . Operating condition



**Method of Measurement**

1. Start the engine, set the machine facing straight to the front, then drive the machine up a 1/5 grade with the bucket empty.
2. Depress the brake, stop the machine, return the directional lever to the neutral position, then stop the engine.
3. Press the parking brake switch to the ON position, release the brake pedal slowly, and check that the machine is held in position.



**24.3.8 CHECK EFFECT OF BRAKE**

Drive the machine at a speed of 20 km/h (12.4 MPH) on a dry flat concrete road surface, and check that the stopping distance is less than 5 m (16 ft 5 in).

**24.3.9 CHECK SOUND OF HORN AND BACKUP ALARM**

**24.3.10 CHECK FLASHING OF LAMPS, CHECK FOR DIRT OR DAMAGE**

**24.3.11 CHECK ENGINE EXHAUST COLOR AND SOUND**

**24.3.12 CHECK OPERATION OF GAUGES**

**24.3.13 CHECK PLAY OF STEERING WHEEL, CHECK OPERATION OF STEERING**

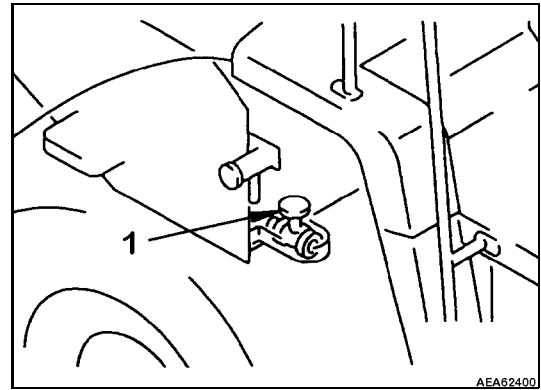
**24.3.14 CHECK DIRECTION OF REAR VIEW MIRROR, CHECK FOR DIRT OR DAMAGE**

## MAINTENANCE

### 24.4 EVERY 50 HOURS SERVICE

#### 24.4.1 DRAIN WATER, SEDIMENT FROM FUEL TANK

Loosen valve (1) on the right side of the tank so that the sediment and water will be drained together with fuel.



### 24.5 EVERY 100 HOURS SERVICE

Maintenance for every 50 hours should be carried out at the same time.

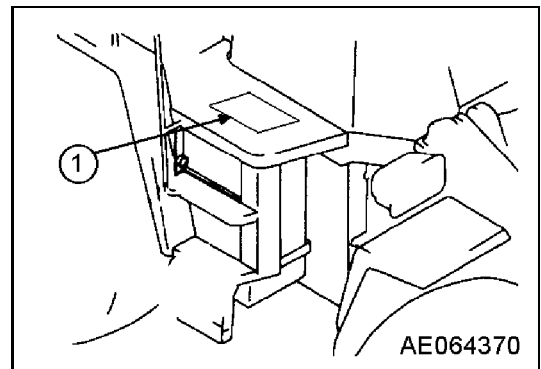
#### 24.5.1 CHECK OIL LEVEL IN HYDRAULIC TANK, ADD OIL



#### WARNING

When the oil filler cap is removed, oil may spurt out, so turn OFF the engine and wait for the oil temperature to cool down, then turn the cap slowly to release the internal pressure before removing the cap.

If oil has been added to above the H mark, turn OFF the engine and wait for the hydraulic oil to cool down, then drain the excess oil from the drain plug.



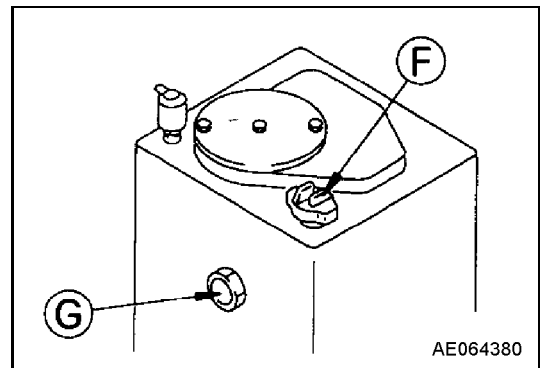
1. Lower the bucket horizontally to the ground and turn OFF the engine. Wait for 5 minutes, then check sight gauge (G). The oil level should be between the H and L marks.

#### NOTE:

Do not add oil if the oil is above the H line. This will damage the hydraulic equipment and cause oil to spurt out.

2. If the oil is below the L level, open the inspection cover above the step and add oil through oil filler port (F).

For specification of the oil to use, see "20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE" on page 3-10.



**24.5.2 CLEAN ELEMENT IN AIR CONDITIONER FRESH AIR FILTER**



**WARNING**

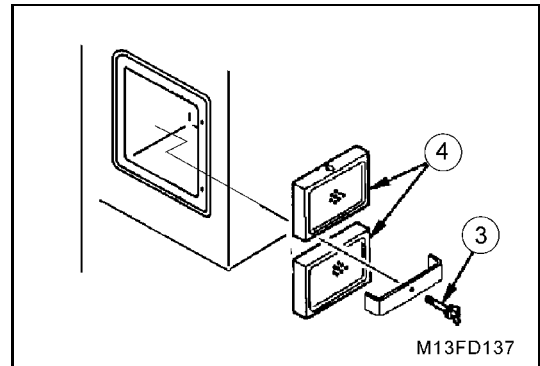
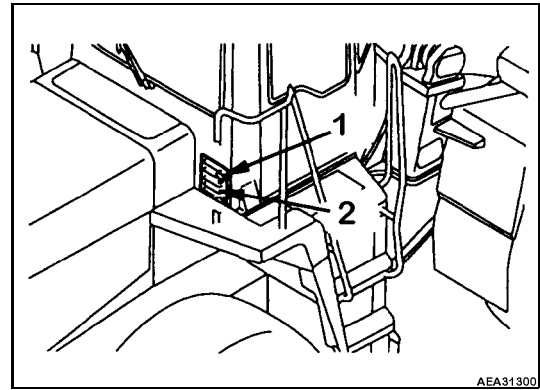
**When using compressed air, wear safety glasses and other approved protective apparel.**

If the air conditioner has been used, its air filter element could need cleaning. Before cleaning the elements, turn the air conditioner OFF.

1. Loosen the screws (1) and remove cover (2).
2. Loosen screw (3) and remove element (4) to clean it.
3. Direct compressed air, less than 7 kg/cm<sup>2</sup> (100 psi), to the element from the inside along its folds, then direct it from the outside along its folds and again from the inside. Check the element for damage and/or deterioration.

**REMARKS**

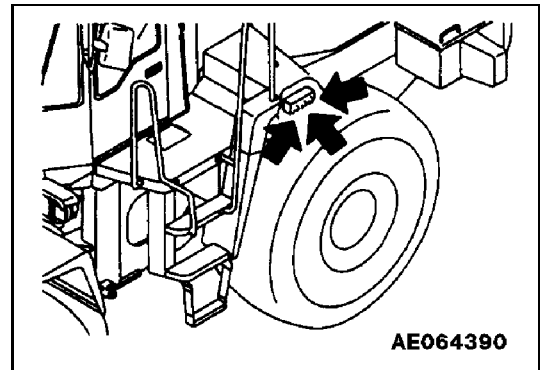
When reassembling the element, install it so that the arrow on top of the filter is facing the inside of the cab.



**24.5.3 LUBRICATE REAR AXLE PIVOT PIN (3 PLACES)**

Set the work equipment in a stable condition, then turn OFF the machine and apply the lock for the work equipment control levers. Apply the parking brake, and lock the front and rear frames with the safety bar and pin.

1. Use a grease pump to pump in grease through the grease fittings marked by the arrows.
2. After greasing wipe off any old grease that was pushed out.



# MAINTENANCE

## 24.6 EVERY 250 HOURS SERVICE

Maintenance for every 50 and 100 hours should be carried out at the same time.

### 24.6.1 CHANGE OIL IN ENGINE OIL PAN, REPLACE ENGINE OIL FILTER CARTRIDGE



#### WARNING

Before changing the oil, wait, at least 10 minutes for the engine to cool down after running it. If the filter is removed before the oil settles the oil might continue to spill.

Prepare the following.



Oil catch container . . . . . Min 22



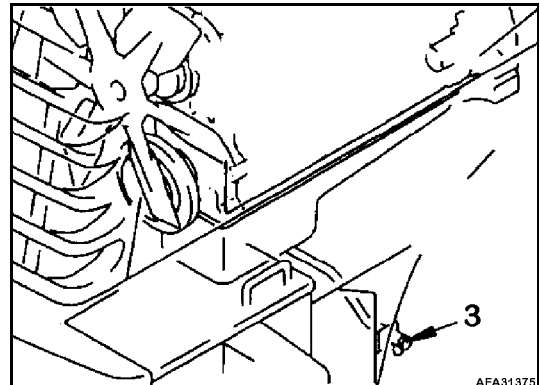
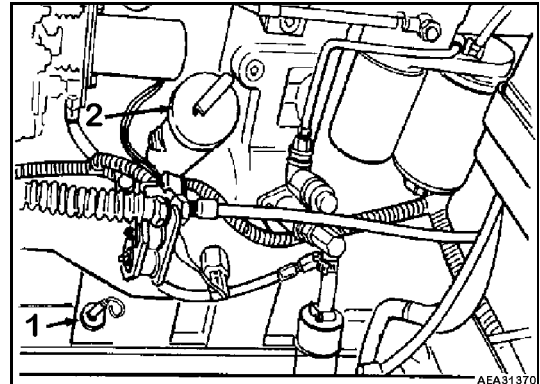
Filter wrench . . . . . 09019-08035



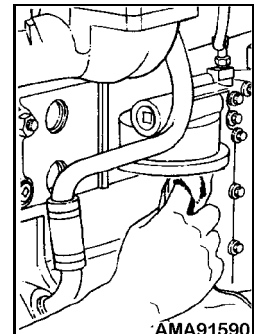
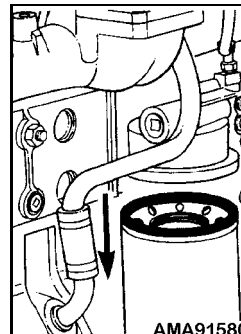
Refill capacity . . . . . 19

For details of the oil to use and refill capacity, see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-10.

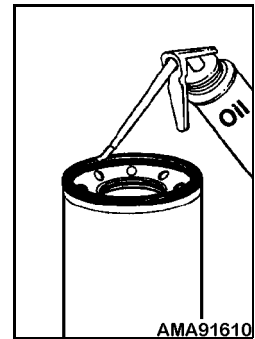
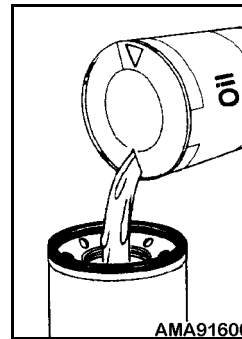
1. Warm up the engine to operating temperature and then turn the engine OFF.
2. Open the engine hoods and lock in position.
3. Open oil filler (2) and remove drain plug (3) to drain oil. After draining, tighten the drain plug.



4. Clean the area around the oil filter.
5. Using a filter wrench, remove oil filter cartridge by turning it counterclockwise.
6. Clean the filter gasket surface of the filter.



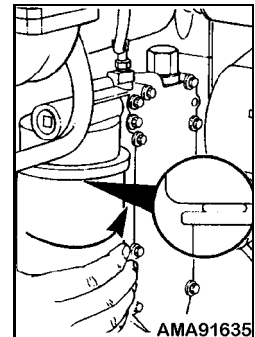
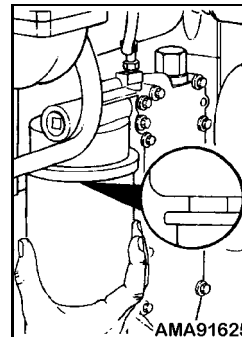
- Fill a new oil filter with engine oil. Then, apply engine oil or a thin coat of grease to the seal.



- 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.



- After replacing the filter, pour in the specified quantity of engine oil at oil filler (2).
- 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 five minutes before checking.
- Close the engine hoods.

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.

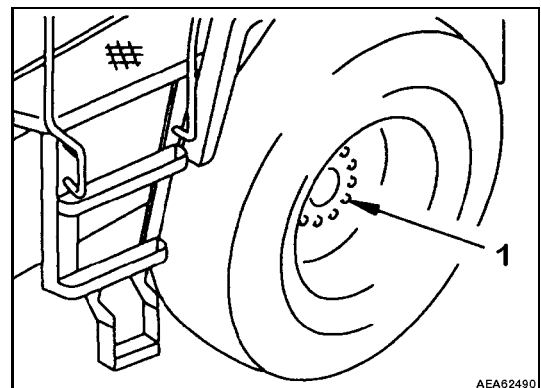
**24.6.2 CHECK FOR LOOSE WHEEL HUB BOLTS, TIGHTEN**

If wheel hub bolts (1) are loose, tire wear will be increased and accidents may be caused. If any hub bolts are loose, tighten them to the specified tightening torque.

Bolt torque . . . . . 927 ± 103 N

If any wheel bolt is broken, replace all bolts for that wheel.

Always rotate in the direction of tightening when checking for loose bolts.

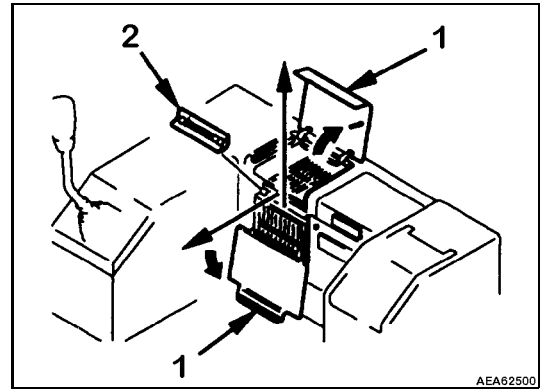




## MAINTENANCE

### 24.6.3 CLEAN ELEMENT IN AIR CONDITIONER RECIRCULATION FILTER

1. Open the filter inspection cover, remove the filter cover, then remove the filter in the direction of the arrow. When removing the filter to the side, put your weight on the seat, and push down.
2. Direct compressed air, less than 7 kg/cm<sup>2</sup> (100 psi), to the filter from the inside along its folds, then direct it from the outside along its folds and again from the inside. Check the filter for damage and/or deterioration. If the filter is extremely dirty, rinse it in water. After rinsing filter, dry it completely before installing it again.

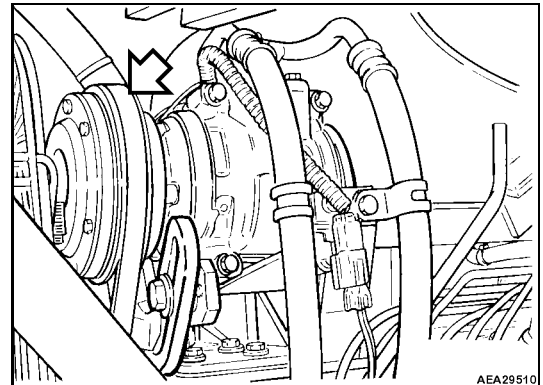


### 24.6.4 CHECK AIR CONDITIONER COMPRESSOR BELT TENSION, ADJUST

#### Checking

The deflection of the belt should be when pressed with the thumb force of midway between the air conditioner compressor pulley and fan pulley.

When belt tension gauge is used, it is considered normal for tension to remain in the range of 353 to 530 N (79 to 119 lbf).



