CEAD003600

Operation & Maintenance Manual

WA380-3

WHEEL LOADER

SERIAL NUMBERS WA380-3MC - A51001 and up

FEB 1999

PRODUCT PUBLICATIONS INFORMATION

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

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

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

DESCRIPTION	FORM NUMBER
PARTS BOOK - PAPER:	
Chassis and Engine	BEPB005500
PARTS BOOK - MICROFICHE:	
Chassis and Engine	BEPM005500
OPERATION AND MAINTENANCE MANUAL:	
Chassis and Engine	CEAM003600
SHOP MANUAL:	
Chassis	CEBM003400
Engine	CEBM000601
STANDARD MAN-HOUR GUIDE:	
Chassis	CEKQ000200
Engine	N/A
SAFETY MANUAL	WLT70-1

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IF THE PIPS SYSTEM IS NOT AVAILABLE AT THE DISTRIBUTOR LOCATION, THEN THE FOLLOWING REQUISITION FOR TECHNICAL SERVICE PUBLICATIONS AND SERVICE FORMS CAN BE USED. FORM KDC91D IS SHOWN ON THE REVERSE SIDE OF THIS PAGE.

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

KDC91D 081696

CURRENT PRICES WILL BE CHARGED

INTRODUCTION

1. FORWARD

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 0-3 and in SAFETY starting on 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 2-60.

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 comfortable feeling as in 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 air conditioner with new refrigerant installed.

Full fender system installed 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 breaking in:

After starting, let the engine idle for 5 minutes to allow proper engine warm up prior to actual operation.

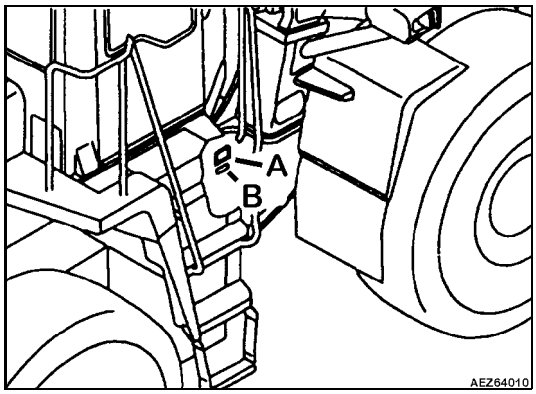
Avoid operation with heavy loads or at high speeds.

Avoid sudden starts or acceleration, unnecessarily abrupt stops and sharp steering except in cases of emergency.

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. PLATE LOCATIONS AND TABLE TO ENTER P.I.N AND DISTRIBUTOR



4.1 P.I.N. PLATE LOCATION

4.1.1 POSITION OF PLATE (A)

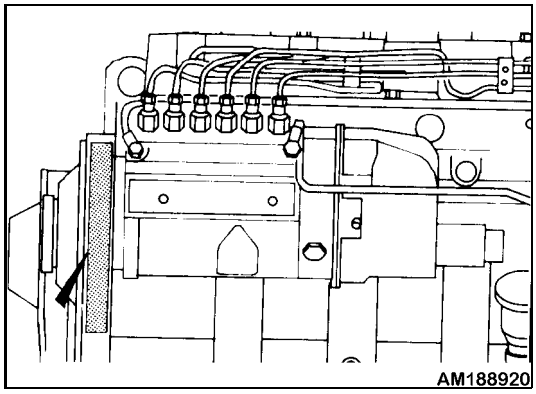
On the center right of the front frame.

4.1.2 POSITION OF STAMP (B)

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

4.2 ENGINE SERIAL NUMBER PLATE

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



4.3 TABLE TO ENTER NUMBERS AND DISTRIBUTOR

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

REMARKS

5. TABLE OF CONTENTS

Introduction

Safety

Operation

Maintenance

Specifications

Options, Attachments

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

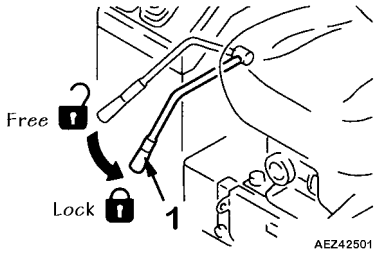
ONLY trained and authorized personnel should be allowed to operate and service this machine.
Follow all safety rules, precautions and instructions when operating or performing maintenance on the machine.
The owner and/or operator must replace any and all safety and warning product graphics if they are 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 operators 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 (1) and seat belt properly.
A seat belt is required by OSHA in 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 belt

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.

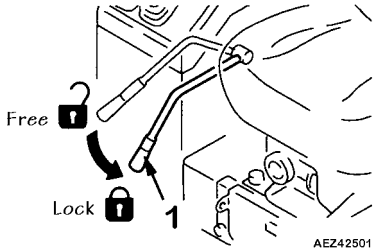
INSIDE OPERATOR'S COMPARTMENT

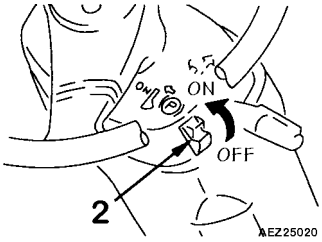
When entering the operators compartment, always remove all mud and oil from the soles of your shoes.
If you operate the brake pedal with mud or oil stuck to your shoes, your foot may slip and this may causea serious accident.
After using the ashtray, make sure that any matches or cigarettesare properly extinguished, and be sure to close the lid. If the ashtray is left open, there is danger of fire.
Do not stick suction pads to the window glass. Suction pads act as a lens and may cause fire.
Do not leave lighters lying around the operators compartment. If the temperature inside the operators compartment become high, there is danger that the lighter may explode.
Do not use cellular telephones insidethe operators compartment when driving or operating the machine. There is danger that this may lead to an unexpected accident.
Never bring any dangerous objects such as flammable or explosive items into the operators cab.
To ensure safety, do not use theradio or music headphones when operating the machine. There is danger that this may lead to a serious accident.
When operating the machine, do not put your hands or head out of the window.

ALWAYS APPLY LOCK WHEN LEAVING OPERATORS SEAT

When standing up from the operators seat, always place the safety lock lever (1) securely in the LOCK position and parking brake switch (2) to the ON position. If you accidentally touch the transmission or 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.

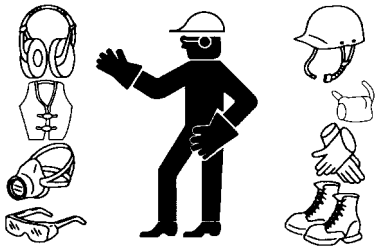
Work equipment posture
Lock





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

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 cleaner element with compressed air. Also, check that no one is near the machine.

Cleaning of air cleaner element **See 24.2.1 CLEAN OR REPLACE AIR CLEANER ELEMENT on page 3-26.**

Check that all protective equipment functions properly.

MOUNTING AND DISMOUNTING

Never jump on or off the machine. In particular, never get on or off a moving machine. These actions may lead to serious injury.

When getting on or off the machine, always face the machine, and maintain three point contact (both feet and one hand or one foot and both hands) with the handrails, steps, and platforms to ensure that you support yourself securely.

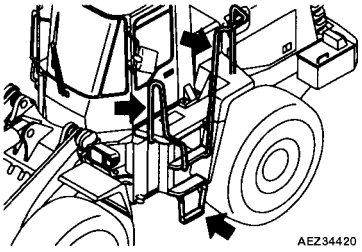
Never hold any control levers when getting on or off the machine. Do not use the machine controls or hoses as handholds when climbing on or off the machine. Controls and hoses can move and do not provide solid support. Movement of the controls may cause unexpected machine movement and injury.

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

Before getting on or off the machine, if there is any oil, grease, or mud on the rails, steps, or platforms, wipe it off immediately. Always keep these parts clean. Repair any damage and tighten any loose bolts.

Apply the door lock securely. If you grip the handrail inside the door when moving on top of the platforms and the door lock is not applied securely, the door may move and cause you to fall.

Use the points marked by arrows in the diagram when getting on or off the machine.



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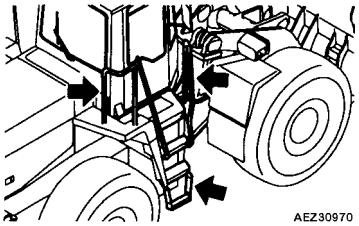

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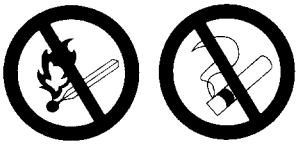
FIRE PREVENTION FOR FUEL, OIL AND ANTIFREEZE

Fuel, oil, and antifreeze can be ignited by a flame. Fuel is particularly FLAMMABLE and can be HAZARDOUS Always strictly observe the following.

- 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 oiling should be made in well ventilated areas.
- Keep oil and fuel in the determined place and do not allow unauthorized persons to enter.
- Do not leave the area when supplying fuel.



PRECAUTIONS WHEN HANDLING AT HIGH TEMPERATURES

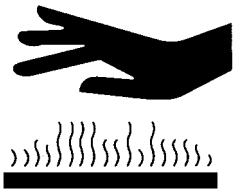
Immediately after operations are stopped, the engine coolant, engine oil, and hydraulic oil are at high temperatures, and are still under pressure. Attempting to remove the cap, drain the oil or water, or replace the filters may lead to serious burns. Always wait for the temperature to go down, and follow the specified procedures when carrying out these operations.

To prevent hot water from spurting out:

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

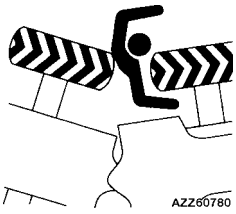
To prevent hot oil from spurting out:

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



CRUSHING OR CUTTING PREVENTION

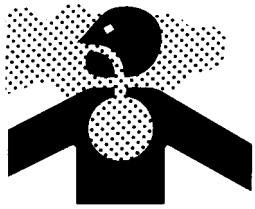
Do not enter, or put your hand or arm or any other part of your body between movable parts such as between the work equipment and cylinders, or between the machine and work equipment. If the work equipment is operated, the clearance will change and this may lead to serious damage or personal injury.



ASBESTOS DUST HAZARD PREVENTION

Asbestos dust can be hazardous to your health if it is inhaled. Komatsu America International Company does not use asbestos in its products, but if you handle materials containing asbestos fibers during demolition operations, always do, as follows.

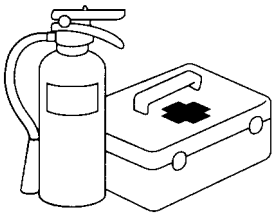
Never use compressed air for cleaning.
Use water to keep down the asbestos dust when cleaning.
If there is danger that there may be asbestos dust in theair, operate the machine with the wind to your back whenever possible.
Use an approved respirator if necessary.
Do not allow any other person into the area during the operation.
There is danger that non-genuine parts maycontain asbestos, so use only Komatsu America International Company genuine parts.
Always observe any rules and regulations related to the job site and working environment.



FIRE EXTINGUISHER AND FIRST AID KIT

As a precaution if any injury or fire should occur, always do as follows.

Be sure that fire extinguishers have been providedand read the labels to ensure that you know how to use them.
Provide a first aid kit at the storagepoint. Check the kit periodically and make any additions if necessary.
Know what to do in the event of injury or fire.
Make a list of the phone numbers of persons you should contact in case of an emergency (doctor, ambulance, fire station), and post the list at specified places to ensure that all workers can carry out the emergency contact.



CAB GLASS AND WINDOW WASHER FLUID

If the cab glass on the work equipment side should be broken, there is serious danger that you may come into direct contact with the work equipment. If the glass breaks, stop operation immediately and replace glass.
Use an ethyl alcohol type washer fluid. DO NOT use a methyl alcohol type washer fluid because it may irritate your eyes.

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.

PRECAUTIONS WHEN USING ROPS

The ROPS (Roll Over Protective Structure) must never be removed when operating the machine. 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, the strength may drop and not be able to fulfill its function properly. It can only display its performance 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 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 will then 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.

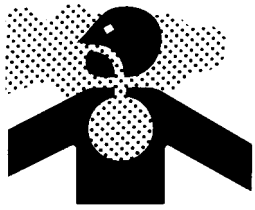
Method of releasing the pressure or charging with gas

The accumulator is charged with high-pressure nitrogen gas, which is extremely dangerous, so read the following items and be careful to handle the accumulator properly.

- Do not make any holes or bring any flame or heat close to the accumulator.
- Do not weld any bosses to the accumulator.
- The gas must be released before disposing of the accumulator, so please ask your distributor to do this.

INDOOR VENTILATION

When starting the engine, or using fuel, flushing oil, or paint indoors or in areas with poor ventilation, always open the windows and doors to improve the ventilation and prevent the danger of gas poisoning.
If the ventilation is still insufficient even when the windows and doors are opened, use a ventilation fan.



PRECAUTIONS FOR MIRRORS, WINDOWS AND LIGHTS

Remove all dirt from the surface of the windows and lights to ensure that you can see well.
Adjust the side mirror so that you can see clearly from the operators seat, and always keep the surface of the mirror clean. If any glass is broken, replace it with a new part.
Check that the head lamps and working lamps light up properly.

7. PRECAUTIONS DURING OPERATION

7.1 BEFORE STARTING ENGINE

SAFETY AT WORKSITE

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

Before starting the engine, thoroughly check the area for any unusual conditions that could be dangerous.

Before starting the engine, examine the terrain and soil conditions of the worksite. Determine the best and safest method of operation.

If you need to operate on a street, protect pedestrians and cars by designating a person for worksite traffic duty or by installing barriers around the worksite.

If water lines, gas lines, telephone lines, and high-voltage electrical lines may be buried under the worksite, contact each utility and identify their locations. Be careful not to sever or cut any of these lines.

Check the depth and flow of water before operating in water or crossing a river. NEVER be in water which is in excess of the permissible water depth.

Permissible water depth **See 12.11 PRECAUTION FOR OPERATION on page 2-65.**

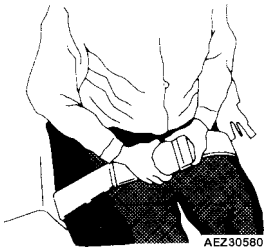
BEFORE STARTING ENGINE

Perform the following checks before starting the engine at the beginning of the days work. Failure to perform these 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 around the battery. Check fuel, lubrication, and hydraulic systems for leaks, and have any leaks repaired. Wipe up any excess oil, fuel or other flammable fluids. Return all fuel containers to their proper place, remove all parts and tools from the operator's compartment, and remove any dirt from the mirrors, handrails, and steps.

Check points

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



Checks before starting

Adjust the operators 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 operators seat **See 12.1.3 ADJUSTMENT BEFORE OPERATION on page 2-43.**

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 **See 12.1.4 OPERATIONS AND CHECKS BEFORE STARTING ENGINE on page 2-46.**

Remove all dirt from the surface of the window glass and lights to ensure good visibility. Adjust the side mirror to a position which gives the best view from the operator's seat, and clean the surface of the mirror. If the mirror glass is damaged, replace with a new part.

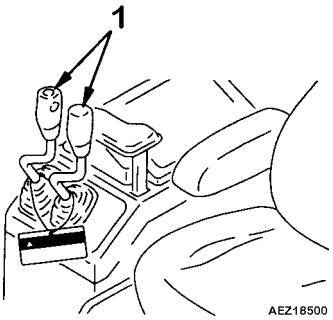
Check that the front lamps and working lamps light up properly. If the results of the inspection show any abnormality, always carry out repairs.

Before starting the engine, check that the safety lock is at the LOCK position.

Be sure a fire extinguisher is present and check the method of using it. Do not operate the machine near any fire or flame.

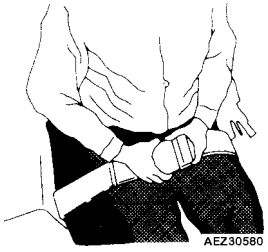
WHEN STARTING ENGINE

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 control lever.
When starting the engine, sound the horn as an alert.
Start and operate the machine only while seated.
An additional worker may ride in the machine only when sitting in the passenger seat. Do not allow anyone to ride on the machine body.



IN OPERATORS CAB

Do not leave tools, spare parts or personal items lying around in the operators compartment. They may damage, break or jam the control levers or switches. Always put them in their proper place.
Keep the cab floor, controls, steps and handrails free of oil, grease, snow, and excess dirt.
Check the seat belt, buckle and hardware for damage or wear. Replace any worn or damaged parts. NEVER use bleach, dye or solvents on the seat belt because this may weaken the webbing and result in personal injury. Clean the seat belt with warm water and a mild detergent. ALWAYS use seat belts when operating your machine.

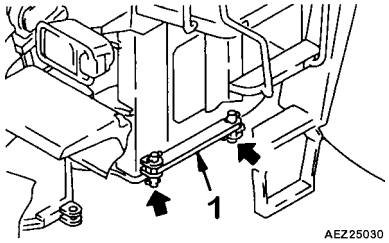


Seat belts

Do not service the air conditioning system unless you have the proper equipment that complies with all government regulations. It is unlawful to discharge freon into the atmosphere.
Know the alternate exit routes from the operators compartment for use in an emergency.

7.2 AFTER STARTING ENGINE

AFTER STARTING ENGINE

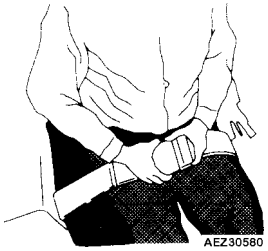


Failure to carry out the checks properly after starting the engine will lead to delays in discovery of abnormalities, and this may lead to serious injury or damage to the machine. When carrying out the checks, use a wide area where there are no obstructions. Do not allow anyone near the machine.

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

Checks for any abnormality in the sound of the machine, vibration, heat, smell, or gauges; check also that there is no leakage of air, oil, or fuel. If any abnormality is found, carry out repairs immediately.

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 (1) is securely locked in the FREE position.

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

When starting off, sound the horn as an alert.

Always operate the machine only when seated in the operators seat.

Always fasten the seat belt.

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

Check that the backup alarm works properly.

TRAVELING ON SLOPES

Traveling on slopes could result in the machine tipping over or slipping to the side.

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

Do not turn on slopes or travel across slopes. Always go down to a flat place to perform these operations.

Do not travel on grass, fallen leaves, or wet steel plates. Even slight slopes may cause machine to slip to the side, so travel at low speed and make sure that the machine is always traveling directly up or down the slope.

When traveling downhill, never shift gears or place the transmission in neutral. It is dangerous not to use the braking force of the engine. Always place the transmission in a low gear before starting to travel downhill.

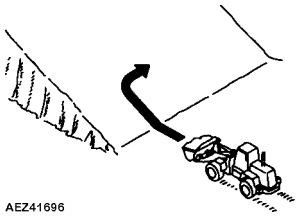
When traveling downhill, use the braking force of the engine and travel slowly. If necessary, use the braking force of the engine together with the brake pedal to control the travel speed.

If the engine stops when the machine is on a slope, immediately depress the brake pedal fully to apply the brakes, lower the bucket to the ground, then 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 and in reverse when going downhill).

When traveling on a slope with a loaded bucket, if the machine travels with the bucket facing downhill, there is danger that the machine may tip over.

INCORRECT



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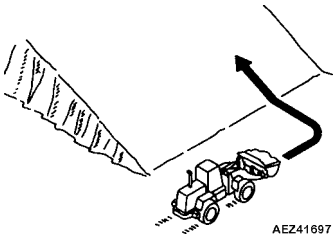


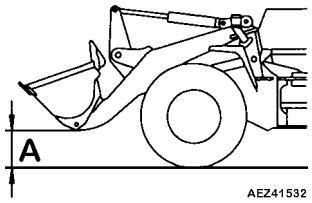
PRECAUTIONS WHEN TRAVELING

Never turn the key in the starting switch to the OFF position 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 you when operating. Always concentrate on your work.

It is dangerous to drive too fast, or to start suddenly, stop suddenly, turn sharply, or zigzag. If you find any abnormality in the machine during operation (noise, vibration, smell, incorrect gauges, air leakage, oil leakage, etc.), move the machine immediately to a safe place and look for the cause.

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



When traveling, do not operate the work equipment control levers. If the 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 as far as possible. 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 coming into contact with them.

NEVER be in water which is in excess of the permissible water depth.

Permissible water depth

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.

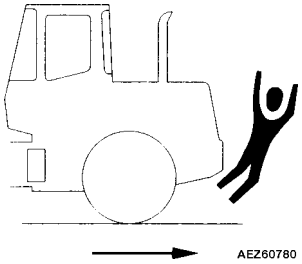
Always obey the traffic regulations when traveling on public roads. This machine travels at a lower speed than automobiles, so keep to the side of road and be careful to leave the center of the road free for other vehicles.

If you drive the machine at high speed continuously for a long time, the tires will overheat and the internal pressure will become abnormally high. This may cause the tires to burst. If a tire bursts, it produces an extremely large destructive force, and this may cause serious injury or accident.

If you are going to travel continuously, please consult your distributor.

CHECK WHEN CHANGING DIRECTIONS

To prevent serious injury or death, always do the following before moving the machine or the 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. This area cannot be seen clearly from the operators seat.

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

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

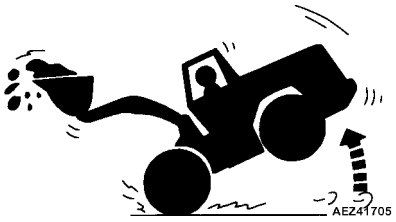
PROHIBITED OPERATION

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

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 of soil to push the first pile.
The load suddenly becomes lighter when the soil is pushed over a cliff or when the machine reaches the top of a slope. When this happens, there is danger that the travel speed will suddenly increase, so be sure to reduce the speed.
When the bucket is fully loaded, never start, turn, or stop the machine suddenly.
When handling unstable loads, such as round or cylindrical objects, or piled sheets, if the work equipment is raised high, there is danger that the load may fall on top of the operators compartment and cause serious injury or damage.

INCORRECT



INCORRECT

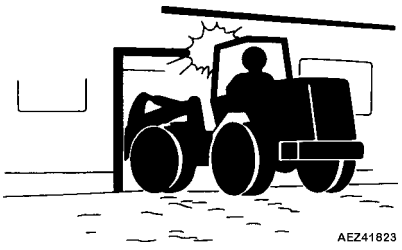
When handling unstable loads, be careful not to raise the work equipment too high or tip the bucket back too much.
If the work equipment is suddenly lowered or suddenly stopped, the reaction may cause the machine to tip over.
Particularly when carrying a load, be sure to operate the work equipment carefully.
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

Do the following to ensure good visibility.
When operating in dark places, turn on the working lamps and front lamps, and install lighting at the jobsite if necessary.
Do not carry out operations in fog, mist, snow, or heavy rain, or other conditions where the visibility is poor. Wait for the weather to clear so that visibility is sufficient to carry out work.
Always do the following to prevent the work equipment from hitting other objects.
When operating in tunnels, under bridges, under electric wires, or other places where the height is limited, be extremely careful not to let the bucket hit anything.
When loading dump trucks, check that there is no one in the area around the machine and be careful not to let the bucket hit the operators compartment of the dump truck.
To prevent accidents caused by hitting other objects, always operate the machine at a speed which is safe for operation, particularly in confined spaces, indoors, and in places where there are other machines.

INCORRECT

INCORRECT

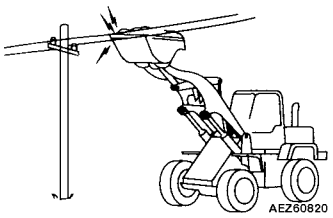


DO NOT GO CLOSE TO HIGH VOLTAGE CABLE

Do not let the machine touch overhead electric cables. Even going close to high-voltage cables can cause electric shock. Always maintain the safe distance given below between the machine and the electric cable.
To prevent accidents, always do as follows.

- On jobsites where there is danger that the machine may touch the electric cables, consult the electricity company before starting operations to check that the actions determined by the relevant laws and regulations have been taken.
- Wear rubber shoes and gloves. Lay a rubber sheet on top of the operators seat, and be careful not to touch the chassis with any exposed part of your body.
- Use a signalman to give warning if the machine approaches too close to the electric cables.
- If the equipment should touch an electric cable, the operator should not leave the operators compartment.
- When carrying out operations near high voltage cables, do not let anyone come close to the machine.
- Check with the electricity company about the voltage of the cables before starting operations.

	Voltage	Minimum safety distance	
Low voltage	100 to 200 V	2 m	7 ft
	6600 V	2 m	7 ft
Very high voltage	22000 V	3 m	10 ft
	66000 V	4 m	14 ft
	154000 V	5 m	17 ft
	187000 V	6 m	20 ft
	275000 V	7 m	23 ft
	500000 V	11m	36 ft



GOOD VISIBILITY

When working in dark places, install working 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.

OPERATE CAREFULLY ON SNOW

When working on snow or icy roads, even a slightslope may cause the machine to slip to the side, so always travel at low speed and avoid sudden starting, stopping, or turning. There is danger of slipping particularly on uphill or downhill slopes.
With frozen road surfaces, the ground becomes soft when the temperature rises, so the travel conditions become unstable. In such cases be extremely careful when traveling.
When there has been heavy snow, 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 fit tire chains.
When traveling on snow covered slopes, never apply the brakes suddenly. Reduce the speed and use the engine as a brake while applying the foot brake intermittently (depress the brake intermittently several times). If necessary, lower the bucket to the ground to stop the machine.
The load varies greatly according to the characteristics of the snow, so adjust the load accordingly 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 that when the engine of a machine with boosters stops, the brake pedal becomes 3.5 times heavier.

WORKING ON LOOSE GROUND

Do not operate the machine on soft ground. It is difficult to get the machine out again.
Avoid operating your machine too close to the edge of cliffs, overhangs, and deep ditches. If these areas collapse under the mass or vibration of your machine, the machine could fall or tip over and this could result in serious injury or death. Remember that the soil after heavy rain, blasting, or earthquakes is weakened in these areas.
Earth laid on the ground and the soil near ditches is loose. It can collapse under the mass or vibration of your machine and cause your machine to tip over.
Install the head guard (FOPS) when working in areas where there is danger of falling stones or rocks.
Install the ROPS and wear the seat belt when working in areas where there is danger of falling rocks or of the machine turning over.

PARKING THE MACHINE

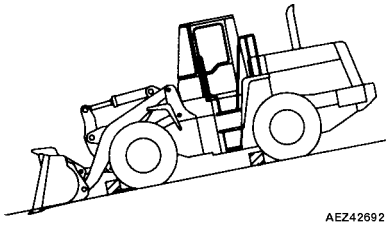
Park the machine on level ground where there is no danger of fallingrocks or landslides, or of flooding if the land is low, and lower the work equipment to the ground.
If it is necessary to park the machine on a slope, set blocks under the wheels to prevent the machine from moving, then dig the work equipment into the ground.
When parking on public roads, provide fences, signs,flags, or lights, and put up any other necessary signs to ensure that passing traffic can see the machine clearly, and park the machine so that the machine, flags, and fences do not obstruct traffic.