#### Check When Installing a new V-Belt

The deflection of the belt should be approximately 8 to 11.5 mm (0.315 to 0.5 in) when pressed with the thumb force of approximately 98 N (22 lbf) at a point midway between the air conditioner compressor pulley and fan pulley.

Tension for a new, unstretched belt, measured with a belt tension gauge, may be higher in the range of 530 to 745 N (119 to 167 lbf).

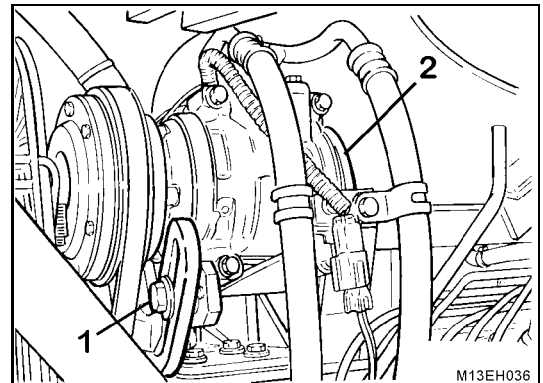
#### Adjusting

Loosen bolt (1) and move compressor (2) to adjust the belt tension.

Check each pulley for damage, wear of the v-groove, and wear of the v-belt. In particular, be sure to check that the v-belt is not touching the bottom of the v-groove.

Replace the v-belt if cut or cracked or if it has stretched leaving no allowance for adjustment.

When adjusting the v-belt, do not push the compressor directly with a bar. Use a wrench.



**24.6.5 CHECK BATTERY ELECTROLYTE LEVEL**

**⚠ WARNING**

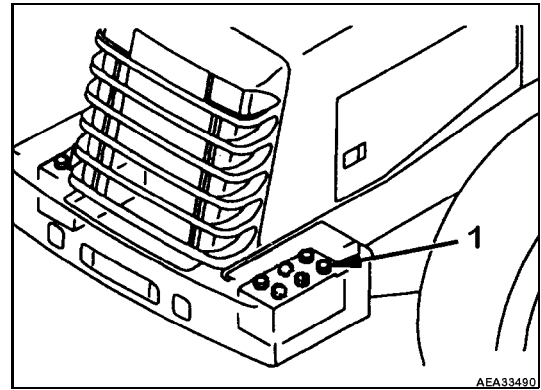
To avoid gas explosions, keep fire and/or sparks away from the battery.  
 Battery electrolyte is acidic and can injure eyes or skin. If it contacts eyes or skin, flush it away with water, and get medical help immediately.

Carry out this check before operating the machine.

1. Open the cover of the battery box. There are two battery boxes: One on each side at the rear of the machine.
2. Remove caps (1), and check each cell, the electrolyte should be at a specified level; 10 to 12 mm (0.40 to 0.47 in) above the plate. If the electrolyte level is low, add distilled water to the specified level.
3. Clean the air hole in each battery cap, then tighten securely.

**NOTE:**

The electrolyte may freeze if diluted in cold weather. When adding distilled water in cold weather, add it just before operating the machine.



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# MAINTENANCE

## 24.6.6 CORROSION RESISTOR

### **WARNING**

Do not remove the radiator cap from a hot engine. Hot steam will cause serious personal injury. Wait until the coolant temperature is below 50 °C. Remove the coolant system pressure cap and close the shutoff valve before removing the corrosion resistor. Failure to do so can result in personal injury from heated coolant spray.



Filter wrench . . . . . 09019-08035

1. Remove and discard the corrosion resistor. Clean the gasket surface.
2. Apply a light film of lubricating oil to the gasket sealing surface before installing the corrosion resistor.

### REMARKS

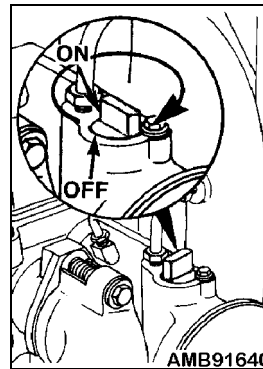
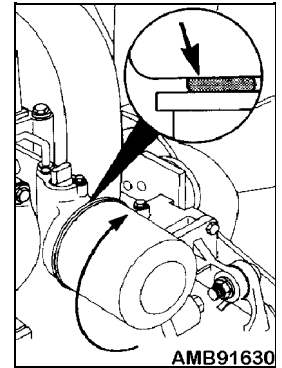
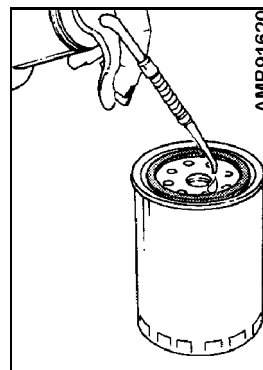
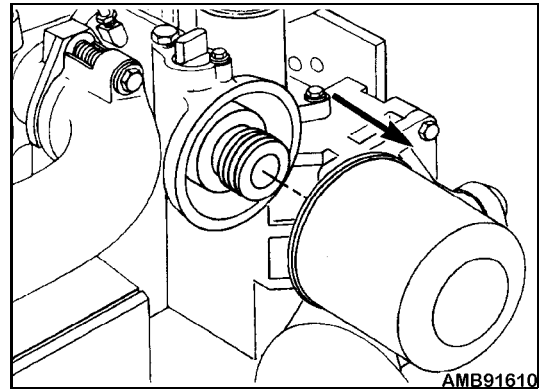
Mechanical over tightening may distort the threads or damage the filter head.

3. Install the new cartridge according to the manufacturers recommendations.
4. Open the shutoff valve and install the coolant system pressure cap.

### NOTE

Failure to open the shutoff valve can result in severe engine damage.

5. Run the engine and check for leaks around the cartridge.



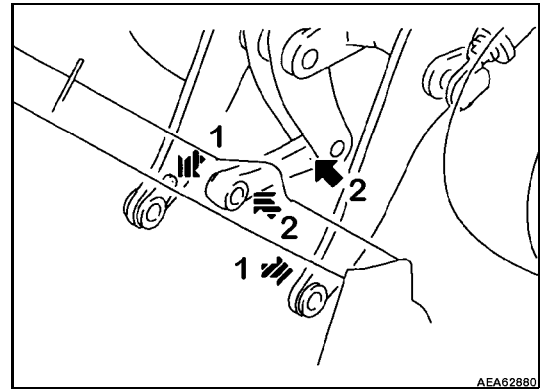
24.6.7 LUBRICATING

**WARNING**

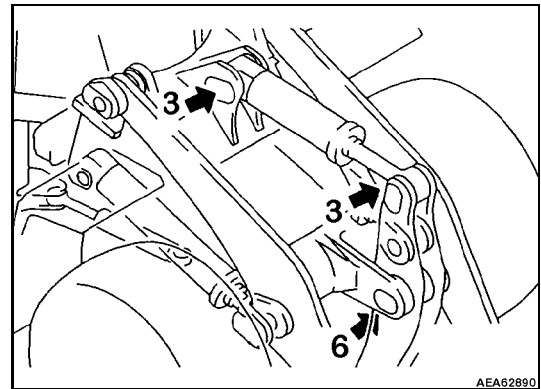
Set the work equipment in a stable condition, then turn OFF the machine and apply the lock for the work equipment control levers.

Apply the parking brake, and lock the front and rear frames with the safety bar and pin.

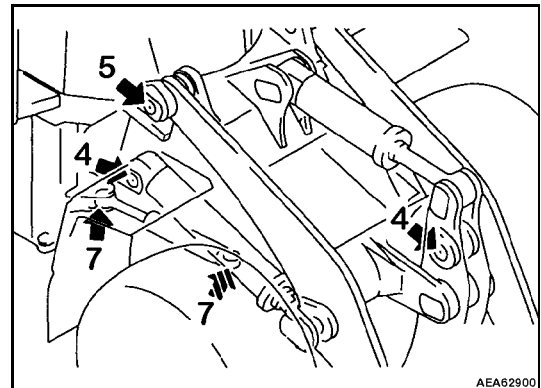
Use a grease pump to pump in grease through the grease fittings marked by the arrows. After greasing, wipe off any old grease that was pushed out.



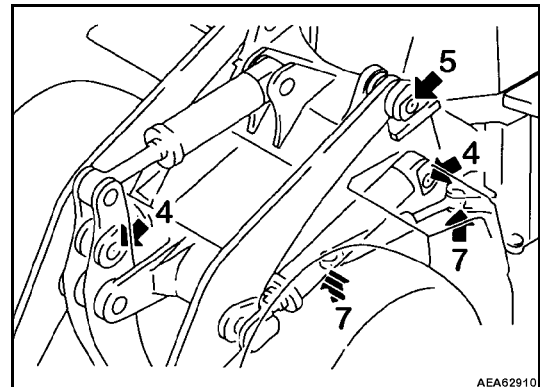
1. Bucket pin (2 places)
2. Bucket link pin (2 places)
3. Dump cylinder pin (2 places)



4. Lift cylinder pin (4 places)
5. Lift arm pivot pin (2 places)



6. Tilt lever pin (1 place)
7. Steering cylinder pin (4 places)



# MAINTENANCE

## 24.7 EVERY 500 HOURS SERVICE

Maintenance for every 50, 100 and 250 hours service should be carried out at the same time.

### 24.7.1 REPLACE FUEL FILTER CARTRIDGE


#### WARNING

Engine temperature remains high immediately after the machine has been operated. Wait for engine to cool down before replacing the filter.  
Keep fire and/or sparks away from the fuel.

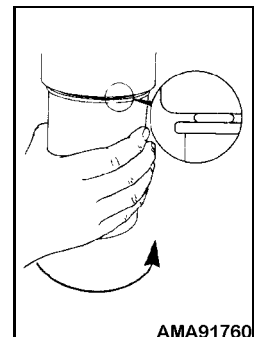
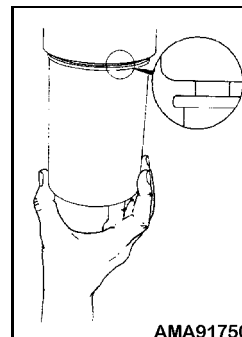
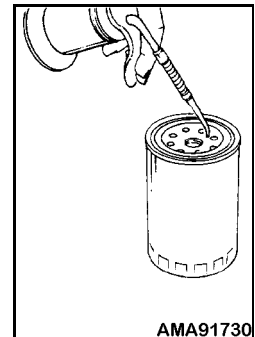
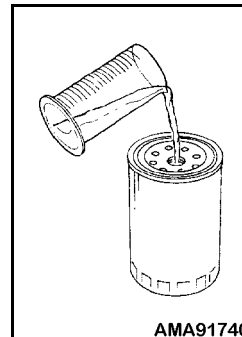
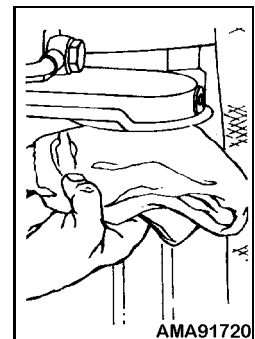
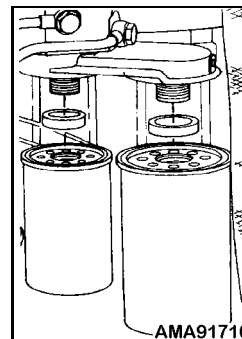
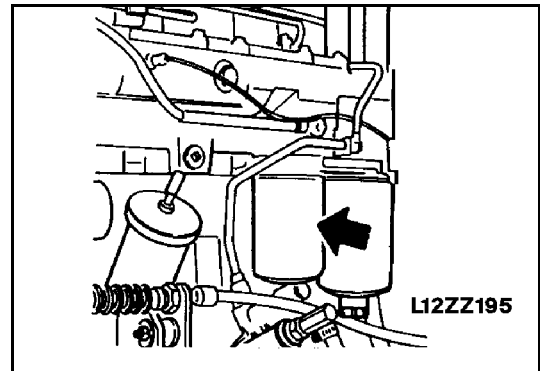
The fuel filters are spin-on type, which cannot be cleaned and should not be disturbed until they are replaced. For average conditions, use the interval listed in the Scheduled Maintenance Guide (sooner if power loss is evident; more often for unusually contaminated fuel).

Prepare a filter wrench and a container to catch the fuel.

 Fuel catch container . . . . . Min 3.8

 Filter wrench . . . . . 09019-08035

1. Set the container to catch the fuel under the filter cartridges. Clean the area around the fuel filters.
2. Using a filter wrench, remove filter cartridges.
3. Clean the filter holder.
4. Fill a new filter cartridge with clean fuel, coat the packing surface with engine oil, then install it to the filter holder.
5. When installing, tighten until the packing surface contacts the seal surface of the filter holder, then tighten it  $\frac{1}{2}$  to  $\frac{3}{4}$  of a turn. If the filter cartridge is tightened too far, the packing will be damaged and this will lead to leakage of fuel. If the filter cartridge is too loose, fuel will also leak from the packing, so always tighten to the correct amount.



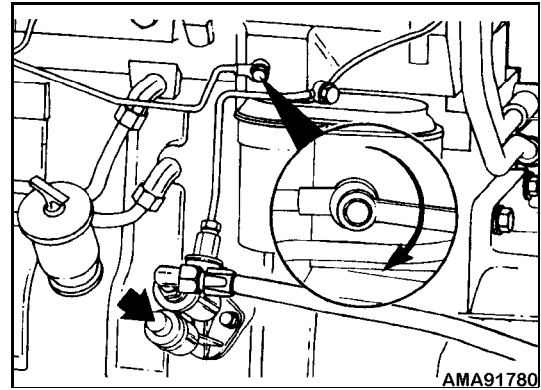
6. After replacing the fuel filter cartridge, run the engine at idle for a few minutes. Check for leaks and repair as necessary.
7. Close the engine hood.

**NOTE:**

**Controlled venting is provided at the injection pump through the fuel drain manifold. Small amounts of air introduced by changing the filters or injection pump supply line will be vented automatically, if the fuel filter is changed in accordance with the instructions.**

Manual bleeding will be required if:


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



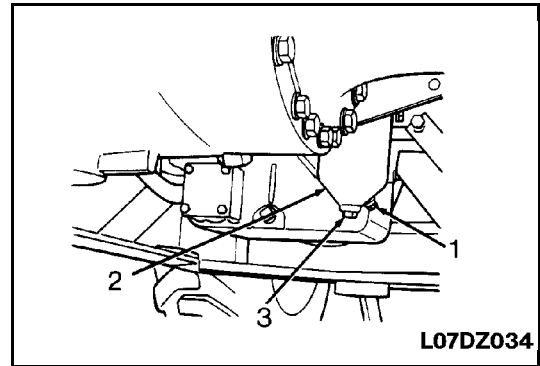
## MAINTENANCE

### 24.7.2 REPLACE TRANSMISSION OIL FILTER ELEMENT

1. Remove drain plug (1) at the bottom of the filter case, and drain the oil. After draining the oil, reinstall and tighten the plug.

 Drain plug . . . . . 108 ± 15 N

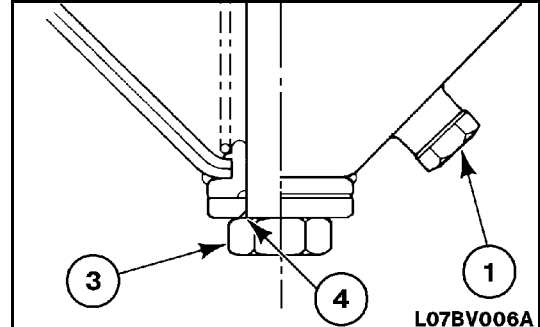
2. Hold case (2) and loosen center bolt (3), then remove case (2).