Parking procedure

When leaving the machine, lower the bucket completely to the ground, set the safety lock to the LOCK position and parking brake switch to the ON position, stop the engine, and lock all the equipment. Always remove the key and take it with you.

Work equipment posture

Places to lock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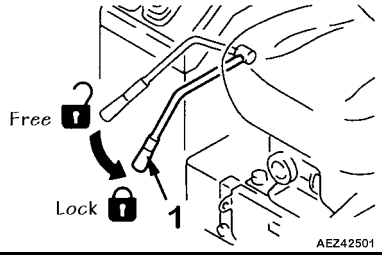

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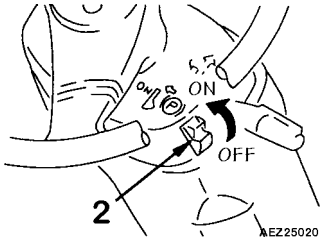

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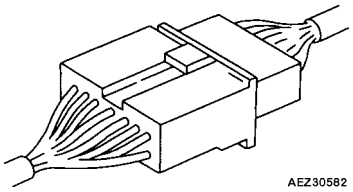
PRECAUTIONS IN COLD AREAS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After completing operations, remove all water, snow, or mud stuck to the wiring harness, connector, switches, or sensors, and cover these parts. If the water freezes, it will cause malfunctions of the machine when it is next used, and this may lead to unexpected accidents.

Carry out the warming up operation thoroughly. If the machine is not thoroughly warmed up before the control levers are operated, the reaction of the machine will be slow, and this may lead to unexpected accidents.

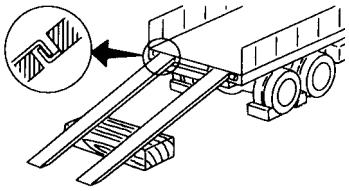
Operate the control levers to relieve the hydraulic pressure (raise to above the set pressure for the hydraulic circuit and release the oil to the hydraulic tank) to warm up the oil in the hydraulic circuit. This ensures good response from the machine and prevents malfunctions.

If the battery electrolyte is frozen, do not charge the battery or start the engine with a different power source. There is danger that this will ignite the battery. When charging or starting the engine with a different power source, melt the battery electrolyte and check for leakage of battery electrolyte before starting.

Battery charge rate

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 a road.

ALWAYS block the wheels of the hauling vehicle and place blocks under both ramps 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 as one another.

Be sure the ramp surface is clean and free of grease, oil, iceand loose materials. Remove dirt from the machine tires.

NEVER correct your steering on the 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 or 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.

Take into account the width, height, and weight of the load when determining the shipping route.

Height, width, load of machine

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.

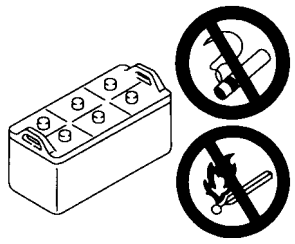
The machine can be divided into parts for transportation, so when transporting the machine, please contact your distributor to have the work carried out.

7.4 BATTERY

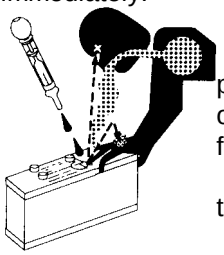
BATTERY HAZARD PREVENTION

Battery electrolyte contains sulphuric acid, and batteries generate hydrogen gas, so mistaken handling can lead to serious injury or fire. For this reason, always observe the following precautions.

- Never bring any lighted cigarette or flame near the battery.
- When working with batteries, ALWAYS wear safety glasses and rubber gloves.
- If you spill acid on your clothes or skin, immediately flush the area with large amounts of water.
- Battery acid could cause blindness if splashed into the eyes. If acid gets into your eyes, flush them immediately with large quantities of water and see a doctor at once.
- If you accidentally drink electrolyte, drink a large quantity of water or milk, beaten egg or vegetable oil. Call a doctor or poison prevention center immediately.



- Before working with batteries, stop the engine and turn the starting switch to the OFF position.
- Avoid short circuiting the battery terminals (between the positive terminal and negative terminal) with objects, such as tools.
- When installing the battery, connect the positive terminal first, and when removing the battery, disconnect the negative terminal.
- When removing or installing, check which is the positive terminal and negative terminal, and tighten the nuts securely.
- If the battery electrolyte is near the LOWER LEVEL, add distilled water. Do not add distilled water above the UPPER LEVEL.

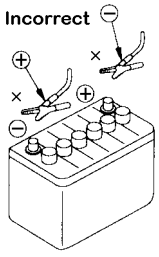


- When cleaning the top surface of the battery, wipe it with a cloth. Never use gasoline, thinner, or any other organic solvent or cleaning agent.
- Tighten the battery caps securely.
- If the battery electrolyte is frozen, do not charge the battery or start the engine with a different power source. There is danger that this will ignite the battery.
- When charging or starting the engine with a different power source, melt the battery electrolyte and check for leakage of battery electrolyte before starting.
- Always remove the battery from the chassis before charging it.

STARTING WITH BOOSTER CABLES

If any mistake is made in the method of connecting the booster cables, it may cause a fire, so always do as follows.

- Carry out the starting operation with two workers (with one worker sitting in the operators seat).
- When starting from another machine, do not allow the two machines to touch.
- When connecting the booster cables, turn the starting switch OFF for both the normal machine and problem machine.
- Be sure to connect the positive terminal to positive terminal and negative terminal to ground or negative terminal.
- The final ground connection is the connection of the ground to the engine block of the problem machine. However, this will cause sparks, so be sure to connect it as far as possible from the battery.



Starting procedure when using booster cables **See 16.3 IF BATTERY IS DISCHARGED on page 2-85.**

- When removing the booster cables, be careful not to let the booster cable clips touch each other or to let the clips touch the machine.

CHARGING BATTERY

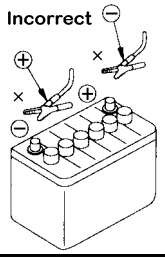
If the battery is handled incorrectly when it is being charged, there is danger that the battery may explode, so follow the instructions in HANDLING BATTERY and in the instruction manual for the charger, and always observe the following precautions.

Carry out the charging in a well ventilated place, and remove the battery caps. This disperses the hydrogen gas and prevents explosion.

Set the voltage on the charger to match the voltage on the battery to be charged. If the voltage setting is wrong, it will cause the charger to overheat and catch fire, and this may lead to an explosion. Connect the positive charging clip of the charger to the positive

to the negative

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, it may cause leakage or evaporation of the electrolyte, which may catch fire and explode.



7.5 TOWING

WHEN TOWING

Injury or death could result if a disabled machine is towed incorrectly or if there is a mistake in the selection of the wire rope, so always do as follows.

Do not tow in a different way from the method given.

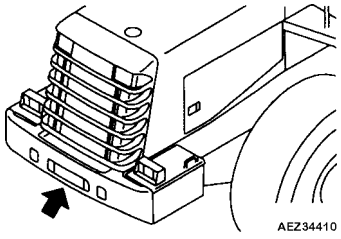
Method of towing machine

Always wear leather gloves when handling wire rope.

When carrying out the preparation for towing with another worker, agree on signals before starting the operation.

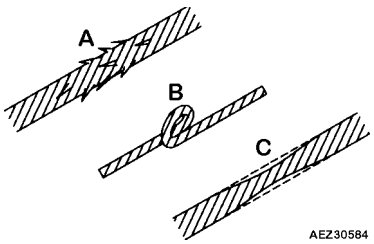
If the engine on the problem machine will not start or there is a failure in the brake system, please contact your distributor for repairs.

It is dangerous to tow a machine on a slope, so choose a place where there is a gradual slope. If there is no place with a gradual slope, carry out work to make the slope as small as possible.



If a problem machine is towed by another machine, ALWAYS use a wire rope with a sufficient towing capacity for the weight of the problem machine.

Do not use a wire rope which has cut strands **A**, kink **B** or reduced diameter **C** .



Do not stand astride the towing cable or wire rope.

When connecting a machine that is to be towed, do not let any one come between the towing machine and the machine that is being towed.

Set the coupling of the machine being towed in a straight line with the towing portion of the machine, and secure it in position.

8. PRECAUTIONS FOR MAINTENANCE

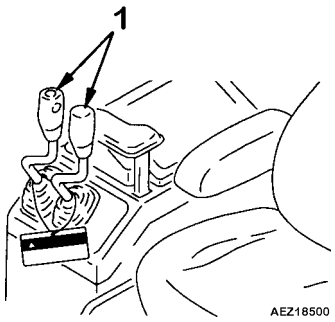
8.1 BEFORE PERFORMING MAINTENANCE

NOTIFICATION OF FAILURE

Doing maintenance not described in this operation and maintenance manual may lead to unexpected failures Please contact your distributor for repairs.

WARNING TAG

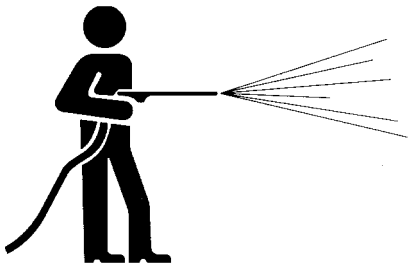
If others start the engine or operate the controls while you are performing service or lubrication, you could suffer serious injury or death.
ALWAYS attach the WARNING TAG to control lever(1) in the operators cab to alert others that you are working on the machine. Attach additional warning tags around the machine, if necessary.
These tags are available from your distributor. (Part No. 09963-03000)

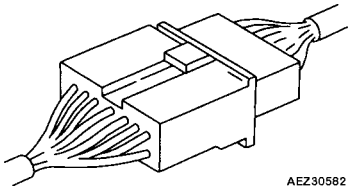


CLEAN BEFORE INSPECTION AND MAINTENANCE

Clean the machine before carrying out inspection and maintenance. This will ensure that dirt does not get into the machine and will also ensure that maintenance can be carried out safely.
If inspection and maintenance are carried out with the machine still dirty, it will be difficult to find the location of problems, and there is also the danger that you will get dirty or mud in your eyes, and that you will slip and injure yourself.
When washing the machine, always do as follows.

- Wear nonslip shoes to prevent yourself from slipping on the wet surface.
- When using high pressure steam to wash the machine, always wear protective clothing. This will protect you from being hit by high pressure water, and cutting your skin or getting mud or dust into your eyes.
- Do not spray water directly on to the electrical system (sensors, connectors). If water gets into the electrical system, there is a danger that it will cause defective operation and malfunction.





KEEP WORK PLACE CLEAN AND TIDY

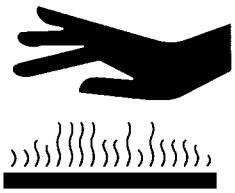
Do not leave hammers or other tools lying around in the work place.Wipe up all grease, oil, or other substances that will cause you to slip. Always keep the work place clean the tidy to enable you to carry out operations safely. If the work place is not kept clean and tidy, there is danger that you will trip, slip, or fall over and injure yourself.

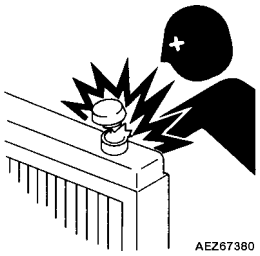
APPOINT LEADER WHEN WORKING WITH OTHERS

When repairing the machine or when removing and installing the work equipment, appoint a leader and follow his instructions during the operation. When working with others, misunderstandings between workers can lead to serious accidents.

RADIATOR WATER LEVEL

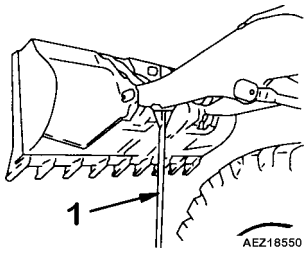
When inspecting the radiator water level, stop the engine, and wait for the engine and radiator to cool down Check the water level in the subtank. Under normal conditions, do not open the radiator cap.
If there is no subtank, or the radiator cap must be removed, always do as follows.
Wait for the radiator water temperature to go down before checking the water level. (When checking if the water temperature has gone down, put your hand near the engine or radiator and check the air temperature. Be careful not to actually touch the radiator or engine.)
Release the internal pressure before removing the radiator cap, and remove the radiator cap slowly.
When adding coolant, add it to the subtank.

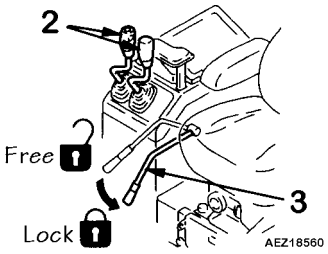




WORK EQUIPMENT SUPPORT

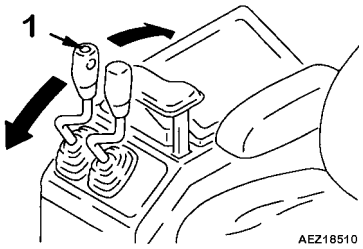
When carrying out inspection and maintenance with the bucket raised, fit stand (1) securely under the lift arm to prevent the work equipment from coming down. Place work equipment control lever (2) at HOLD, and set safety lock lever (3) to the LOCK position.

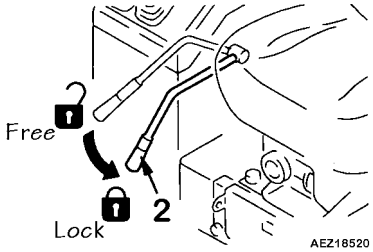


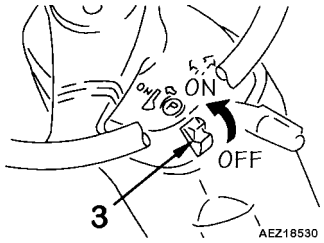


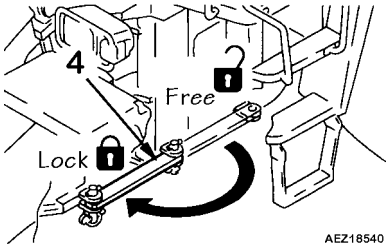
STOP ENGINE BEFORE CARRYING OUT INSPECTION AND MAINTENANCE

When carrying out inspection and maintenance, park the machine on level ground where there is no danger of falling rocks or landslides, or of flooding if the land is low, then lower the work equipment to the ground and stop the engine.
After stopping the engine, operate bucket control lever (1) several times to the RAISE and LOWER positions to release the remaining pressure in the hydraulic circuit, then set safety lock (2) to the LOCK position.
Turn parking brake switch (3) to ON and apply the brake, then put blocks under the tires.
Lock the front and rear frames with safety bar (4).
The worker carrying out the maintenance should be extremely careful not to touch or get caught in the moving parts.









PROPER TOOLS

Use only tools suited to the task. Using damaged, low quality, faulty, or makeshift tools could cause personal injury. There is danger that pieces from chisels with crushed heads or hammers may get into your eyes and cause blindness.

Tools

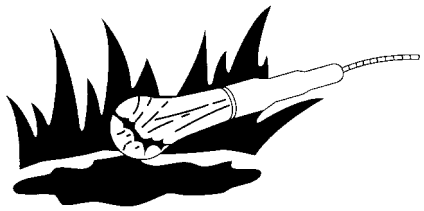
REPLACEMENT OF SAFETY CRITICAL PARTS

Hoses and other parts of the fuel, hydraulic, and brake system are critical parts for ensuring safety, so they must be replaced periodically. Replacement of safety critical parts requires skill, so please ask your Komatsu distributor to carry out replacement.
Replace these components periodically with new ones, regardless of whether or not they appear to be defective. These components deteriorate over time, and can cause fire because of oil leakage or failure in the work equipment system.
Replace or repair any such components if any defect is found, even though they have not reached the time specified.

Replacement of safety critical parts **See 22 PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS on page 3-19.**

USE OF LIGHTING

When checking fuel, oil, battery electrolyte, or window washer fluid, always use lighting with anti-explosion specifications. If such lighting equipment is not used, there is danger of explosion.
If work is carried out in dark places without installing lighting, there is danger of injury, so always install proper lighting.
Even if it is dark, do not use a lighter or flame instead of lighting. There is danger of starting a fire, and if the battery gas ignites, it may cause an explosion.
When using the machine as the power supply for the lighting, follow the instructions in this Operation and Maintenance Manual.



PREVENTION OF FIRE

There is danger of the fuel and battery gas catching fire during maintenance, so always follow the precautions below when carrying out maintenance.
Store fuel, oil, grease, and other flammable materials away from flame.
Use nonflammable materials as the flushing oil for cleaning parts. Do not use diesel, oil or gasoline. There is danger that they will catch fire.
Never smoke when carrying out inspection or maintenance. Always smoke in the prescribed place.
When checking fuel, oil, or battery electrolyte, always use lighting with anti-explosion specifications. Never use lighters or matches as lighting.
When carrying out grinding or welding operations on the chassis, remove flammable materials to a safe place. Be sure that a fire extinguisher is present at the inspection and maintenance point.

8.2 DURING MAINTENANCE

PERSONAL

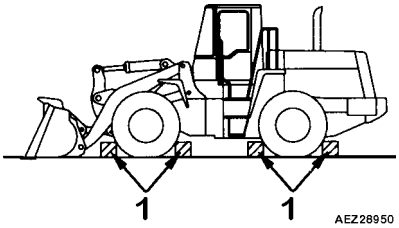
Only authorized personnel can service and repair the machine. Do not allow unauthorized personnel into the area. If necessary, employ an observer. Extra precaution should be used when grinding, welding, and using a sledge hammer.

ATTACHMENTS

Appoint a leader before starting removal or installation operations for attachments.
Do not allow anyone other than the workers close to the machine or attachment.
Place attachments that have been removed from the machine in a safe place so that they do not fall. Put a fence around the attachments, and set up No Entry signs to prevent unauthorized persons from coming close.

WORK UNDER THE MACHINE

Stop the machine on firm, level ground, and lower all work equipment to the ground before performing service or repairs under the machine.
Always block (1) the tires securely.
It is extremely dangerous to work under the machine if the tires are off the ground and the machine is supported only by the work equipment.
Never work under the machine if the machine is poorly supported.



MAINTENANCE WITH CHASSIS RAISED

When carrying out operations with the work equipment or chassis raised, lock the front and rear frames with the safety bar, return the control levers to HOLD, set the control lever safety lock to the LOCK position, and block the work equipment and chassis.
Block the wheels on the opposite side before jacking up. Set blocks under the machine after checking up.

WORK ON TOP OF MACHINE

When carrying out maintenance on top of the machine, make sure that the footholds are clean and free of obstructions, and follow the precautions below to prevent yourself from failing.

Do not spill oil or grease.

Do not leave tools lying around.

Mind your step when you are walking.

Never jump down from the machine. When getting on or off the machine, always use the steps and handrails, and maintainthree-point contact (both feet and one hand or both hands and one foot) at all times.

Use protective equipment if necessary.

MAINTENANCE WITH ENGINE RUNNING

To prevent injury, do not carry out maintenance wth the engine running. If maintenance must be carried out with the engine running, carry out the operation with at least two workers and do as follows.

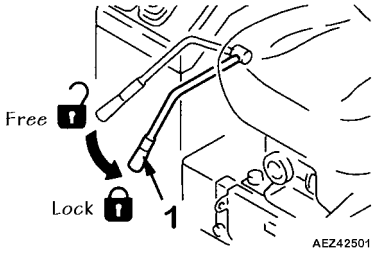
One worker must always sit in the operators seat and be ready to stop the engine at any time. All workers must maintain contact with the other workers.

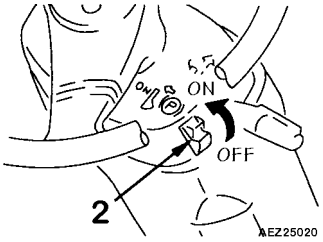
When carrying out operations near rotating parts, there is danger of being caught in the parts, so be extremely careful.

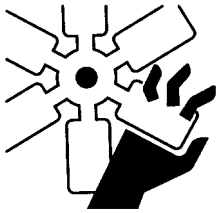
When cleaning inside the radiator, set safety lock (1) to the LOCK position to prevent the work equipment from moving. In addition, turn parking brake switch (2) to ON.

Do not touch any control levers. If any control lever must be operated, always give a signal to the other workers to warn them to move to a safe place.

Never touch the fan blade or fan belt with any tool or any part of your body. There is danger of serious injury.







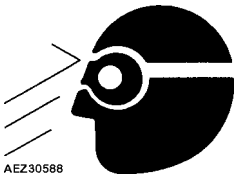
DROPPED TOOLS OR PARTS INSIDE MACHINE

When opening the inspection window or tank oil filler to carry out inspection, be careful not to drop any nuts, bolts, or tools inside the machine. If such parts are dropped into the machine, it will cause breakage of the machine, mistaken operation, and other failures. If you dropany part into the machine, always be sure to remove it from the machine.

When carrying out inspection, do not carry any unnecessary tools or parts in your pocket.

PRECAUTIONS WHEN USING HAMMER

When working with hammers, wear protective glasses, helmet, and other protective clothing. Put a brass rod between the hammer and the object when hitting with the hammer.
If hard metal parts such as pins, edges, teeth, and bearings are hit with a hammer, there is danger that small pieces will fly off and get into your eyes.



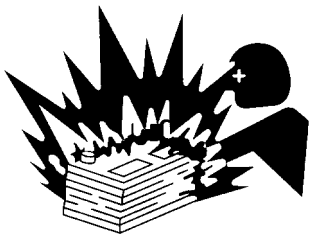
REPAIR WELDING

Welding operations must always be carried out by a qualified welder and in a place equipped with a proper equipment. Gas is generated, and there is danger of fire or electrocution when carrying out welding, so never allow any unqualified personnel to carry out welding.
The qualified welder must follow the precautions given below.

- Disconnect the battery terminals to prevent explosion of the battery.
- Remove the paint from the place being welded to prevent gas from being generated.
- If hydraulic equipment or piping, or places close to these are heated, flammable vapor or spray will be generated, and there is danger of this catching fire, so avoid applying heat to such places.
- If heat is applied directly to rubber hoses or piping under pressure, they may suddenly burst, so cover them with fireproof sheeting.
- Always wear protective clothing.
- Ensure that there is good ventilation.
- Clear up any flammable materials, and make sure that there is a fire extinguisher at the workplace.

PRECAUTIONS WITH BATTERY

When repairing the electrical system or when carrying out electrical welding remove the negative

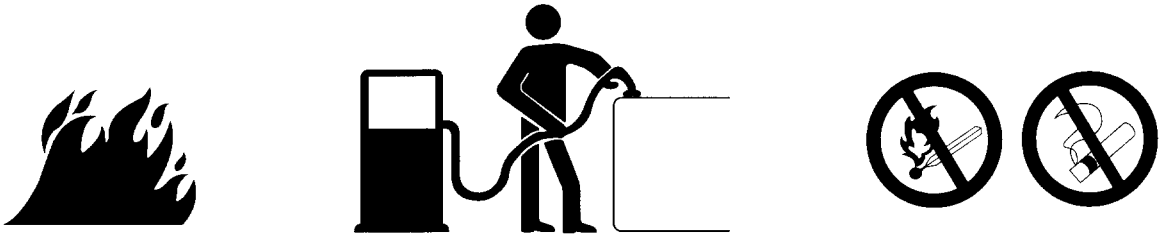


WHEN ABNORMALITY IS LOCATED

If any abnormality is found during inspection, always carry out repairs. In particular, if the machine is used when there is any abnormality in the brakes or work equipment systems, it may lead to serious accident.
Depending on the type of failure, please contact your distributor for repairs.

RULES TO FOLLOW WHEN ADDING FUEL OR OIL

Fuel, oil, antifreeze, and window washer fluid can be ignited by a flame.
Always observe the following:
- Do not smoke.
- Wipe up any spilled fuel, oil, antifreeze, or window washer fluid immediately.
- Tighten all fuel, oil, antifreeze, and window washer fluid caps securely.
- Use well ventilated areas for adding or storing fuel, oil, antifreeze, and window washer fluid.



HANDLING HIGH PRESSURE HOSES

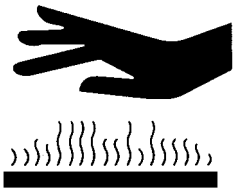
Do not bend high pressure hoses or hit them with hard objects. Do not use any bent or cracked piping, tubes or hoses. They may burst during use.
Always repair any loose or broken fuel hoses or oil hoses. If fuel or oil leaks, it may cause a fire.

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.
If oil is leaking under high pressure from small holes, it is dangerous if the jet of high pressure oil hits your skin or enters your eyes. Always wear safety glasses and thick gloves,and use a piece of cardboard or a sheet of wood to check for oil leakage.
If you are hit by a jet of high pressure oil, consult a doctor immediately for medical attention.

PRECAUTIONS WHEN CARRYING OUT MAINTENANCE AT HIGH TEMPERATURE OR HIGH PRESSURE

Immediately after stopping operations, the engine cooling water and oil at all parts is at high temperature and under high pressure. In this condition, if the cap is removed, or the oil or water are drained, or the filters are replaced, this may result in burns or other injury. 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 or cooling system, check lubricating oil level, add oil 2 WHEN REQUIRED on page 3-26.
Check cooling level, engine oil pan, oil level, brakeoil level, add oil or water 12.1 CHECK BEFORE STARTING on page 2-34.
Checking hydraulic oil level, adding oil
Changing oil, replacing filters

TIRE MAINTENANCE

Disassembly, repair, and assembly of tires requires special equipment and skill, so please ask your tire repair shop to perform the repairs.

CHECKS AFTER INSPECTION AND MAINTENANCE

Failure to carry out inspection and maintenance fully, or failure to check the function of various maintenance locations may cause unexpected problems and may even lead to personal injury or damage, so always do as follows.

Checks when engine is stopped

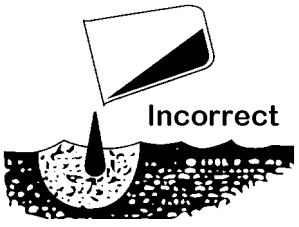
- Have all the inspection and maintenance locations been checked?
- Have all the inspection and maintenance items been carried out correctly?
- Have any tools or parts dropped inside the machine? It is particularly dangerous if they get caught in the lever linkage.
- Has water and oil leakage been repaired? Have bolts been tightened?

Checks when engine is running

- Do the inspection and maintenance locations work normally?
- Is there any oil leakage when the engine speed is raised and load is applied to the hydraulic system?

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.



8.3 TIRES

HANDLING TIRES

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

To maintain safety, always keep to the following conditions.

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

Avoid overloading.

Suitable inflation pressure

Suitable load

Use the specified tires.

The values given in this manual for the tire inflation pressure and permissible speed are general values. The actual values 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.