Be sure to use a genuine Komatsu 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 surface faces the hexagonal head of the center bolt. Be careful not to apply excessive torque to center bolt (3).



 Center bolt . . . . . 76 ± 12 N

4. Run the engine for a short time at idle, then turn the engine off and check that the oil is at the specified level.

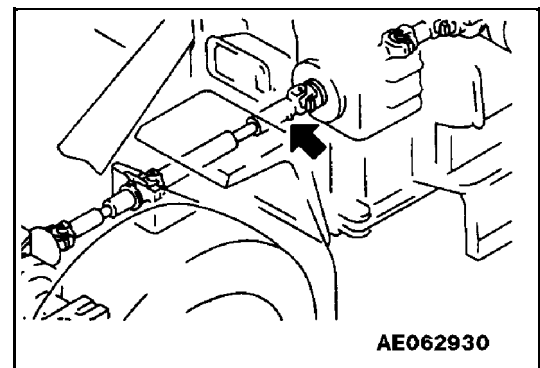
For details, see **24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL** on page 3-33.

### 24.7.3 LUBRICATE CENTER DRIVE SHAFT SPLINE (1 PLACE)

#### **WARNING**

With the work equipment in a stable condition, turn OFF the machine and apply the lock for the work equipment control levers. Apply the parking brake, and lock the front and rear frames together with the safety bar and pin.

1. With a grease gun, pump in grease through the fittings located by the arrow.
2. After lubricating, wipe off excess grease.



#### REMARKS:

Lubricate the center drive shaft spline as directed, even on machines with optional greasing systems.

## 24.8 EVERY 1000 HOURS SERVICE


Maintenance for every 50, 100, 250 and 500 hours should be carried out at the same time.

### 24.8.1 CHANGE OIL IN TRANSMISSION, CLEAN STRAINER

**⚠ WARNING**

The oil is at a high temperature immediately after the machine has been operated. Wait for the oil to cool down before carrying out this maintenance.

Prepare a container to catch the oil.

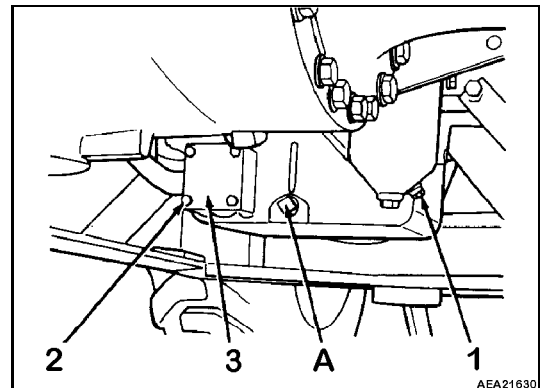
 Oil catch container . . . . . Min 42

1. Loosen drain plug **A**, pull out the plug slowly to prevent the oil spouting out. After draining out the oil, then tighten up drain plug.

 Drain plug . . . . . 68.6 ± 9.8 N

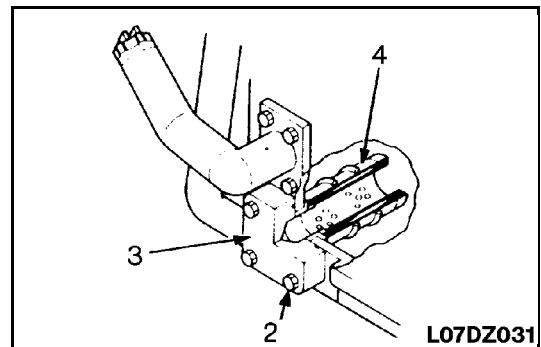
2. Loosen drain plug (1) of transmission oil filter to drain oil. After draining out the oil, tighten up drain plug.

 Drain plug . . . . . 107.9 ± 14.7 N



3. Remove bolts (2) and cover (3), then remove strainer (4).
4. Remove all dirt from the surface of strainer (4), then wash in clean light oil (such as diesel oil or flushing oil). If strainer (4) is damaged, replace with a new part.
5. Install strainer (4) to cover (3).

 Strainer torque . . . 107.9 ± 14.7 N



Replace the cover O-ring with a new part, then install the cover.

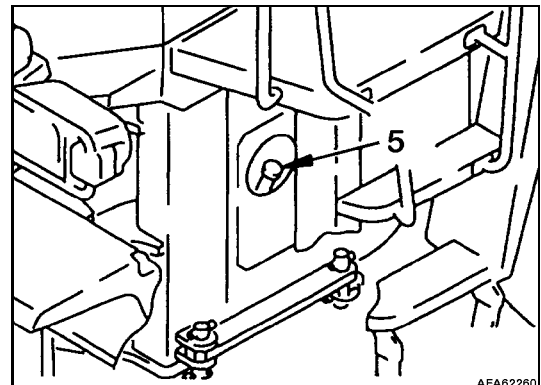
6. Pour in the specified amount of oil at oil filler (5).

For details of the oil to use and refill capacity, see **20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE** on page 3-10.

7. After refilling, check that the oil is at the specified level.

For details, see **24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL** on page 3-33.

8. Check for oil leaks at transmission case and filter.



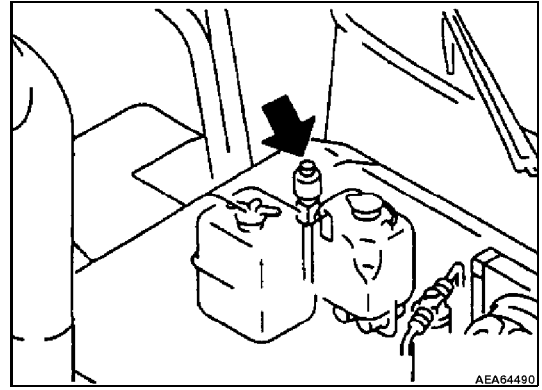


## MAINTENANCE

### 24.8.2 CLEAN TRANSMISSION CASE BREATHER

Remove all mud and dirt from around the breather, then remove the breather and put it into a cleaning fluid to clean.

Take care not to let any dust or dirt get into the transmission case through the port while the breather is removed.



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### 24.8.3 LUBRICATE



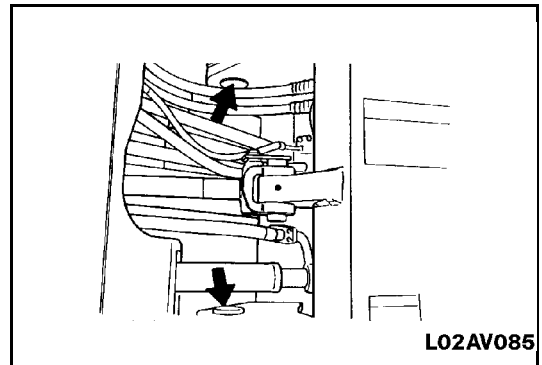
#### WARNING

Set the work equipment in a stable condition, then turn OFF the machine and apply the lock for the work equipment control levers.

Apply the parking brake, and lock the front and rear frames with the safety bar and pin.

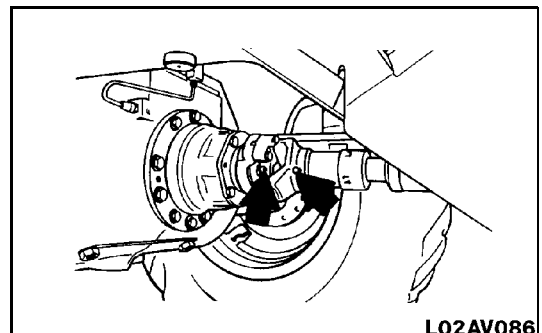
Use a grease pump to pump in grease through the grease fittings marked by the arrows. After greasing, wipe off any old grease that was pushed out.

1. Center hinge pin (2 places)



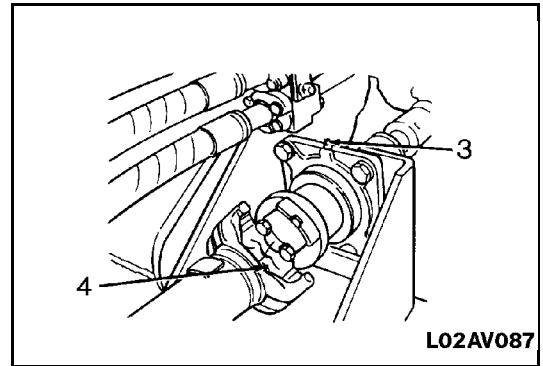
L02AV085

2. Front drive shaft (2 places)

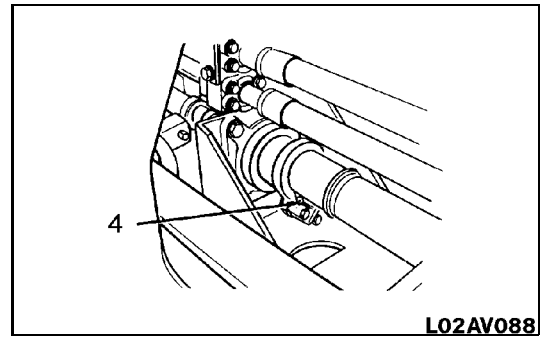


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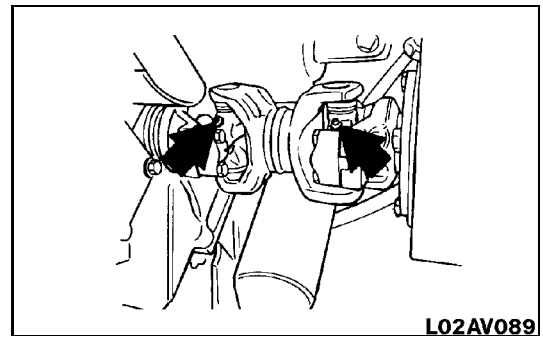
3. Drive shaft center support (1 place)



4. Center drive shaft (2 places)



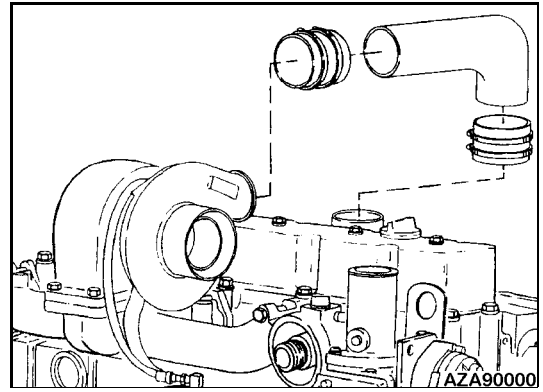
5. Rear drive shaft (2 places)



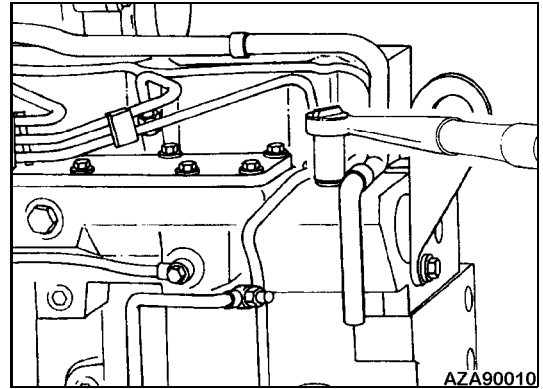
## MAINTENANCE

### 24.8.4 CHECK ENGINE VALVE CLEARANCE, ADJUST

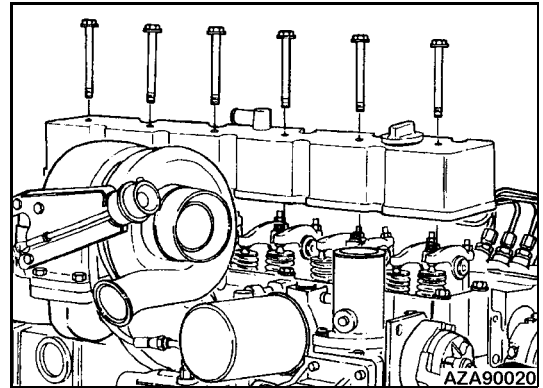
1. Remove the air crossover tube.



2. Disconnect the support clamps, hose clamp and wastegate sensing line. Remove the crankcase vent tube and any other parts that would prevent removal of the valve cover.

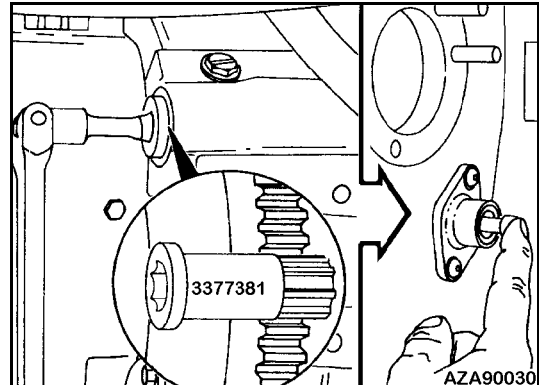


3. Remove the valve cover.

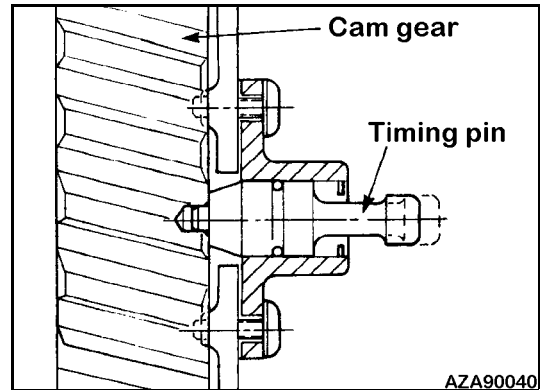


4. Locate top dead center (TDC) for cylinder number 1 by rotating the crankshaft slowly while pressing on the engine timing pin.

Tool: 1/2-inch drive, Barring Gear 3377381

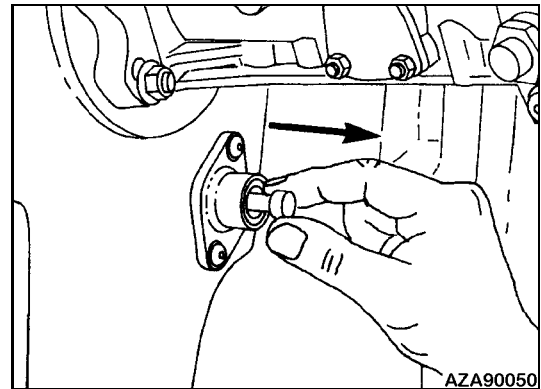


- When the engine timing pin engages the hole in the camshaft gear, Cylinder Number 1 is at TDC on the compression stroke.