When pumping up the tires, use an air chuck with a clip. When pumping up the tires, parts of the wheel may fly off, so do not stand in front of the tire.

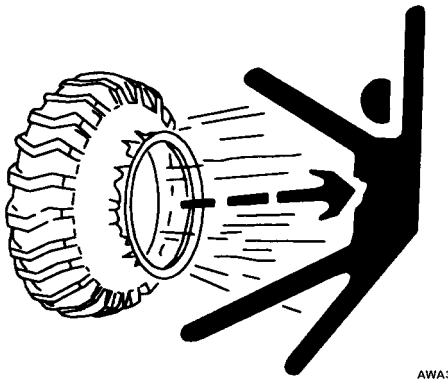
Do not adjust the tire inflation pressure immediately after traveling at high speed or after carrying out work under high load.

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, sothe 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 carrying out 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.



AWA36370

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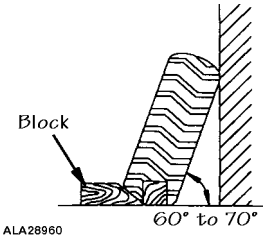
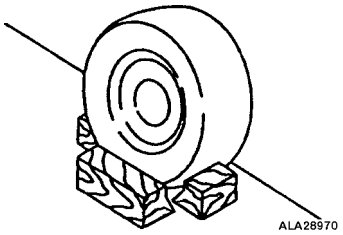
TIRES AFTER REMOVAL

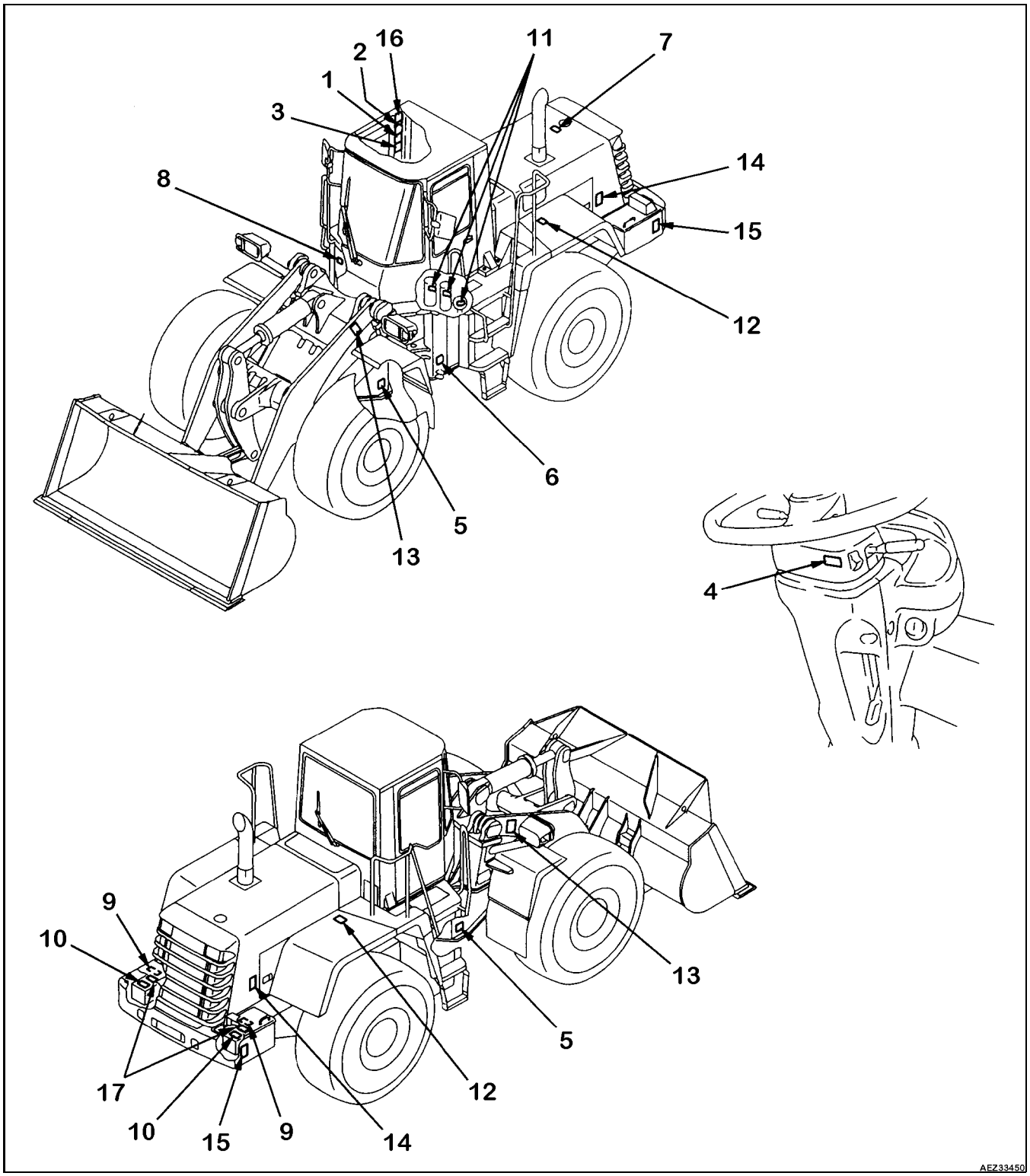
As a basic rule, store the tires in a warehouse which unauthorized persons cannot enter. If the tires are stored outside, always erect a fence around the tires and put up NO ENTRY and other warning signs that even young children can understand.
Stand the tire on level ground, and barricade it securely with wooden blocks so that it cannot roll or fall over.
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.





9. POSITION FOR ATTACHING SAFETY LABELS

Always keep these labels clean. If they are lost or damaged, attach them again or replace them with a new label. There are other labels in addition to the safetylabels listed as follows, so handle them in the same way. Safety labels may be available in languages other than English. To find out what labels are available, contact your distributor.



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.

L02AD204

2. Precautions for safety lock lever.

WARNING

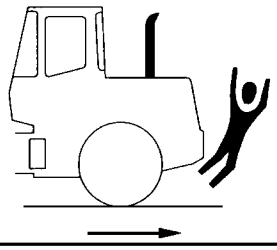
To avoid hitting unlocked operation levers, lower equipment to ground and move SAFETY LOCK LEVER (located near seat) to LOCK position before standing up from operator's seat.

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

L02AD205

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.

L02AD206

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.

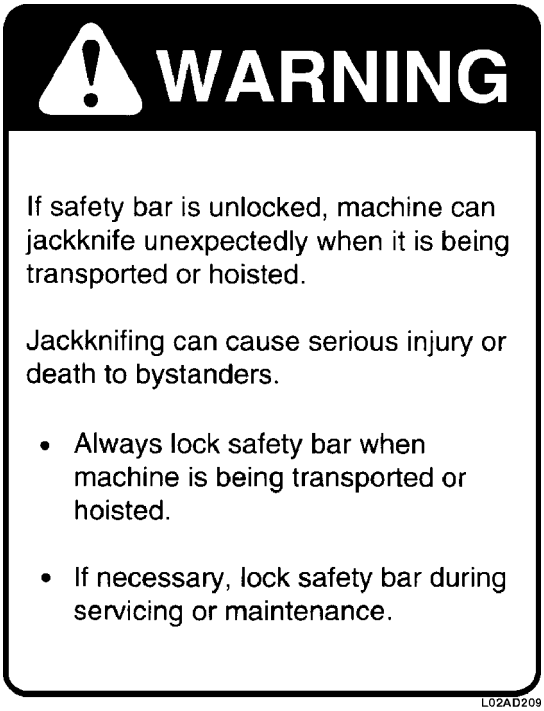
L02AD207

Please request part number 419-93-A1410 for Safety Labels 1 through 3.

Please request part number 419-93-A1421 for Safety Label 4.

5. Do not enter.

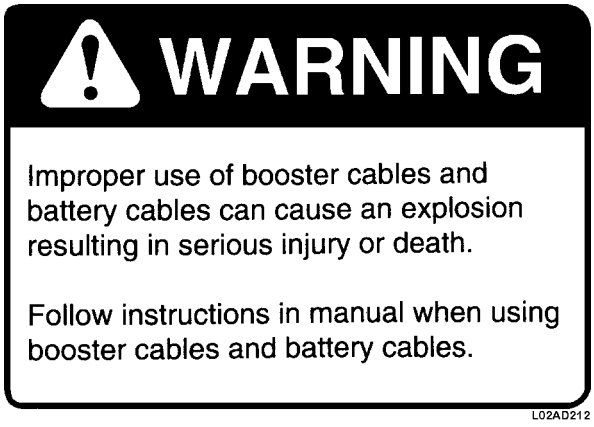
6. Precautions for safety bar.



7. Precautions when coolant is at high temperature.

8. Precautions when oil is at high temperature.

9. Precautions when handling battery cable.

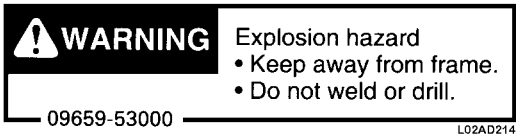


Please request part number 419-93-21311 for Safety Labels 5 through 9.

10. Provided by battery manufacturer.

11. High pressure warning.

09659-53000



12. Do not climb on fender.

09805-03000

13. Do not go under work equipment sign

09812-13000

14. Do not open when engine is running.

09667-03001

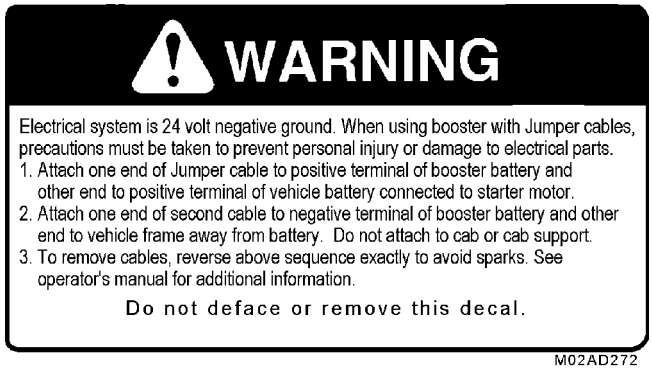
15. Do not come near machine sign

09812-13000

16. Precautions for back up alarm

M02AD273

17. Precautions when using booster with jumper cables



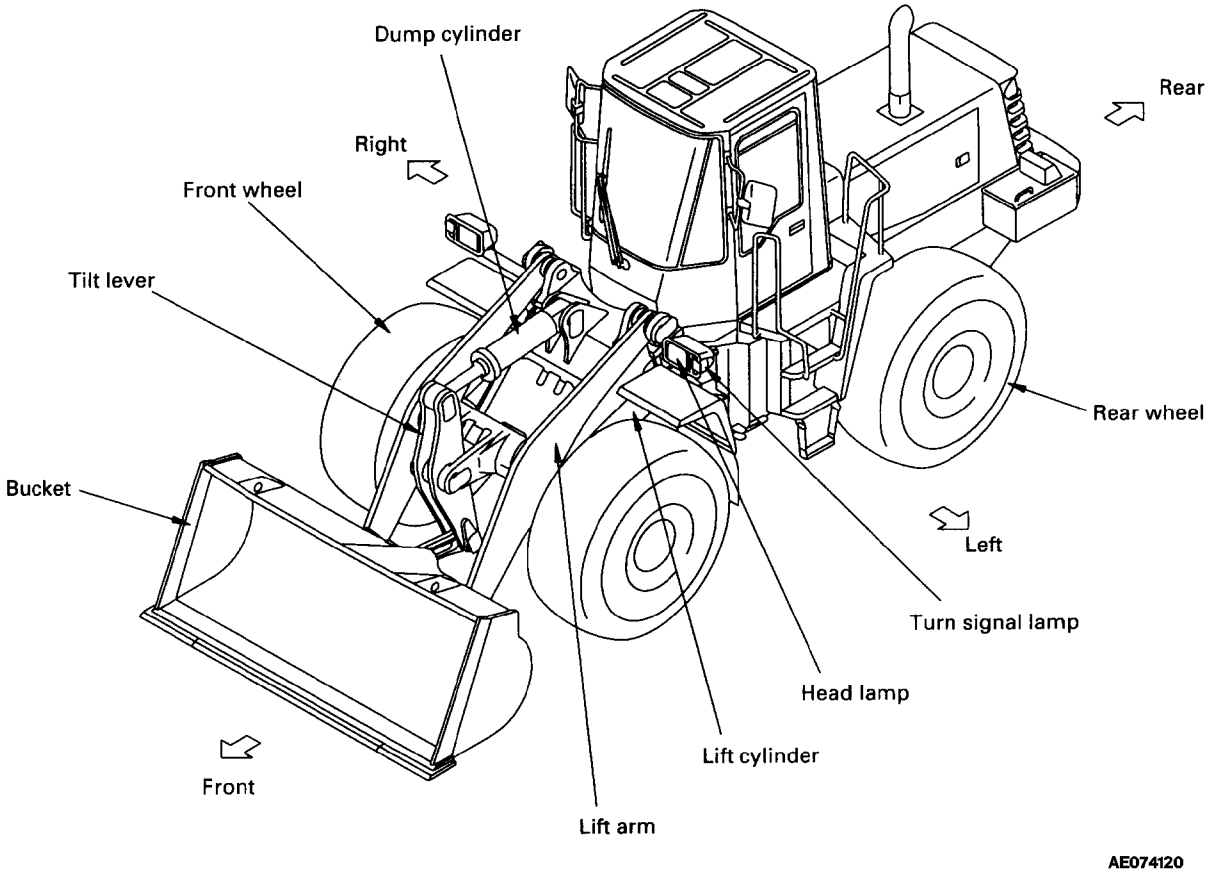
M02AD272

OPERATION

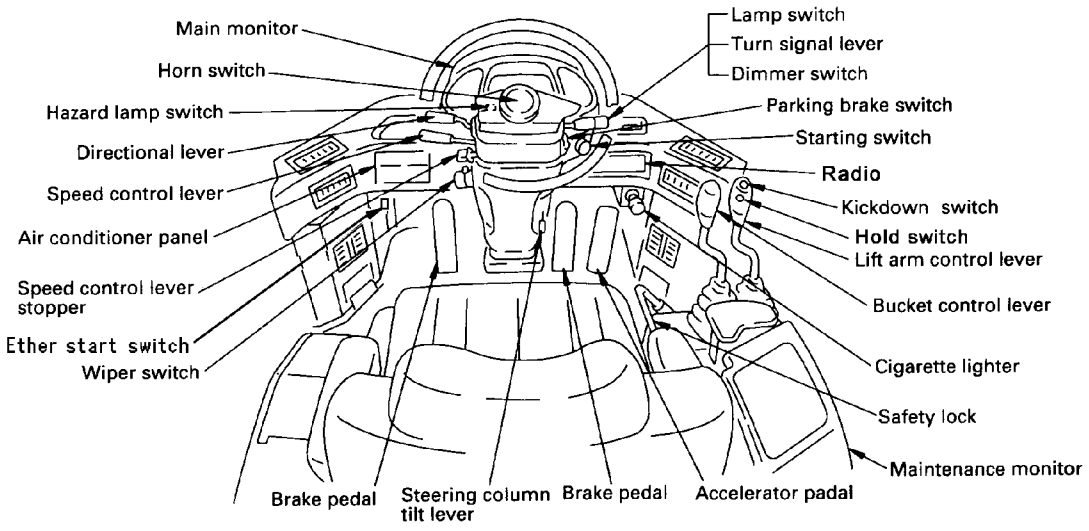
10. GENERAL VIEW

10.1 GENERAL VIEW OF MACHINE

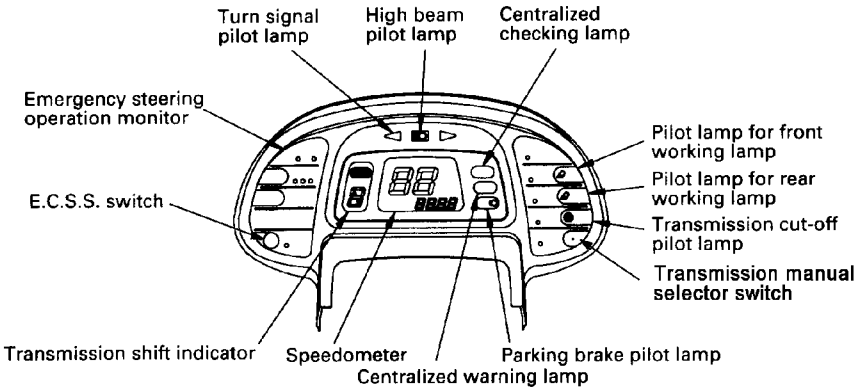
If directions are indicated in this manual, they refer to the directions shown by the arrows in the diagram below.



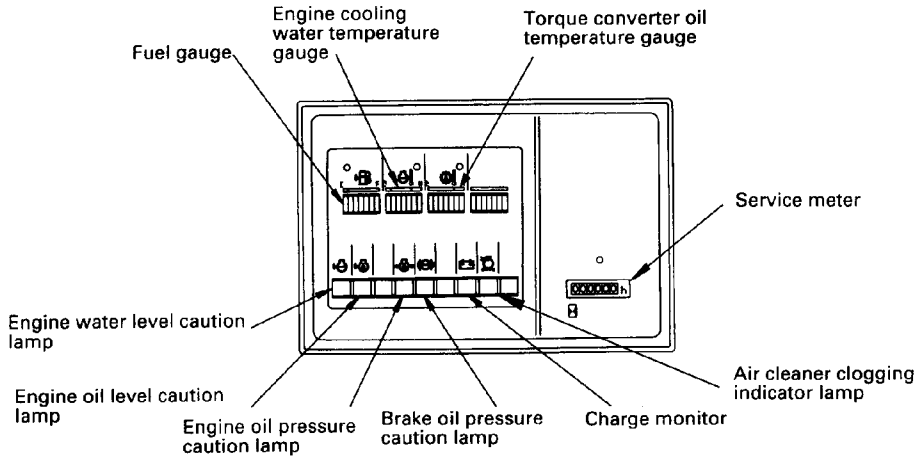
10.2 GENERAL VIEW OF CONTROLS AND GAUGES



MAIN MONITOR



MAINTENANCE MONITOR



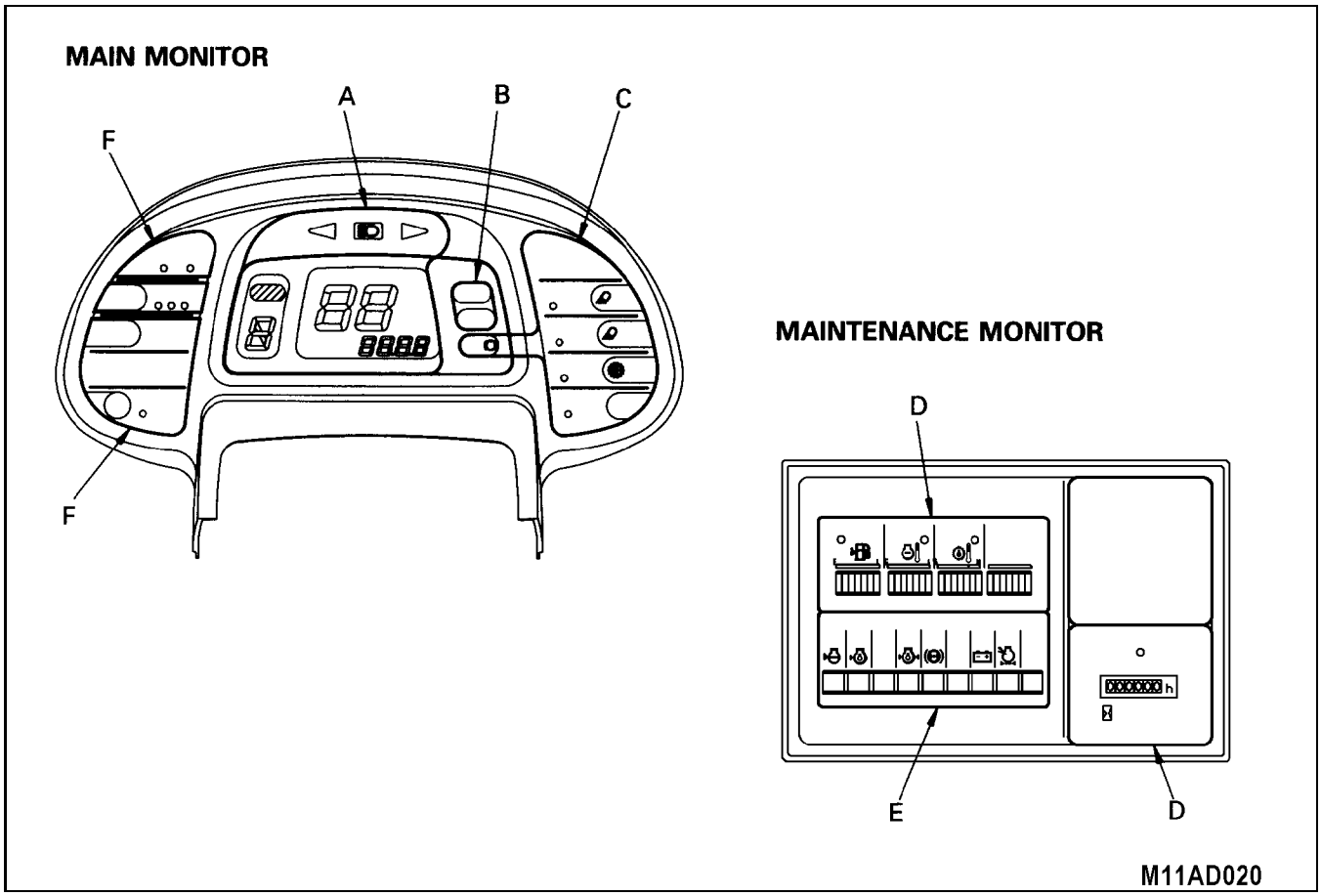
M11AD032

11. COMPONENT EXPLANATION

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

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

11.1 MACHINE MONITOR



The machine monitor system consists of the main monitor, which is in front of the operator's seat, and the maintenance monitor, which is 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) (11.1.3)
This consists of the monitor lamps and switches for the emergency steering system, and ECSS.

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 3 seconds, and thealarm buzzer will sound for about 1 second.

When this situation happens, 88 is displayed on the speedometer, and 8 is displayed on the transmission shift indicator.

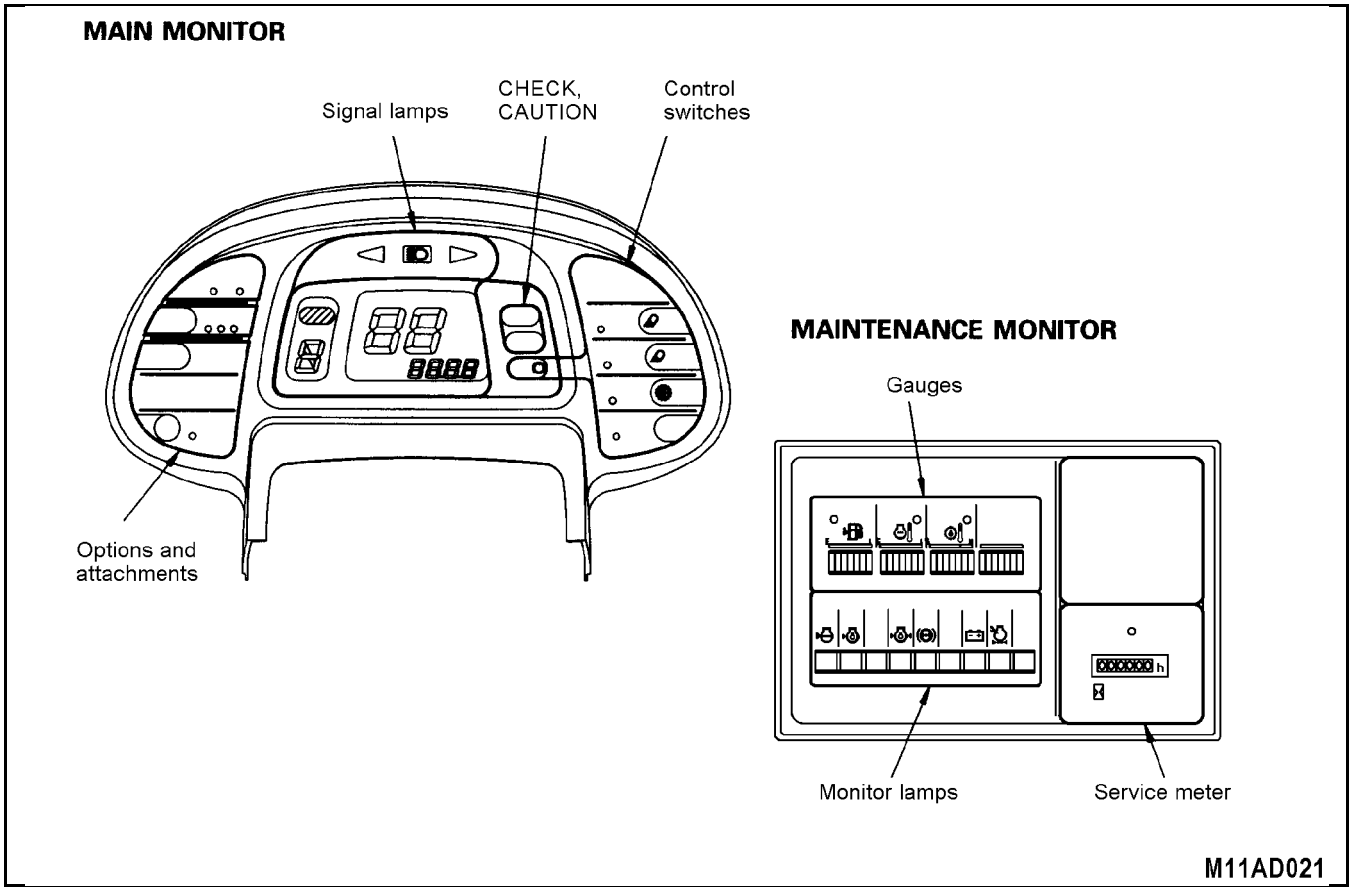
Finally, there will be two beeps to indicate that the monitor check has been completed.

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

When the starting switch is turned to the ON position, if the directional lever is not in the neutral position, the central warning lamp (CAUTION) will flash and the alarm buzzer will sound intermittently. If this situation 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 out for at least 30 seconds after the engine has been stopped.