**⚠ WARNING**

**Be sure to disengage the engine timing pin after locating TDC to prevent damage to the engine timing pin.**

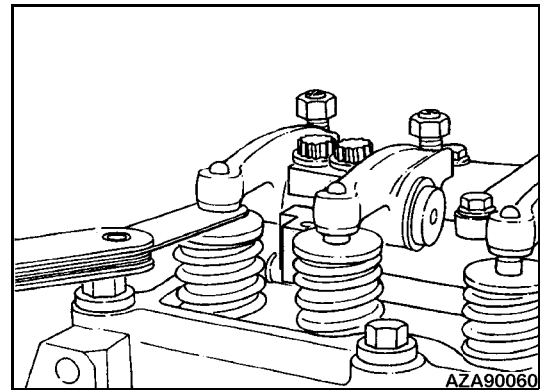


- Intake Clearance: ..... 0.30 mm (0.012 in)  
Exhaust Clearance: ..... 0.61 mm (0.024 in)

Check or set valves with engine cold - below 60

**REMARK**

The clearance is correct when some resistance is felt as the feeler gauge slips between the valve stem and the rocker lever.



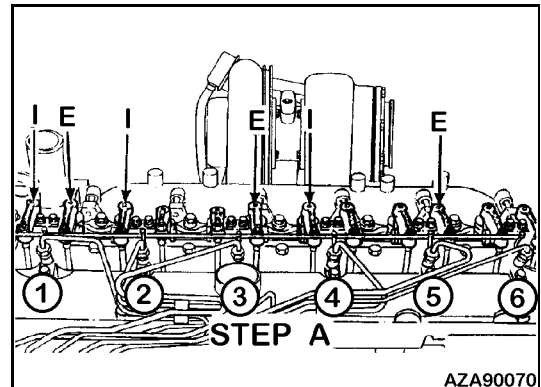
**Step A**

Locate top dead center (TDC) for cylinder number 1.

Check/Adjust the valves ..... I = Intake; E = Exhaust

Locknut ..... 24 N

After tightening the rocker lever locknut, check the valve clearance to make sure it has not changed.

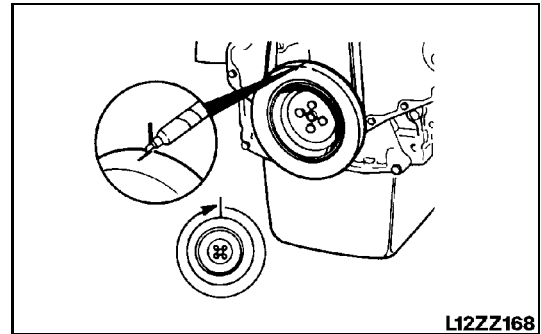


# MAINTENANCE

## REMARK

Be sure that the timing pin is disengaged to prevent damage to the engine timing pin.

7. Mark the vibration damper and rotate the crankshaft 360 (degrees).

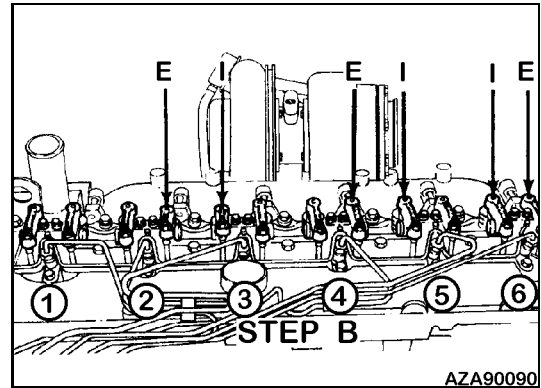


## Step B

Check/Adjust the valves ..... I = Intake; E = Exhaust

**N·m** Locknut ..... 24 N

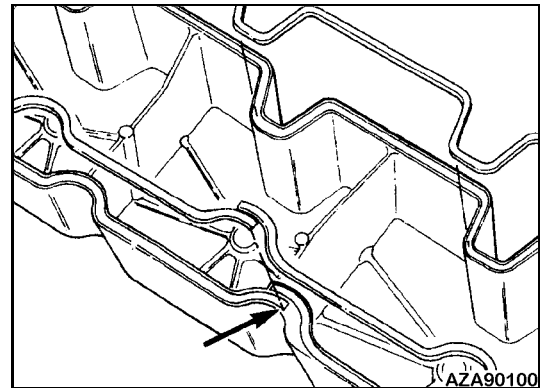
After tightening the rocker lever lock nut, check the valve clearance to make sure it has not changed.



8. Install the rubber seal into the groove in the valve cover. Start the installation at the overlap area shown in the illustration.

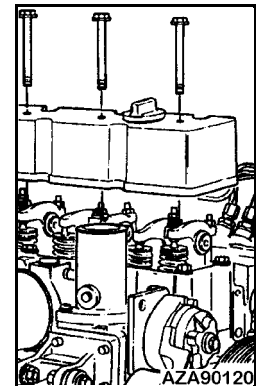
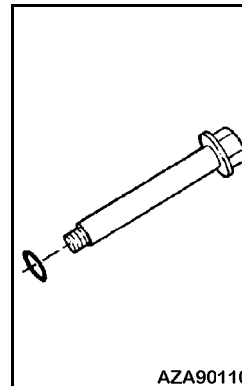
## REMARK

Do not stretch, twist or distort the rubber seal.

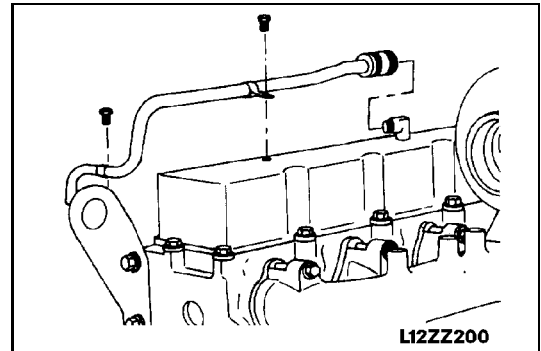


9. Install new sealing O-rings on the bolt.
10. Install the valve cover and wastegate sensing tube.

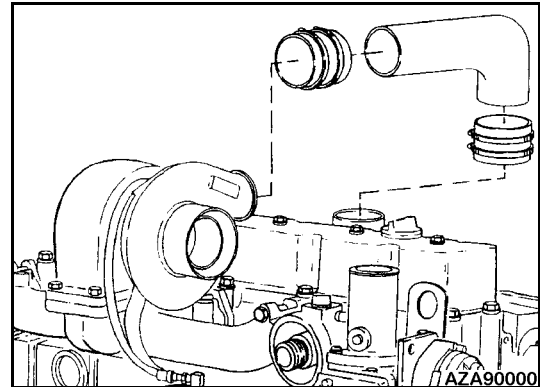
**N·m** Bolt ..... 24 N



11. Install the crankcase vent tube and secure with the support clamps and hose clamp.



12. Install the air crossover tube and any other parts previously removed to gain access to the valve cover.



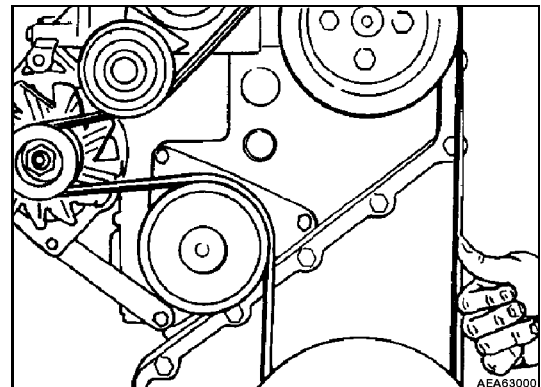
**24.8.5 CHECK TENSION OF DRIVE BELT**

1. Measure the belt deflection at the longest span of the belt when pressed with the finger.

Maximum deflection . . . . . 9.5 to 12.7 mm (

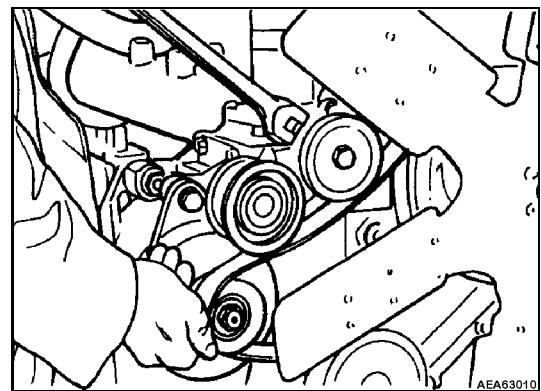
**NOTE:**

Belt tension gauge ST-1293 may be used. The required gauge value is 35 to 50 kg (80 to 110 lbs).



**24.8.6 CHECK DRIVE BELT TENSIONER BEARING AND FAN HUB BEARING**

1. Remove the drive belt.
2. Inspect the belt for damage.



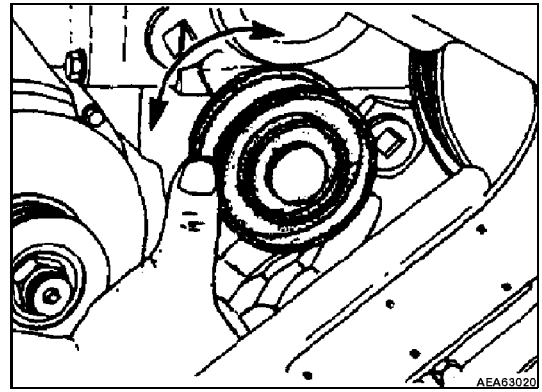
## MAINTENANCE

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3. Check the tensioner bearing.

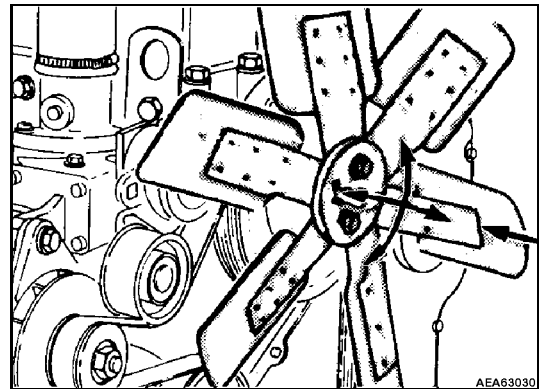
**NOTE:**

The tensioner pulley should spin freely under hand pressure with no rough spots detected.

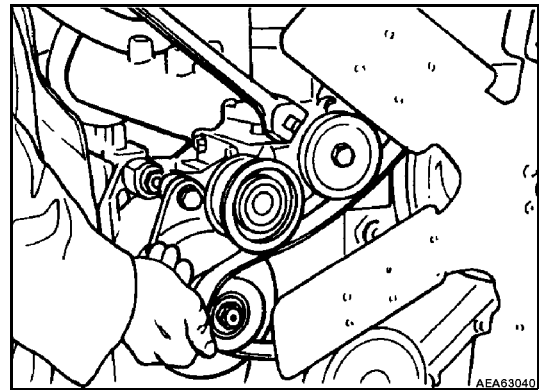


4. Check the fan hub bearing.

The fan hub should spin freely without excessive end play.



5. Install the drive belt.



## **24.9 EVERY 2000 HOURS SERVICE**

Maintenance for every 50, 100, 250, 500 and 1000 hours should be carried out at the same time.

### **24.9.1 COOLING SYSTEM, REPLACE COOLANT AND FLUSH THE SYSTEM**



#### **WARNING**

**If the engine was just running, then the coolant could be hot and cause personal injury. Allow the engine to cool before draining water.**

**Never remove the radiator cap when the engine is at operating temperature. At operating temperature, the coolant is under pressure. Steam blowing up from the radiator could cause personal injury. Allow the engine to cool until the radiator filler cap is cool enough to touch with your hand. Remove the filler cap slowly to allow pressure to be relieved.**

#### **GENERAL**

The cooling system operates under pressure which is controlled by the pressure relief valve in the radiator cap. The belt-driven water pump circulates the coolant through the engine block, cylinder heads, radiator and engine oil cooler. A thermostat controls circulation by routing coolant flow around the radiator until the engine reaches operating temperature.

Proper cooling is possible only when the system is sealed, the radiator cap gasket is in good condition, the pressure relief valve and thermostats are operating properly. The system must be free of coolant and air flow restrictions and the system filled to the proper level.

The engine coolant is important to long engine life. The following information provides recommendations for selecting the engine coolant, maintaining the coolant inhibitors and servicing the cooling system. The system operates successfully with a water/antifreeze mixture or inhibited/conditioned water as the coolant. Water by itself allows rust, scale deposits, and corrosion to occur.

After 2,000 hours or one year of operation, whichever comes first, the cooling system should be drained, flushed, and refilled and the corrosion resistor filter replaced as described in this section.

For complete coolant specifications **see "20.3 COOLANT SPECIFICATIONS" on page 3-14.**

#### **REMARKS:**

Always replace the coolant corrosion resistor filter after cleaning and flushing the cooling system and installing new coolant. **See "24.7 EVERY 500 HOURS SERVICE" on page 3-54.**

#### **RADIATOR CAP GENERAL INFORMATION**



## MAINTENANCE

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The radiator cap seals the coolant filler opening of the radiator. Positive sealing requires a cap gasket and its contacting surfaces to be in good condition and a properly tightened cap.

The radiator cap incorporates a pressure relief valve. The pressure relief valve keeps the pressure of the coolant at approximately 34 to 64 kPa or 0.35 to 0.65 kg/cm<sup>2</sup> (5 to 9 psi).

### NOTE:

**Operating the machine without a radiator cap, or with a cap without a relief valve set to operate at the correct pressure, can cause damage.**

### RADIATOR CAP REMOVAL



#### WARNING

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

**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.**

To remove the cap, turn the cap to the left, or counterclockwise up to the safety stop until all pressure is released. Press down on the cap and continue to turn until the cap is free to be removed.

### RADIATOR CAP INSTALLATION

When installing the cap, the gasket and contacting surfaces must be clean. Turn the cap to the right, or clockwise until snug.

### DRAINING THE COOLING SYSTEM

#### NOTE:

**Park the machine on level ground**

1. Run the engine until it reaches operating temperature; then turn the engine OFF.

#### NOTE:

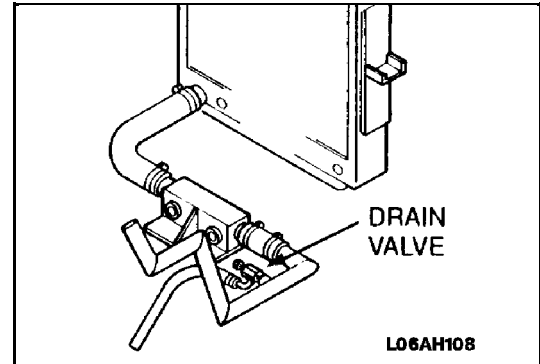
**Check for damaged hoses and loose or damaged hose clamps. Replace and fix where needed. Check the radiator for leaks, damage and accumulation of dirt. Clean and repair**

2. Remove the radiator cap as outlined in this section.

3. Open the drain valve (located on the left side of the machine, on the inside of the frame, above the fuel tank) on the engine coolant inlet tube coming from the oil cooler off the bottom of the radiator.
4. Allow the system to completely drain into a suitable container. (MAKE SURE the drain outlets do not plug up during draining.)
5. Close the drain valve.

**REMARKS:**

Always replace the coolant corrosion resistor filter after cleaning and flushing the cooling system and installing new coolant. See **"24.7 EVERY 500 HOURS SERVICE"** on page 3-54.



**FLUSHING THE COOLING SYSTEM**

6. Refill the system with water only.
7. Then run the engine at low idle and open the drain valve (described in step 3).
8. With the engine is running continue adding water in the top of the radiator, so that water is passing through the cooling system for about 10 minutes.
9. After flushing the system with water, close the drain valve.
10. Now clean the system with a flushing agent. For details of cleaning see instructions given with the cleaning agent.

**NOTE:**

**If the system shows mineral build-up, scale rust or oil, use a heavy duty radiator cleaner.**

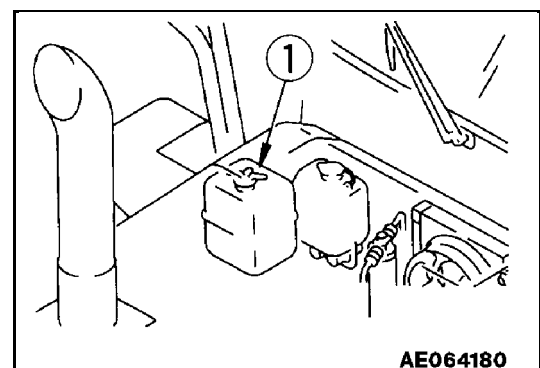
**NOTE:**

**Do not use a caustic cleaners in the cooling system. Aluminum components will be damaged.**

11. After cleaning with the flushing agent, refill the system with fresh water and repeat step 7 and 8 until clean water comes out the drain valve.
12. Now turn the engine OFF, drain all the water out, and then close the drain valve.

**FILLING THE COOLING SYSTEM**

13. Prepare the proper coolant for your environment as specified. See **"20.3 COOLANT SPECIFICATIONS"** on page 3-14.
14. Fill the system with the new coolant, leave the radiator cap off and run the engine for 5 minutes at low idle and then for 5 minutes at high idle to eliminate any trapped air in the system.
15. Turn the engine OFF and wait 3 minutes then add more



## MAINTENANCE

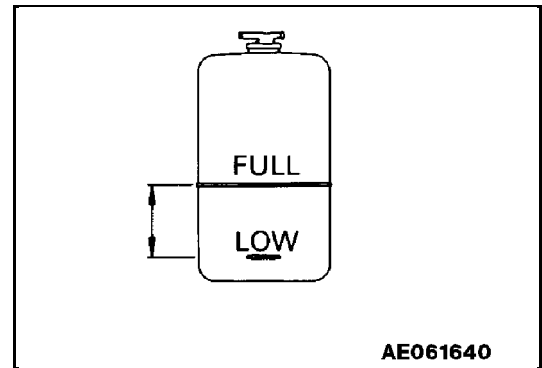
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coolant until the radiator is full.

17. Drain and clean the inside of the radiator overflow tank (1). Then add coolant up to the FULL mark.
18. Install the radiator cap as outlined in this section.

**REMARKS:**

Always replace the coolant corrosion resistor filter after cleaning and flushing the cooling system and installing new coolant. **See “24.7 EVERY 500 HOURS SERVICE” on page 3-54.**

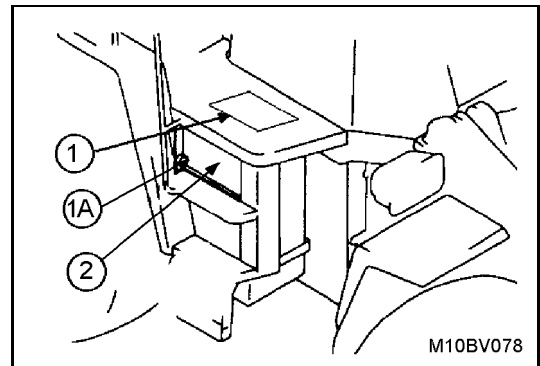


24.9.2 CHANGE OIL IN HYDRAULIC TANK, REPLACE HYDRAULIC FILTER ELEMENT

**⚠ WARNING**

The oil is hot if the machine has just been operated. Wait for the oil to cool down before changing it. When removing the oil filler cap turn it slowly to release the internal pressure, then remove it carefully.

1. Lower the bucket to the ground and apply the parking brake, then turn OFF the engine.
2. Open cover (1).



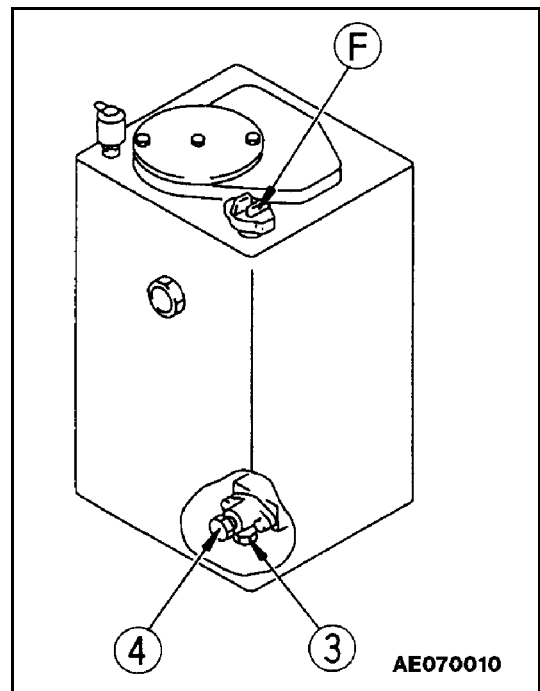
3. Remove the cap of the oil filler (F).
4. Set a container to catch the oil under drain plug (3).
5. Remove drain plug (3).
6. Open drain valve (4) gradually to drain the oil.
7. After draining the oil. close drain valve (4), then tighten drain plug (3).

Tightening torque:



Drain plug (3) to  $68.6 \pm 9.8$  N m ( $50.6 \pm 7.2$  lbft)  
 Drain valve (4) to  $63.7 \pm 14.7$  N m ( $47.0 \pm 10.8$  lbft)

8. Remove bolt (1A) and remove cover (2)



## MAINTENANCE

- Remove mounting bolts (6) of the cover (5) at the top of the tank, then remove the covers.

### REMARKS:

The cover is spring-loaded and could pop off from the force of spring (7), so keep the cover pushed down while removing the bolts.

- Remove spring (7) and bypass valve (8), then remove element (9).
- Check that there is no foreign matter inside the tank before cleaning it.
- Install a new element, then install bypass valve (8), spring (7), and cover (5).  
If the O-ring of the cover is damaged or deteriorated, replace it with a new part.
- When installing the cover bolts, push down on the cover and tighten the bolts evenly.
- Add hydraulic oil through oil filler port (F) to the specified level, then install cap (F).

For details of the oil to use and refill capacity see **“20.1 PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS”** on page 3-10.

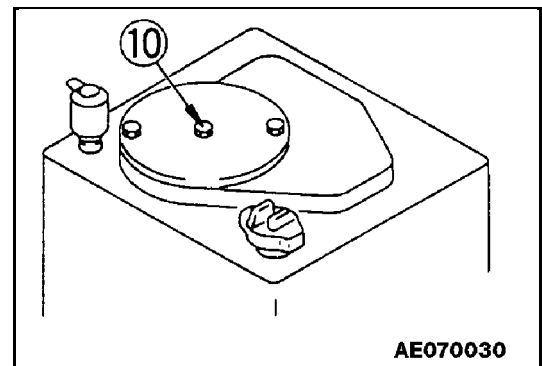
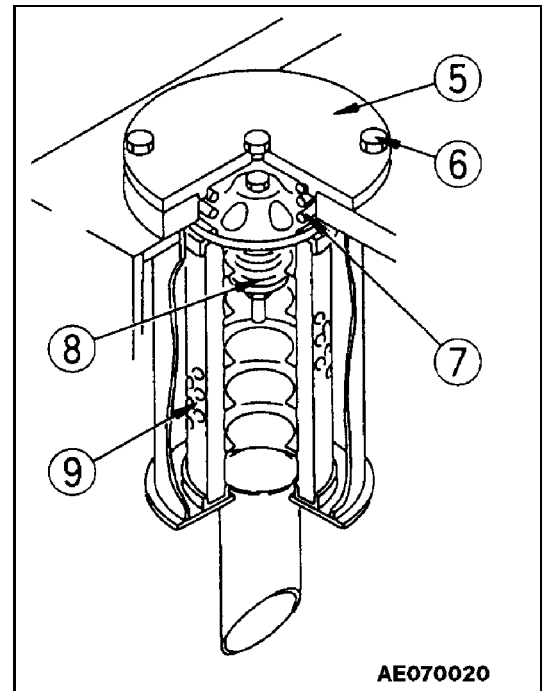
- Check that the hydraulic oil is at a standard level. See **“24.5 EVERY 100 HOURS SERVICE”** on page 3-46.
- Run the engine at LOW idle and extend and retract the steering, bucket, and lift arm cylinders 4-5 times. Be careful not to operate the cylinder to the end of its stroke (stop approximately 100 mm (4 in) before the end of the stroke).



### WARNING

**If the engine is run immediately at high speed or the cylinder is operated to the end of its stroke, the air inside the cylinder could cause damage to the piston packing.**

- Next, operate the steering, bucket, and lift arm cylinders to the ends of end their strokes 3-4 times, then turn OFF the engine and loosen bleed plug (10). Run the engine at low idle to bleed the air from the hydraulic tank. After bleeding the air, turn OFF the engine and tighten plug (10) again.



18. Check the hydraulic oil level and add oil to the specified level. For details, see “**24.5 EVERY 100 HOURS SERVICE**” on page 3-46.
19. Next, increase the engine speed and repeat the procedure in Step 17 to bleed air. Continue this procedure until no more air comes out from plug (10).
20. Tighten plug and torque to:  $11.3 \pm 1.5$  N m ( $8.3 \pm 1.1$  lbf)
21. Check that the hydraulic oil is at the standard level. For details, see “**24.5 EVERY 100 HOURS SERVICE**” on page 3-46.
22. Check to be sure that there are no leaks of oil from the filter cover mount.

**24.9.3 REPLACE HYDRAULIC TANK BREATHER ELEMENT**

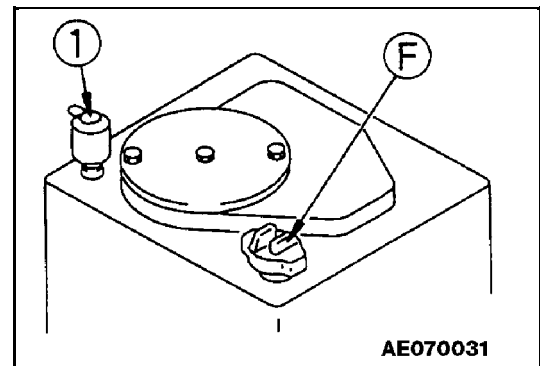
**⚠ WARNING**

**The oil is hot if the machine has just been operated. Wait for the oil to cool down before changing it. When removing the oil filler cap turn it slowly to release the internal pressure, then remove it carefully.**

1. Remove cap of oil filler (F).
2. Remove the snap ring on breather (1), then remove the breather cap.
3. Replace the filter element with a new part, then install cap and snap ring.
4. Tighten the cap of oil filler (F).

**REMARKS:**

It is possible to replace the element with the breather installed in the tank. However, if the breather is removed, do not wrap the taper thread of the breather with seal tape when reassembling, and be careful not to over-tighten it.



## MAINTENANCE

### 24.9.4 CHANGE AXLE OIL

#### WARNING

The oil is hot if the machine has just been operated. Wait for the oil to cool down before changing it.

1. Set a container to catch the oil under drain plug (P).
2. Remove front and rear oil filler plugs (1), then remove drain plug (P) to drain the oil.
3. After draining the oil, clean all the plugs.
4. Add axle oil through plug hole (1) to the specified level.

For oil recommendations and refill capacity see “20.1 PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS” on page 3-10.

Be sure that the oil is at the specified level; see “24.2 WHEN REQUIRED” on page 3-31.

#### REMARKS:

For operations where the brake is used frequently, change the axle oil at shorter intervals.

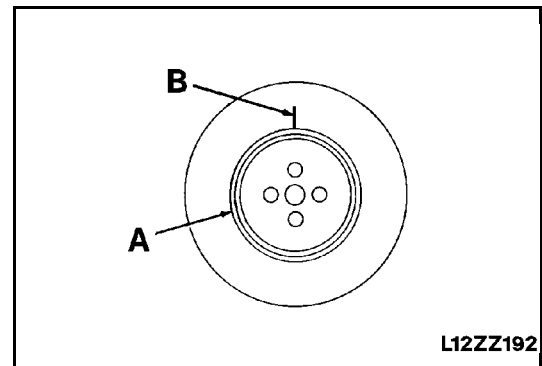
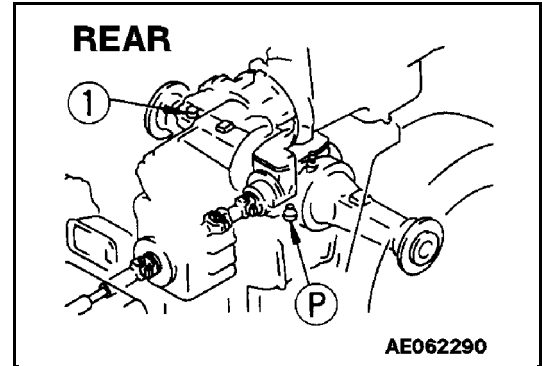
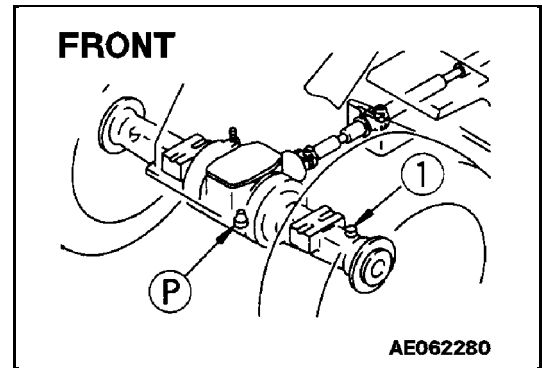
### 24.9.5 CHECK BRAKE DISC WEAR

Have your distributor check and repair brake discs.

### 24.9.6 CHECK VIBRATION DAMPER

The vibration damper hub is located below the engine fan hub on the engine

1. Check the index lines (B) on the damper hub and the inertia member (A). If the lines are more than 1.59 mm (1/16 in) 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 (1/8 in) below the metal surface, replace the damper.
3. Look for forward movement of the damper ring on the hub. Replace the damper if any movement is detected.

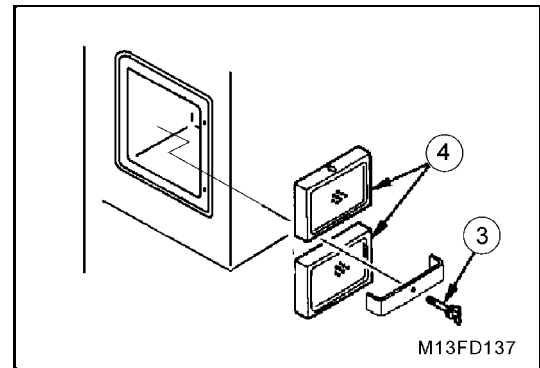


**24.9.7 REPLACE ELEMENT IN AIR CONDITIONER RECIRCULATION FILTER AND FRESH FILTER**

Remove both the recirculation filter and the fresh air filter in the same way as when cleaning, and replace them with new parts.