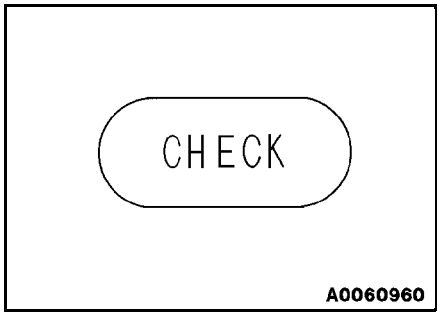
11.1.1 WARNING DISPLAYS



1. CENTRAL CHECK LAMP

⚠ WARNING

If this monitor flashes, perform an inspection and maintenance of the appropriate location 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 abnormal location will flash and the central CHECK lamp will also flash. Check the location where the monitor lamp is flashing and perform the check before starting. When performing the checks before starting, do not rely on just the monitor. Always carry out the specified maintenance items.

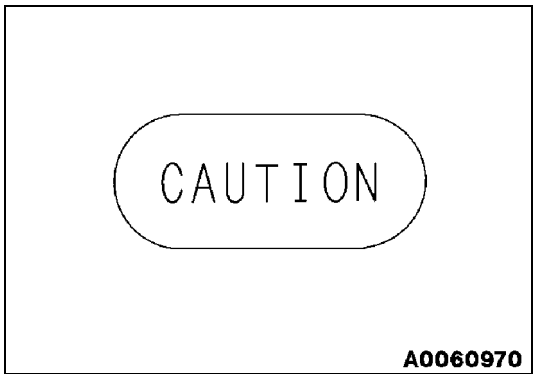
If the engine oil level is abnormal before starting the engine, the engine oil level will change after starting the engine. Thus, the central CHECK lamp and monitor lamp will stop flashing. An abnormal engine water level will cause the central CHECK lamp to flash and the alarm buzzer to sound intermittently after starting the engine. If any abnormality in the charging system exists 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

⚠ WARNING

If these monitor lamps flash, stop the engine immediately or run it low idle.

If there is 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), the alarm buzzer will sound intermittently and the monitor lamp for the location of the abnormality will flash and the central CAUTION lamp will also flash.



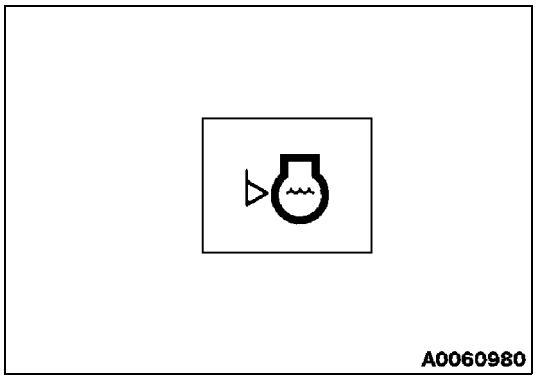
If the fuel gauges enters the red range when the engine is running, the fuel gauge will flash and the central CAUTION lamp will also flash. If they flash, check the fuel level and add fuel.

3. ENGINE WATER LEVEL CAUTION LAMP

This lamp warns the operator that the coolant level in the radiator has dropped. When performing the checks before starting (main switch ON, engine stopped):

If the coolant level in the radator 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. Add water, if needed.



When operating (engine running):
If the condition is normal, the caution pilot lamp should be off.

If the coolant level 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 and check the coolant level in the radiator and sub-tank. Add water, if needed.

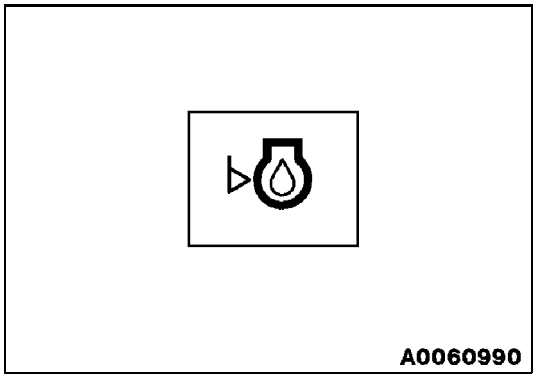
Stop the machine on level ground before performing this check.

4. ENGINE OIL LEVEL CAUTION PILOT LAMP
This lamp warns the operator that the oil level in the oil pan has dropped.

When performing 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 and add oil, if needed.

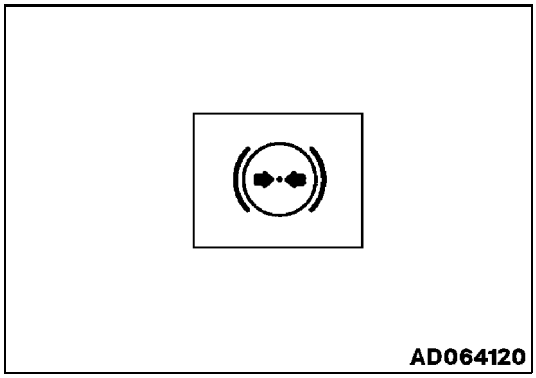


When operating:
Even if the engine oil level caution pilot lamp is flashing during the check before starting, it will go out when the engine is started.

5. BRAKE OIL PRESSURE CAUTION PILOT LAMP
This lamp 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.



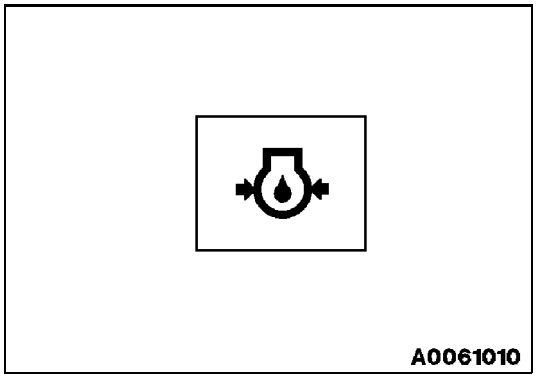
REMARKS
The monitor lamp may flash and go out after about 10 seconds after the engine is started because pressure is being stored in the brake accumulator. No malfunction is indicated.

6. ENGINE OIL PRESSURE CAUTION PILOT LAMP
This lamp warns the operator that the engine oil pressure has dropped.

If it flashes, stop the engine and check the oil level and pressure.

Check before starting: lights up

Engine running:
When the engine is started, oil pressure is formed and the lamp goes out. If the oil pressure drops, the warning pilot lamp and the central CAUTION lamp will flash, and the buzzer will sound intermittently.

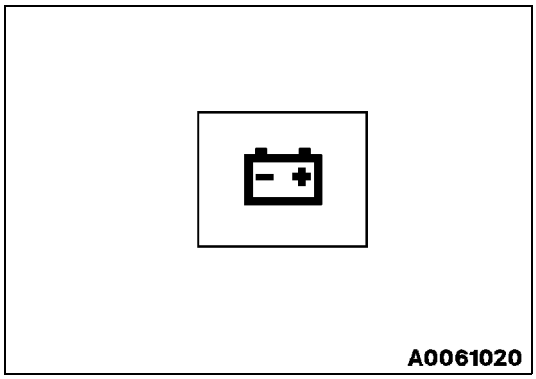


7. BATTERY CHARGE CAUTION PILOT LAMP

This lamp warns the operator that a malfunction in the charging system exists when the engine is running.

Check before starting: Lights up

Engine started or running:
When the engine is started, the alternatorgenerates electricity and the lamp goes out. If any problem occurs in the charging system, the CAUTION pilot lamp and the central CHECK lamp will flash. If they flash, check the engine charging circuit.

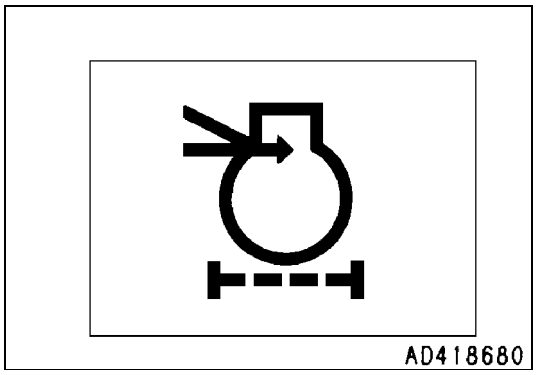


8. AIR CLEANER CLOGGING PORTION PILOT LAMP

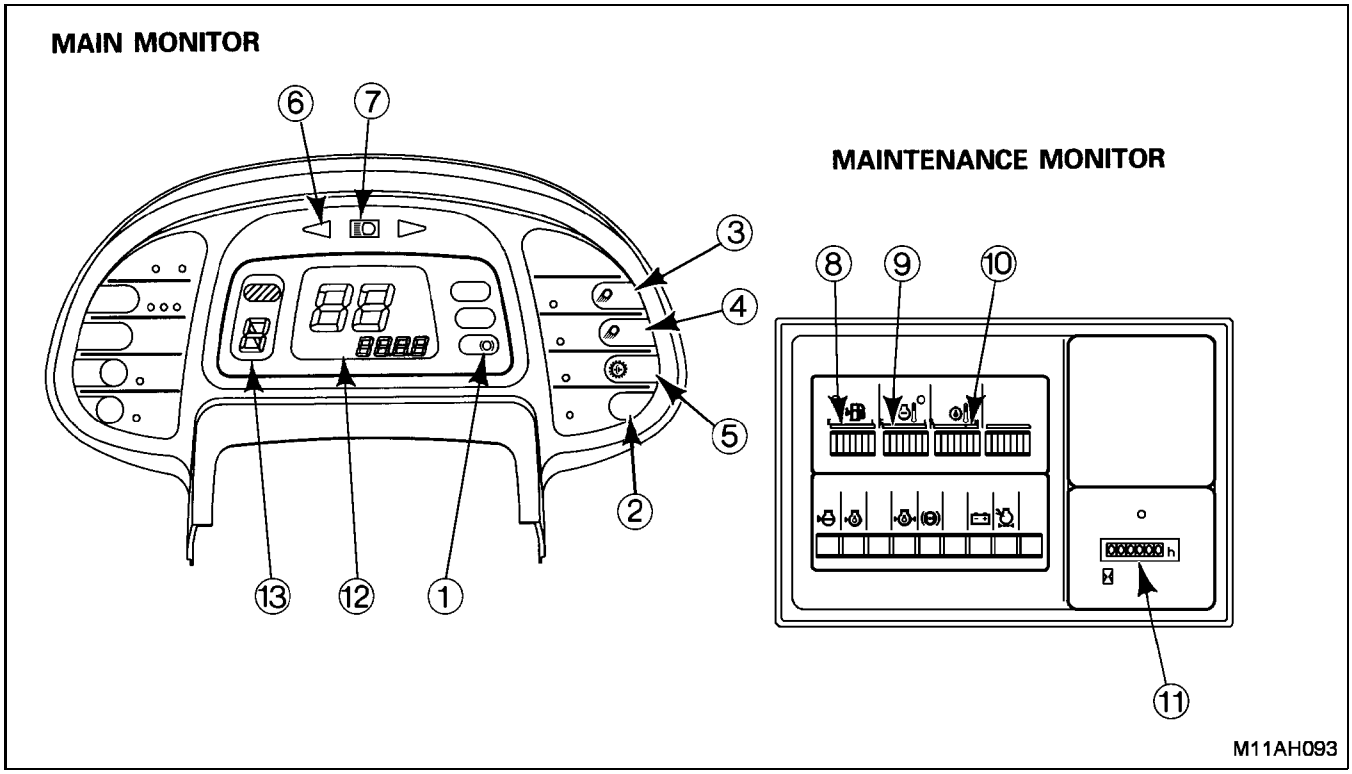
When the engine is ruming, this lamp warns the operator that the air cleaner element is clogged.

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.

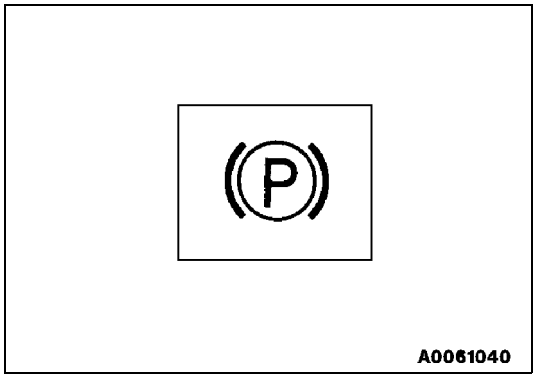


11.1.2 METER DISPLAY PORTION

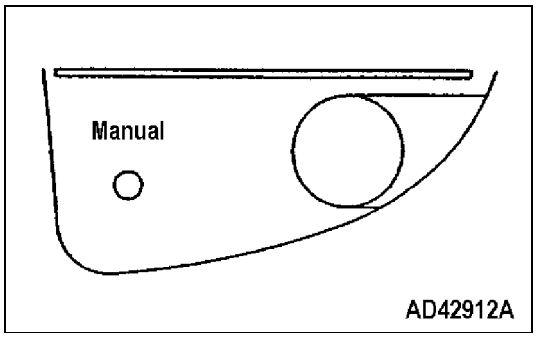


PILOT DISPLAY
When the starting switch is on, the pilot display lights up when the display items are functioning.

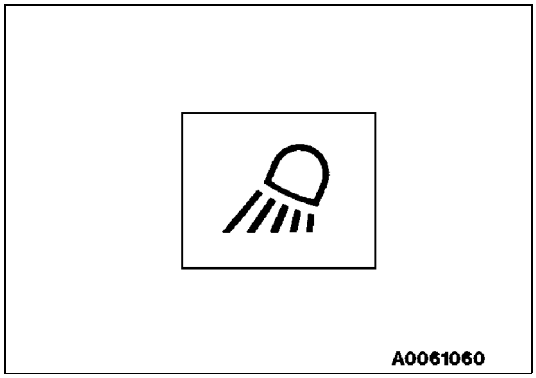
1. PARKING BRAKE PILOT LAMP
This lamp lights up when the parking brake is applied.