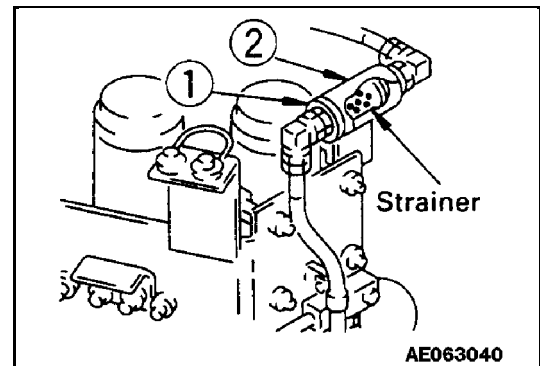
For details of cleaning the recirculation air filter, see “**24.6.3 CLEAN ELEMENT IN AIR CONDITIONER RECIRCULATION FILTER**” on page 3-50.

For details of cleaning the fresh air filter, see “**24.6.3 CLEAN ELEMENT IN AIR CONDITIONER RECIRCULATION FILTER**” on page 3-50.



**24.9.8 CLEAN PPC CIRCUIT STRAINER**

1. Remove flange (1).
2. Remove strainer case (2), take out the strainer, and wash it in clean diesel oil.
3. Assemble the strainer to strainer case (2), then install with flange (1).



**24.9.9 CHECK ACCUMULATOR GAS PRESSURE**

When carrying out the 2000 HOURS SERVICE or EVERY YEAR SERVICE when making periodic replacement of critical parts, have your distributor check the accumulator gas pressure. See “**24.9 EVERY 2000 HOURS SERVICE**” on page 3-65.



# **SPECIFICATIONS**

## SPECIFICATIONS

### 25. WA320-3MC

#### PERFORMANCE

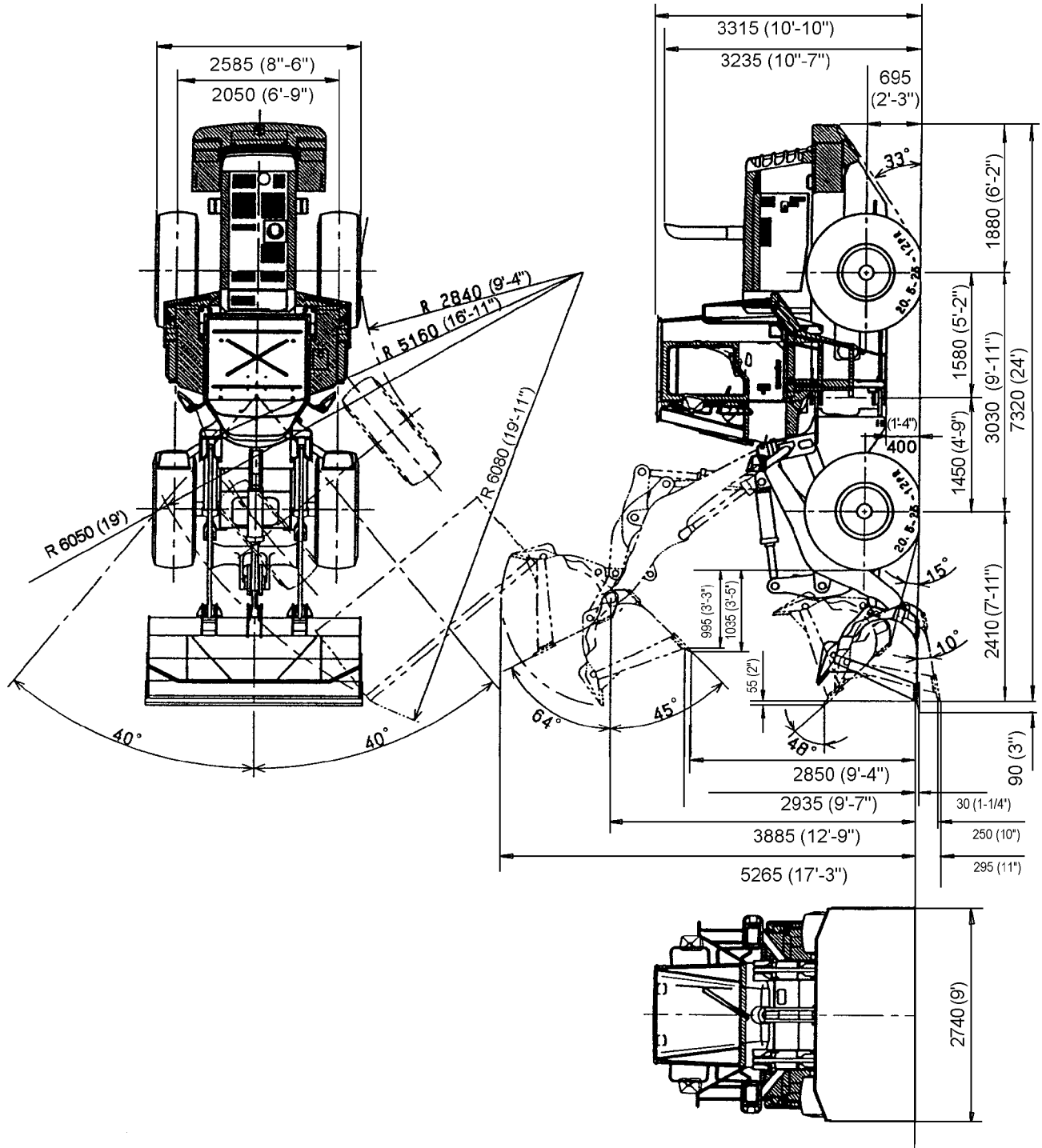
Bucket capacity		2.7 m <sup>3</sup> (3.55 cu.yd)	
Normal load		4000 kg (8820 lb)	
Travel speed	FORWARD	1st	7.5 km/h (4.7 MPH)
		2nd	12.0 km/h (7.5 MPH)
		3rd	21.0 km/h (13.0 MPH)
		4th	34.0 km/h (21.1 MPH)
	REVERSE	1st	7.8 km/h (4.8 MPH)
		2nd	12.5 km/h (7.8 MPH)
		3rd	22.0 km/h (13.7 MPH)
		4th	35.0 km/h (21.7 MPH)
Max. rimpull		12200 kg (119640 N)	
Min. turning radius	Outside of chassis		6080 mm (19 ft 11 in)
	Center of outside tire		5160 mm (16 ft 11 in)

#### WEIGHT

Operating weight (including 1 operator: 80 kg (176 lb.)) (with bolt on cutting edge)		14150 kg (31200 lb)
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#### ENGINE

Model		Komatsu S6D114E-1
Flywheel horsepower		122 kW (166 HP)/2380
Max. torque (gross)		671 N rpm
Starting motor		24V 7.5 kW
Alternator		24V 50A
Battery		12V 150 Ah x 2 pieces



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# **OPTIONS, ATTACHMENTS**

## OPTIONS, ATTACHMENTS

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### 26. OPTIONAL PARTS AND ATTACHMENTS

NAME	SPECIFICATION, USE
Excavating bucket	Capacity 2.0 m <sup>3</sup> (2.6 yd <sup>3</sup> ) Capacity (with BOC) 2.2 m <sup>3</sup> (2.8 yd <sup>3</sup> )
Light material bucket	Capacity (for light duty work) 3.0 m <sup>3</sup> (3.9 yd <sup>3</sup> ) Capacity (for light duty work, with BOC) 3.2 m <sup>3</sup> (4.1 yd <sup>3</sup> )
Bucket tooth	Bolt-on tooth - Tip tooth
Log lumber grapple	Loading and transporting large logs or lumber
Log lumber fork	Loading and carrying comparatively small diameter lumber
Dumping fork	Loading and carrying comparatively small diameter lumber
Log grapple	Loading and carrying large logs

The following attachments are also available.

ROPS canopy

ECSS (Electronic Controlled Suspension System)

Emergency steering

Rear full fenders

Seat belt

Tires

## 27. SELECTING BUCKETS AND TIRES

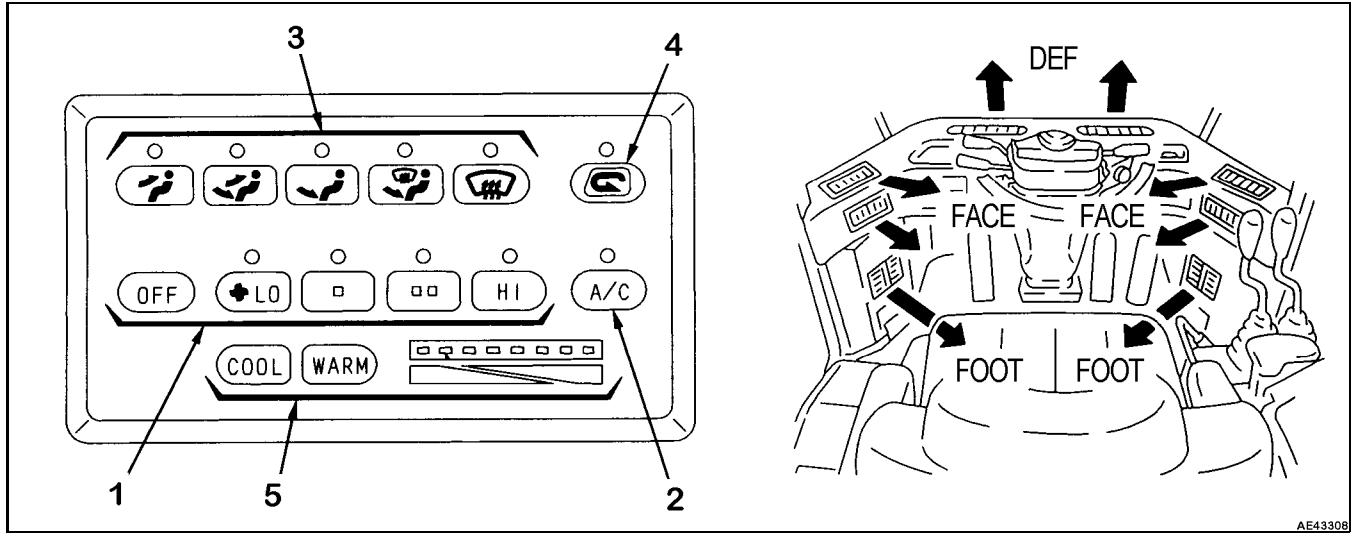
Select the most suitable bucket and tires for the type of work and job site conditions.

TYPE OF WORK	BUCKET	GROUND CONDITIONS	TIRE
Loading products Loading and carrying products	Stockpile bucket with bolt on edge 2.7 m <sup>3</sup> (3.55 cu.yd <sup>3</sup> )	General ground condition	20.5-25-12PR (Rock)
		Leveled ground condition	20.5-25-12PR (Traction)
		Hard ground	20.5-25-12PR (Rock)
Loading products and crushed rock	Stockpile bucket with teeth 2.3 m <sup>3</sup> (3.0 cu.yd <sup>3</sup> )	General ground condition	20.5-25-12PR (Rock)
		Hard ground	20.5-25-12PR (Rock)
Loading crushed rock	Excavating bucket with teeth 2.0 m <sup>3</sup> (2.6 cu.yd <sup>3</sup> )	General ground condition	20.5-25-12PR (Rock)
		Hard ground	20.5-25-12PR (Rock)

The speed display differs according to tire size, so when using optional tires, please contact your distributor.

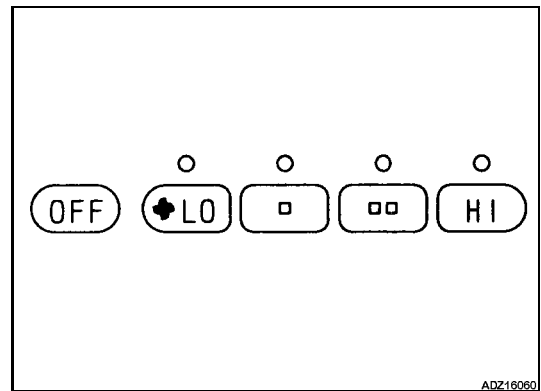
**28. AIR CONDITIONING**

**28.1 GENERAL LOCATIONS AND FUNCTION OF CONTROL PANEL**



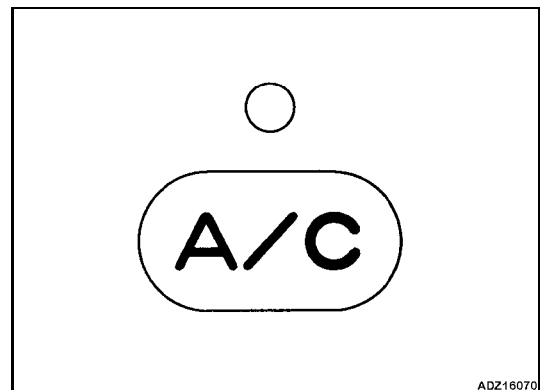
**28.1.1 FAN SWITCH**

This can be used to adjust the air flow to four stages. This switch also acts as the main switch for the air conditioner. When the switch is pressed, the indicator lamp above the switch lights up to indicate the air flow.



**28.1.2 AIR CONDITIONER SWITCH**

This is used to start or stop the cooling or dehumidifying function. When the fan switch is turned ON and the air conditioner switch is pressed, the indicator lamp above the switch lights up. When the switch is pressed again, the switch is turned OFF and the indicator lamp goes out.

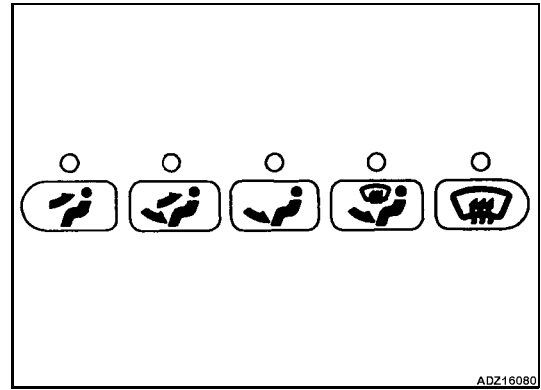


**28.1.3 MODE SELECTOR SWITCH**

This is used to select the vents. The following five vent modes are available (left to right in the illustration):

- FACE
- FACE/FOOT
- FOOT
- FOOT/DEF
- DEF

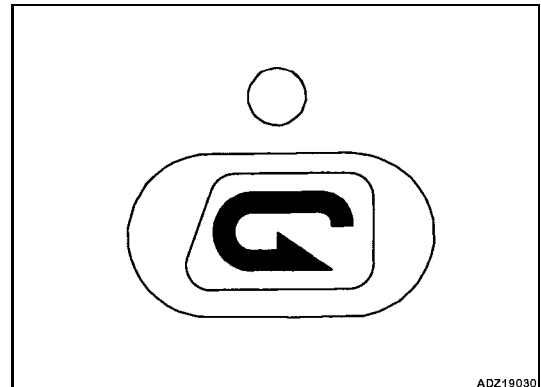
When the switch is pressed, the indicator lamp above the switch lights up to display the vent mode.



ADZ16080

**28.1.4 FRESH/RECIRC SELECTOR SWITCH**

This switch is used to select between recirculating the air inside the cab or taking in fresh air from outside. When the RECIRC position is selected, the indicator lamp above the switch lights up. When the switch is pressed again the indicator lamp goes out, and fresh air is taken in.



ADZ19030

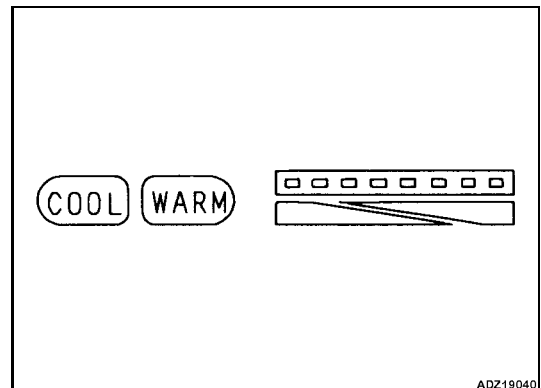
**28.1.5 TEMPERATURE CONTROL SWITCH**

The temperature can be adjusted steplessly from low temperature to high temperature. The temperature level indicator lamps light up to display the temperature of the air coming from the vents. The more the blue lamps light up, the lower the temperature. The color of the indicator lamp changes while the switch is being pressed. When the temperature reaches the desired level, release the switch to set the temperature. The settings for each mode are retained in memory even when the starting switch is turned OFF.

However, in the following cases, the settings must be made again.

- When the machine has been out of use for more than seven days
- When the battery voltage is extremely low
- When there has been abnormal interference from outside
- When the fan switch is turned OFF (the setting is not kept in memory with only the air conditioner switch)

Using the air conditioner at the FRESH position causes positive air pressure inside the cab, which will prevent the entry of dust from outside. The higher the position of the fan switch, the more effective the pressurizing becomes.



ADZ19040



## OPTIONS, ATTACHMENTS

### 28.2 METHOD OF OPERATION

Switch		Air conditioner switch	Fan switch	Temperature control switch	FRESH/RECIRC switch	Vent mode selector switch
Condition of use						
Cooling	Rapid	ON	HI	All blue	RECIRC	FACE
	Normal	ON	HI-LO	More than half are blue	FRESH	FACE
Dehumidifying, heating		ON	HI-LO	More than half are red	FRESH	FOOT
Heating	Rapid	OFF	HI	All red	RECIRC	FOOT
	Normal	OFF	HI-LO	More than half are red	FRESH	FOOT
Defroster		ON	HI	More than half are red	FRESH	DEF
Ventilation or pressurizing		OFF	HI-LO	All blue	FRESH	FACE

If the temperature control switch is set during defrosting so all lamps are red, this will improve the performance for defrosting and demisting. Set the vent mode selector switch to the intermediate position to give the desired condition. With the FACE vents, it's possible to adjust the direction of the air flow and to turn it on or off. However, do not set to the FACE mode with the vents closed.

#### 28.2.1 WHEN NOT USING THE AIR CONDITIONER REGULARLY

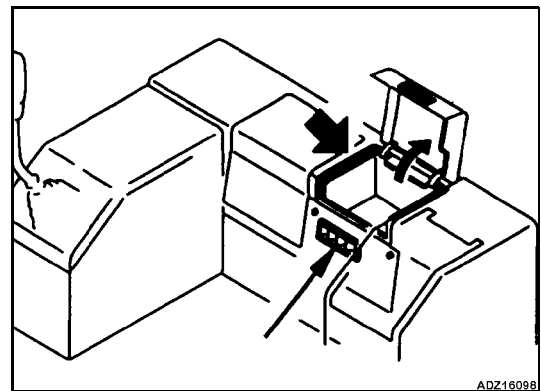
The compressor requires regular lubrication to preserve and protect moving parts. Maintain the compressor lubrication by occasionally operating the system (cooling, dehumidifying and heating) for a few minutes, regardless of weather.

#### REMARKS

When temperature in the cab already is low, the air conditioner may not operate. In such cases, warm the air inside the cab by recirculating, and then turn on the air conditioner.

### 28.3 COOL BOX

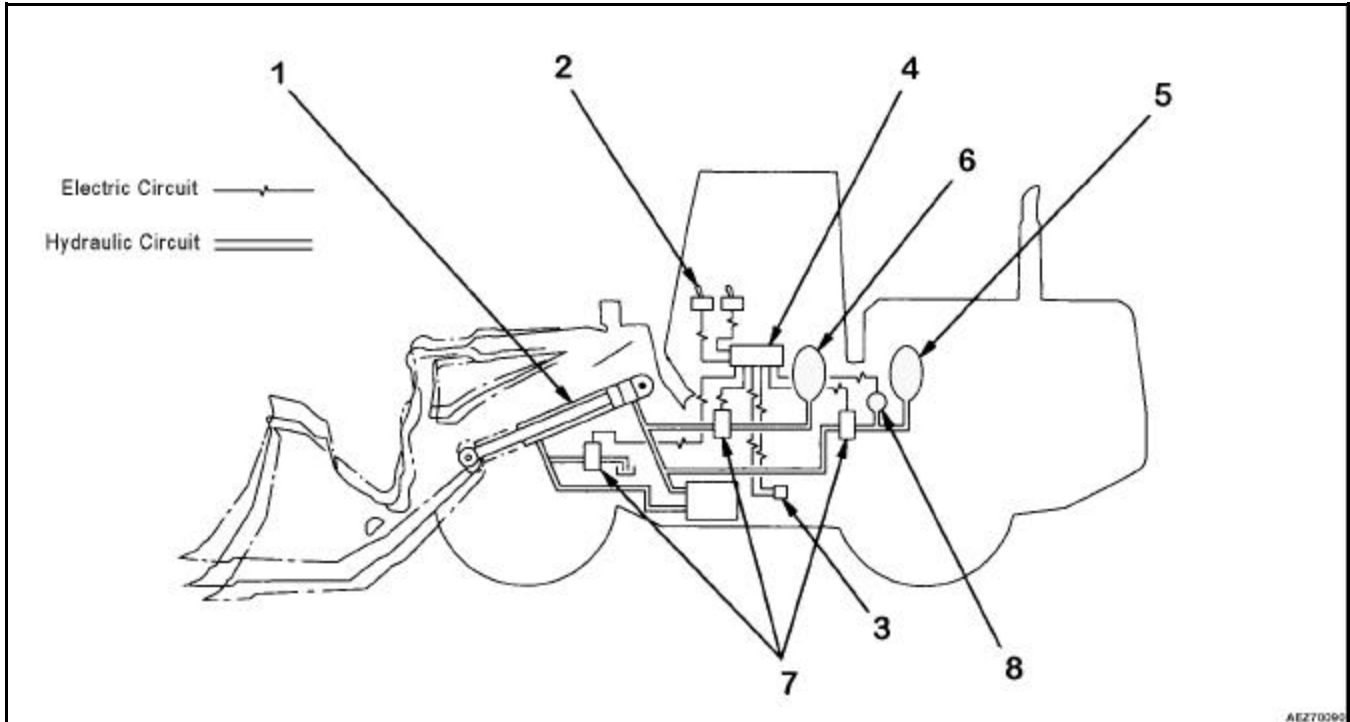
This compartment can keep small items cool (when the cooling is being used) or warm (when the heating is being used). When using the box, open the vent grill. When not using the box, close the grill. Do not use the cool box for things with strong odors or which leak water or break easily. Do not use it as a holder for tools or similar objects.



## 29. HANDLING ECSS (Electronic Controlled Suspension System)

Read this section before using the ECSS in order to use it safely and effectively.

### 29.1 STRUCTURE AND FUNCTION OF ECSS



The ECSS uses the hydraulic spring effect of the hydraulic accumulator installed in the circuit at the lift cylinder (1) bottom to absorb the chassis vibration when the machine is traveling. This enables the machine to travel smoothly at high speed.

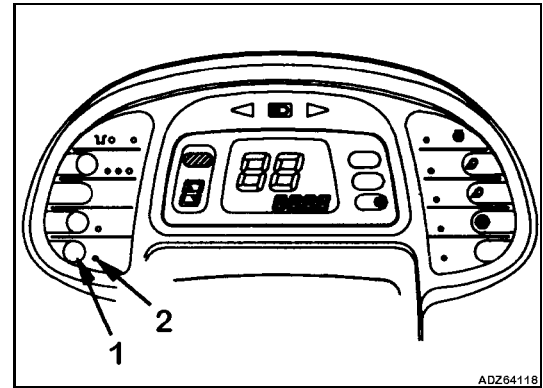
The ECSS consists of the ECSS switch (2), travel speed sensor (3), controller (4), hydraulic accumulator (5 and 6), solenoid valves (7) and pressure switches (8). When the ECSS switch is turned ON, if the travel speed rises to 5 km/h (3.1 mph) or higher, the solenoid valves open, the circuit at the lift cylinder bottom is connected with the hydraulic accumulator, and the ECSS is actuated. If the travel speed lowers below 5 km/h (3.1 mph), the solenoid valves close, the circuit at the lift cylinder bottom is shut off from the hydraulic accumulator, and the ECSS is not actuated.

When the ECSS is actuated, the pressure switches automatically open and close the solenoid valves in accordance with the bucket load to switch the accumulators. If the bucket is empty, the hydraulic accumulator for travel when empty (1) is actuated; and if the machine is loaded, the hydraulic accumulator for travel when loaded (2) is actuated. This enables the damper to provide the most effective absorption of travel vibration both when traveling empty and when traveling loaded.

### 29.2 METHOD OF OPERATING ECSS

The ECSS switch (1) is on the left side of the panel. When the ECSS switch is pressed, it is turned ON, the pilot lamp (2) (orange) lights up, and the ECSS is actuated. If the switch is pressed again, it is turned off, the pilot lamp goes out, and the ECSS is canceled.

It is possible to carry out operation with the ECSS switch kept ON. If the damper is kept ON during operations, and the hydraulic pressure in the circuit at the bottom end of the lift cylinder exceeds 150 kg/cm<sup>2</sup> (2130 psi) during operations, the solenoid valves are automatically closed, and the ECSS is canceled to protect the hydraulic accumulator from high pressure.



### 29.3 PRECAUTIONS WHEN OPERATING ECSS SWITCH

#### WARNING

If the ECSS switch is turned ON when the machine is traveling or when the work equipment is raised, the hydraulic accumulator for the ECSS is immediately connected to the circuit at the bottom of the lift cylinder, and the oil enters or leaves the hydraulic accumulator in the direction to maintain the balance. This means that the work equipment will move, so be extremely careful when operating the switch.

If operations are carried out with ECSS switch kept ON, and the hydraulic accumulator is automatically switched by the action of the pressure switches during operation, the work equipment could immediately move.

Never carry out inspection and maintenance with the ECSS switch kept ON. This is extremely dangerous, as the work equipment could move.

Always stop the machine and lower the equipment to the ground before operating the ECSS switch.

When carrying out inspection and maintenance, also lower the work equipment to the ground then turn the ECSS switch OFF before starting the maintenance operation.

#### REMARKS

If the starting switch is at the OFF position the ECSS will not work even if the ECSS switch is at the ON position. However, if the starting switch is at the ON position it is possible for the ECSS to be actuated, so it will switch to the actuation condition if the ECSS switch is turned ON. The ECSS is not actuated if the transmission is in 1st less than 5 km/h (3.1 mph). It is actuated when the transmission is in 2nd to 4th, and the accumulator pressure is switched to two levels in accordance with load to absorb the vibration of the chassis effectively.

## 29.4 ACCUMULATOR PRECAUTIONS

**⚠ WARNING**

**The accumulator is charged with high pressure nitrogen gas, which is extremely dangerous, so read the following items and be careful to handle the accumulator properly.**

If any problem or failure occurs with the accumulator, contact your distributor immediately.

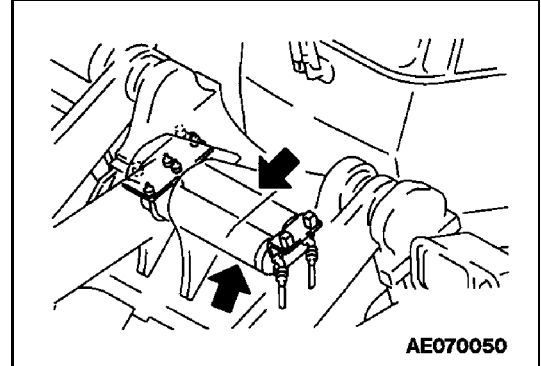
The gas must be charged into the accumulator only by a qualified serviceman from your distributor or by a person licensed to handle high pressure gas.

Do not bring any flame or heat close to the accumulator when it is charged with gas.

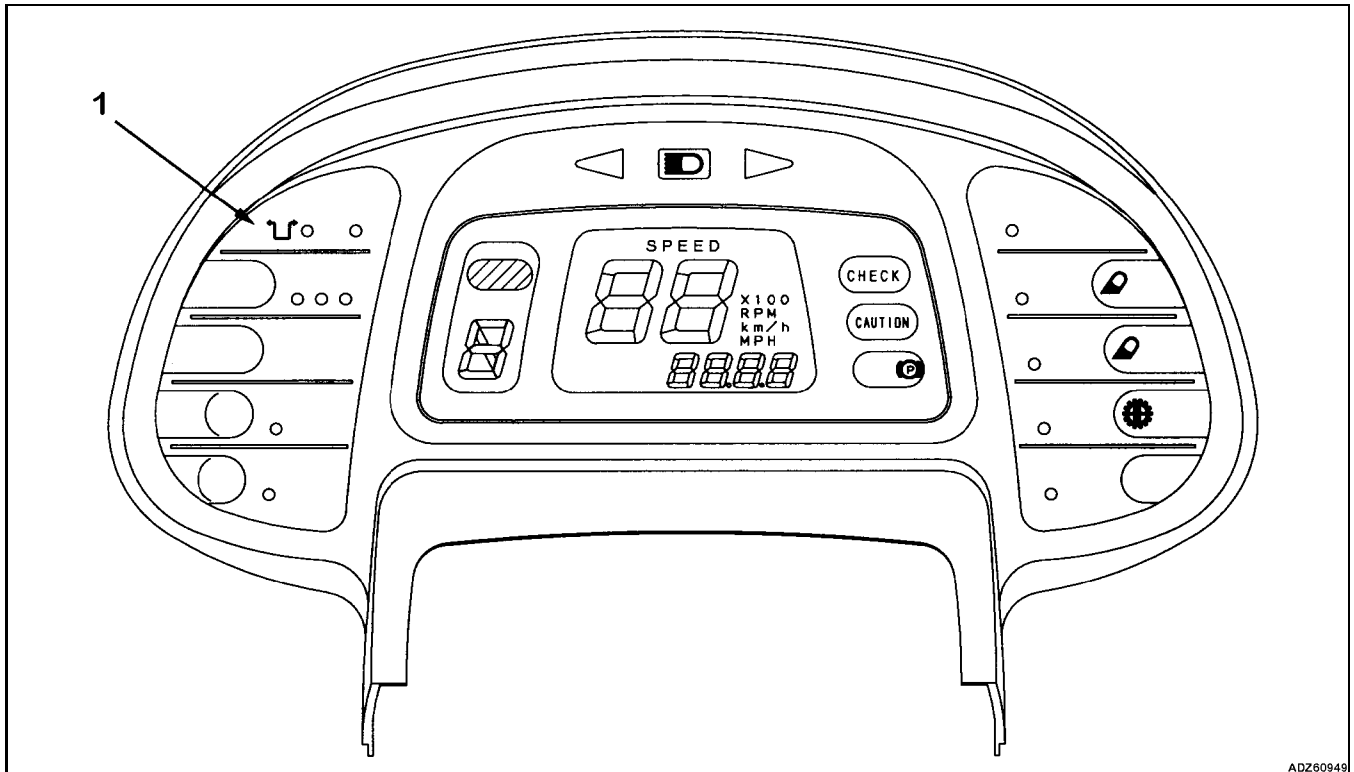
Do not make any hole in, or weld anything to, the accumulator.

Always release the gas before disposing of the accumulator or disassembling it for maintenance. Use the air bleed valve to release the gas.

Every 2000 hours or once a year, have your distributor check the gas pressure.



### 30. OPTION DISPLAY

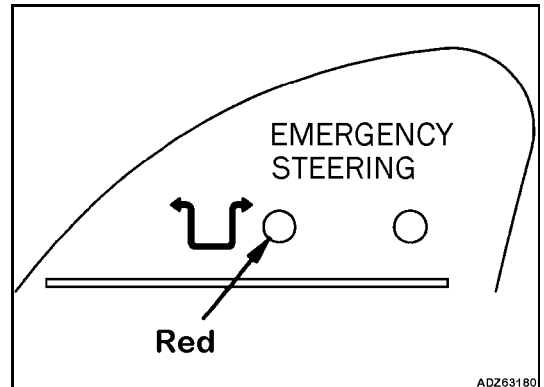


The options display is on the left side of the main panel and indicates the condition of actuation of the options.

#### 30.1 EMERGENCY STEERING PILOT LAMP

This indicates that the main pump is operating normally when the machine is traveling.

If the engine stops when the machine is traveling, or if there is an abnormality in the pump circuit, the monitor flashes to indicate that the emergency ground driven steering system has been actuated. If the monitor flashes, turn off the engine immediately.



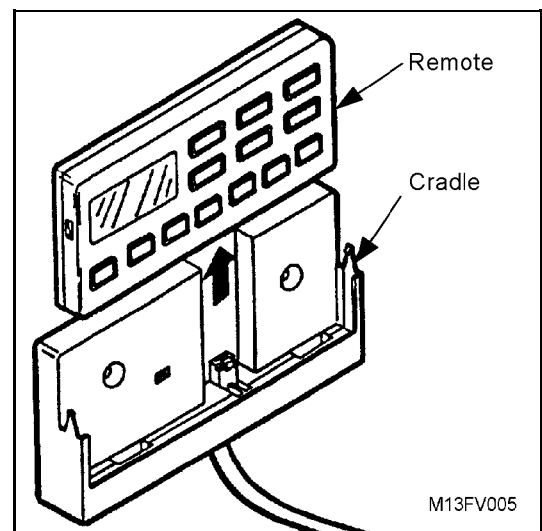
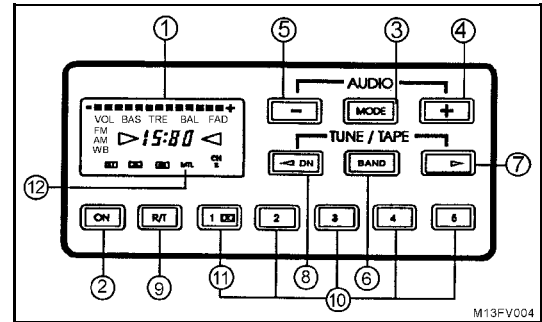
## 30.2 RADIO

### 30.2.1 OPERATING CONTROLS

1. LIQUID CRYSTAL DISPLAY (LCD) PANEL  
This panel graphically represents all functions selected: radio frequencies, time and cassette functions.
2. ON-OFF POWER BUTTON  
This is the primary control for turning the system on and off.
3. AUDIO MODE SELECTOR BUTTON (MODE)  
This single button allows selection of volume, bass, treble, balance and fader control.
- 4 and 5. AUDIO LEVEL BUTTONS (+) (-)  
Press repeatedly to adjust the mode selected with the Audio Mode Selector Button (3).
6. RADIO BAND/TAPE PROGRAM BUTTON (BAND)  
In the radio mode, this control selects the broadcast band (FM1, FM2, AM, WB). In the cassette mode, this button allows selection of Side 1 or Side 2 of the cassette being played.
- 7 and 8. UP-DOWN TUNING/FAST-FORWARD REWIND (DN)(UP)  
In the radio mode, these buttons allow operator to search for radio frequency -- up down or automatic-seek. In the cassette mode, they select Fast-Forward or Rewind operation.
9. RADIO TIME/RADIO - TAPE SELECTOR (R/T)  
In the radio mode, this button allows operator to display either time or radio frequency. In the tape mode, it allows selection between radio and tape operation.
10. RADIO PRE-SET MEMORIES  
These five buttons allow the operator to store up to 20 radio stations (10 FM, five AM and five Weather Band) into pre-set memory.
11. DOLBY ® NOISE REDUCTION (NR)  
In the tape mode, this button allows engaging the Dolby ® Noise reduction. In radio mode, this button is preset 1.
12. AUTO METAL TAPE SENSOR (MTL)  
The equipment senses automatically a cassette that requires Metal or CrO2 equalization and adjusts reproduction accordingly. When activated the symbol "MTL" appears on the display.

**NOTE:**

The control panel operates all radio and cassette functions except "eject", which is actuated from the cassette player. The "remote" portion of the unit includes the controls only, and it will not operate outside of its cradle holder.



## OPTIONS, ATTACHMENTS

### 30.2.2 OPERATION

#### 1. LIQUID CRYSTAL DISPLAY (LCD) PANEL

The Liquid Crystal Display Panel is the primary information display: radio frequency being received, time, audio settings and cassette operation (if used).

#### NOTE:

**Like most LCD equipment, the radio's display panel may be affected by extreme cold or exposure to very bright sunlight; numbers may be less visible and slow to appear.**

#### 2. ON-OFF POWER BUTTON

Press this button to turn off the power for the radio and optional cassette player. Press again to turn on the power.

#### 3. AUDIO MODE SELECTOR BUTTON (MODE)

To adjust an audio function, first select the audio function with this button (volume, bass, treble, balance or fader), and then adjust with the audio "+" and "-" buttons (4) and (5). The results will show up on the Liquid Crystal Display panel: volume (VOL), bass (BAS), treble (TRE) and fader (FAD). FAD operation will be displayed only if four speakers are connected to the system.

#### Volume

To increase volume (louder) tap or hold the "+" button (4); to decrease the volume, tap or hold the "-" button (5). The Liquid Crystal Display shows the progress with a bar graph to a maximum of 13 spots (

#### Bass

To adjust bass level (low range), first select the Bass mode by pressing the Mode button (3) once so BAS is indicated on the display panel. Within five seconds, press the "+" or "-" audio button (4 or 5) to emphasize the low sounds. A triangle ( the display panel will indicate the level. The unit will retain the setting even when turned off.

#### Treble

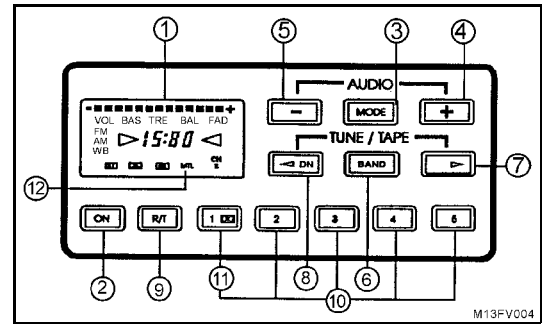
To adjust treble level (high range), first select the Treble mode by pressing the Mode button (3) twice so TRE is indicated on the display panel. Within five seconds, press the "+" or "-" audio button (4 or 5) to emphasize the high sounds. A triangle ( the display panel will indicate the level.

#### Balance

To adjust the audio balance, left-right, first select the Balance mode by pressing the Mode button (3) three times. BAL appears on the display panel, along with "L" (left) and "R" (right). Within five seconds, press the "+" audio button (4) to emphasize the volume of the right speaker(s) or the "-" button (5), to emphasize volume of the left speaker(s). The center illuminated arrow indicates mid-balance position.

#### 4 and 5. AUDIO LEVEL BUTTONS (+) (-)

Press repeatedly to adjust the mode selected with the Audio Mode Selector Button (3).



6. RADIO BAND SELECTOR (BAND)

Radio operation: Press this button to change the radio band (FM1, FM2, AM, Weather Band).

Cassette operation: Press this button to change manually from side one to side two of a cassette being played.

7 and 8.

UP-DOWN TUNING/SEEK TUNING/CASSETTE FAST FORWARD AND REWIND

To manually select a radio station, momentarily press the "UP" tuning button (7) to advance the tuning and display one digit higher, or the "DN" tuning button to tune one digit lower. Continue tapping to change to the desired station.

To automatically "seek" the station nearest to the one you are receiving, press the UP tuning button (7) to seek upward and hold until a "beep" is heard. Release the button and the radio tuning will stop and the next higher broadcasting station. Perform the same operation using DN button (8) to seek downward.

During cassette operation, the UP and DN buttons actuate the fast-forward and rewind functions, respectively, regardless of which side of the cassette is being played. Press and release to start rewind or fast-forward; press again to halt the function.

9. RADIO-TIME/RADIO-TAPE SELECTOR (R/T)

This displays the frequency, time, and operation modes.

If a cassette is in the player, this button functions as a radio/tape selector.

Operation (tape playing): Tap the R/T button to pause the cassette and operate the radio; tap the R/T button again to display the frequency for five seconds; press until a "beep" is heard and then release to resume cassette play.

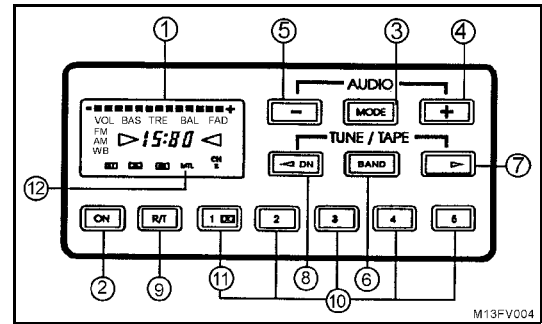
Operation (radio playing): Normally the time is displayed, until the radio tuning is changed or button (9) is pressed. Then the radio frequency being received is displayed for five seconds.

**NOTE: If a cassette is in the player, a small cassette symbol appears on the LCD display. Leaving cassettes in the player for extended periods (overnight) can cause damage.**

10. RADIO STATION PRE-SET MEMORIES

To set any of the five pre-set memories in each band:

- A. Turn on the system and select the band.
- B. Select the first station to be pre-set with the UP and DN tuning controls (7) and (8).
- C. Press the desired pre-set button (1 through 5) and hold until a "beep" is heard.
- D. Release the button. The display will show "CH1", "CH2" etc., depending on which button was set. Now simply press the desired pre-set button to tune to the station in memory.






## OPTIONS, ATTACHMENTS

- E. Repeat the procedure for each button and four bands. You can change any pre-set without affecting the others. It's unlikely that more than one Weather Band station will be available in a given area, so most of the Weather Band pre-sets will go unused.

### 11. DOLBY® NOISE REDUCTION ( )

Dolby noise reduction helps reduce background noises common on cassette recordings. If cassette has been recorded with Dolby noise reduction (indicated by the Dolby symbol), press this button to engage the system.

Press the button again to turn the system off. To most listeners, tapes recorded without Dolby noise reduction sound better when played back without Dolby noise reduction.

Dolby and  are trademarks of Dolby Laboratories Licensing Corporation.

### 12. AUTO-METAL TAPE SENSOR

Cassettes with metal or CrO2 tape require special equalization circuitry to play back the best sound. The system automatically recognizes and adjusts for the special tape and displays "MTL" on the LCD display.

## 30.2.3 SETTING THE CLOCK

1. Turn on the radio power. Remove cassette from the player.
2. Press and hold R/T button (9) until the time display begins to flash. Release the R/T button.
3. Within 10 seconds of releasing the R/T button, press the down tuning (DN) (8) to advance hours. Press the UP button (7) to advance minutes.
4. About 10 seconds after the time is set, the display will stop flashing and time keeping will begin.

## 30.2.4 REMOTE CONTROL UNIT

1. Turn off radio power.
2. Grasp the sides of the remote at the top serrated edges and pull upward.

### NOTE:

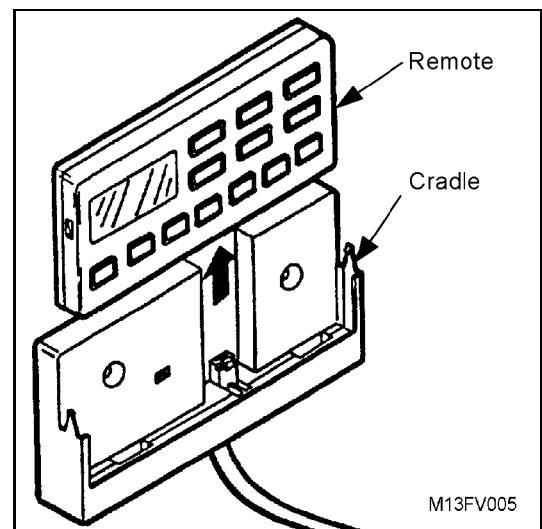
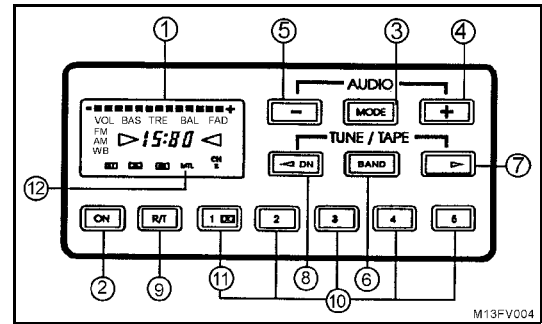
**The remote when removed from the cradle is inoperable and power has been turned off.**

**Do not expose the remote or cradle to extreme heat, direct sunlight, solvents or water.**

**Use slightly damp, soft cloth to clean the remote; never immerse in water.**

**Keep the male telephone-type plug in the cradle clean. Use of a damp cotton swab is acceptable.**

3. Reverse steps 1 and 2 to reinstall the remote control unit.



### 30.2.5 BATTERY REPLACEMENT

Two AA size alkaline batteries in the electronics module are required to maintain the unit's memory when its main power is turned off. Replacement is required when the clock or memory pre-sets fail to keep time or memory.

**NOTE:**

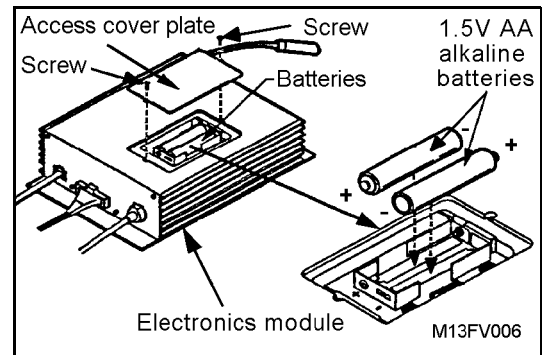
**Turn off the radio power before replacing the back-up memory batteries.**

1. Remove the two screws that secure the access cover plate on the top of the module. Remove the access cover plate.
2. Remove the two batteries.
3. Install two new 1.5 volt AA type alkaline batteries.

**NOTE:**

**Be sure to observe proper polarity when installing batteries, as shown in the diagram and on the battery holder.**

4. Replace the access cover plate and secure with the two screws.



### 30.2.6 PRECAUTIONS WHEN USING

Retract the antenna when traveling in places with a low over head clearance.

For safety reasons, when operating, keep the radio volume at a level that permits hearing sounds from outside the vehicle.

Water can cause damage if allowed in the speaker enclosures, radio, cassette player or remote control unit. Keep water away from these parts.

Do not wipe the knobs or buttons or any other parts with solvents such as benzene or thinner. Always wipe with a soft dry cloth (in extreme cases, alcohol may be applied sparingly to the cleaning cloth).