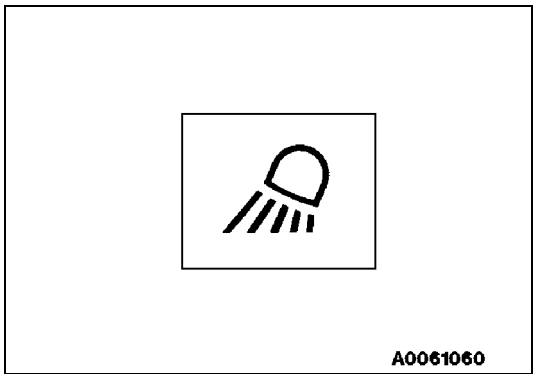
2. TRANSMISSION SHIFT SELECTOR - PILOT LAMP
Selecting the manual transmission turns this lamp on. However, selecting the auto transmission turns this lamp off.



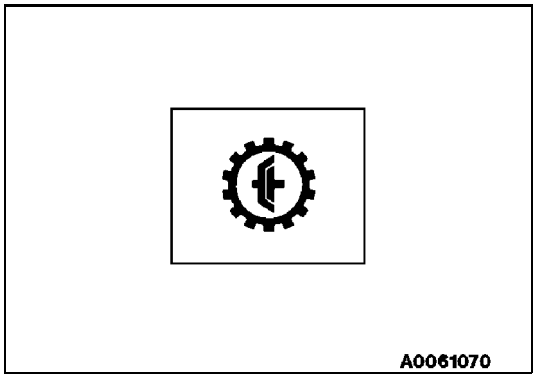
3. FRONT WORKING LAMP PILOT LAMP
This lamp lights up when the front working lamp is on.



4. REAR WORKING LAMP PILOT LAMP
This lamp lights up when the rear working light is on.

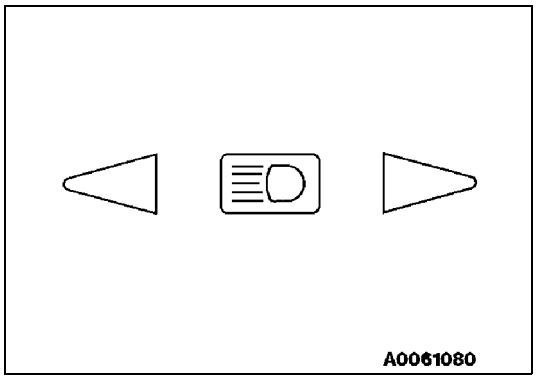


5. TRANSMISSION CUT-OFF PILOT LAMP
This lamp lights up when the transmission cut-off switch is on Depressing the left brake pedal while the monitor lamp is on causes the transmission to return to neutral.



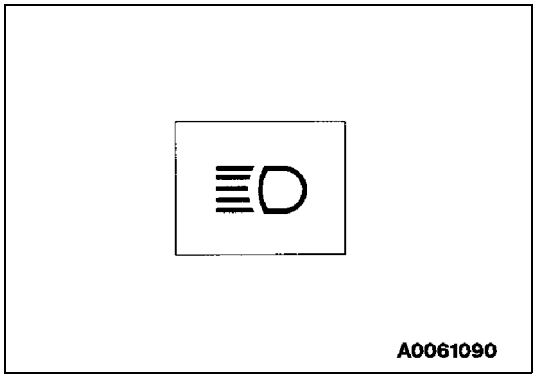
6. TURN SIGNAL PILOT LAMP

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



7. HIGH BEAM PILOT LAMP

This lamp is lit when the high beam lamp is on.

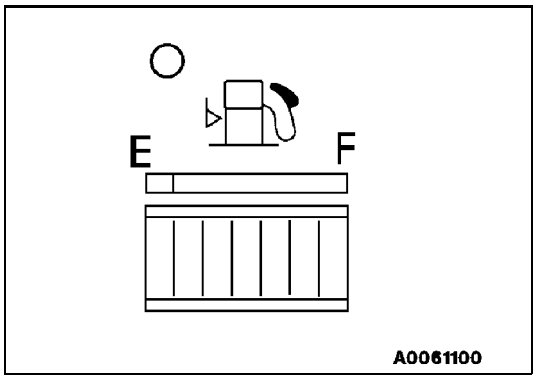


8. FUEL GAUGE

This gauge indicates the amount of fuel in the tank.

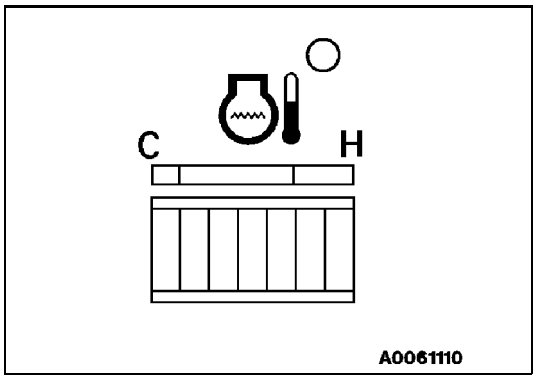
E = an empty tank
F = a full tank

The lamp should light up in the green range during operation. If the red scale lights up, fewer than 44 liters (11.6 U.S. gallons) of fuel remains.

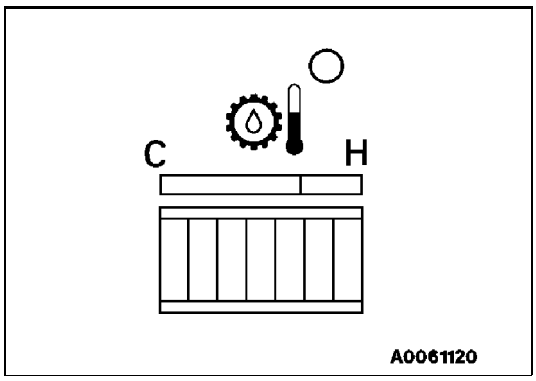


9. ENGINE WATER TEMPERATURE

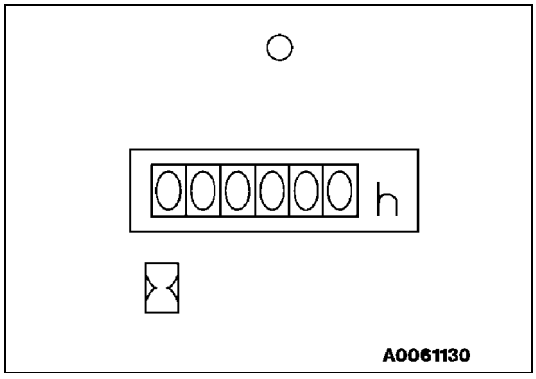
This gauge indicates the engine water temperature. If the temperature is normal during operation, the green range will light. If the red range lights during operation, stop the machine and run the engine with no load at midrange speed until the green range lights. If the lamps light up to the 1st red 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.



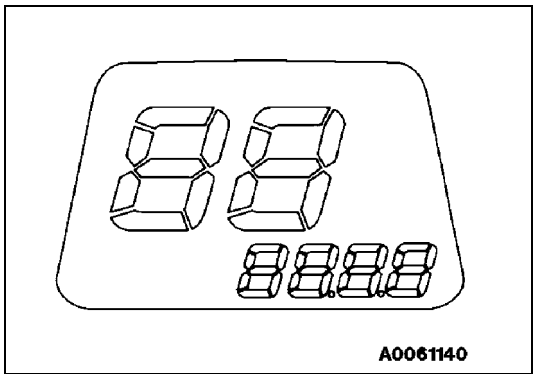
10. TORQUE CONVERTER OIL TEMPERATURE GAUGE
This gauge indicates the torque converter oil temperature. If the temperature is normal during operation, the green range will light. If the red range lights during operation, stop the machine and run the engine with no load at midrange speed until the green range lights. If the lamps light up to the 1st redlevel, the torque converter oil temperature gauge lamp and central CAUTION lamp will flash; when the lamps lights 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 in increments of one (1) 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.



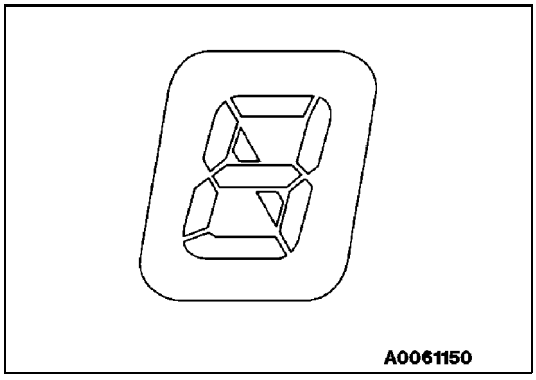
12. SPEEDOMETER
This meter indicates the travel speed of the machine.



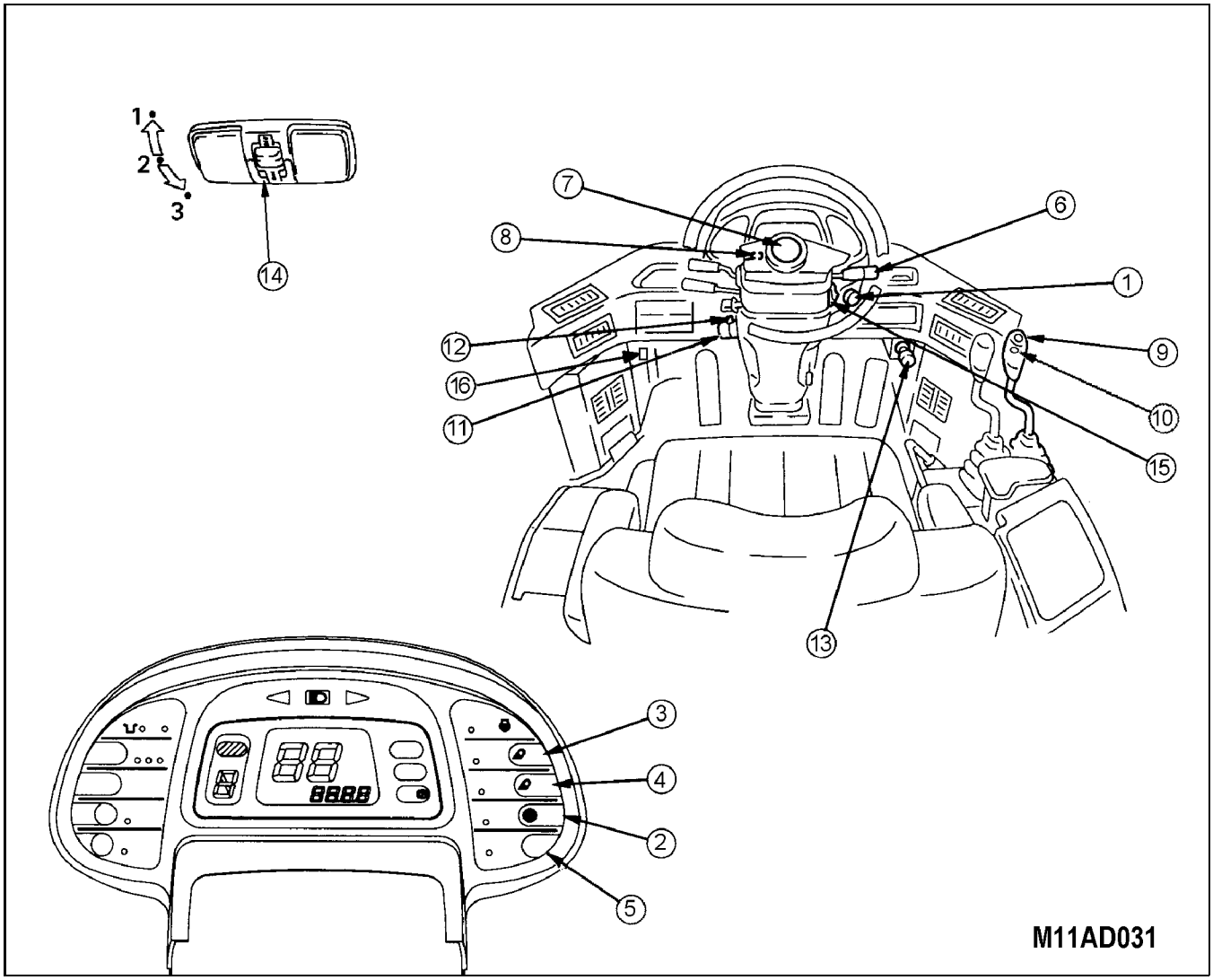
13. TRANSMISSION SHIFT INDICATOR
This lamp indicates the present speed range of the transmission.

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

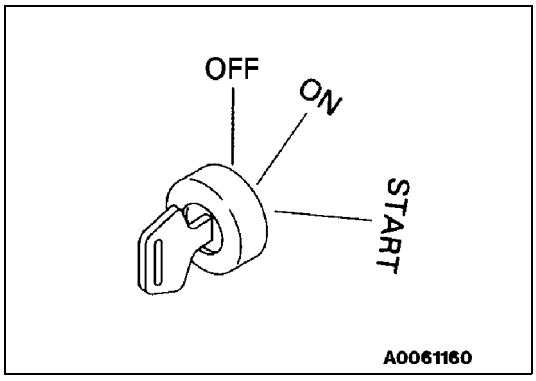
When the directional lever is in the F or R position, the position of the speed lever is displayed as a numeral.



11.2 SWITCHES



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 through the charging circuit, lamp, and accessory circuits while in this position. Keep the key at the ON position to keep the engine running.

START position
The engine-start position. Keep the key at this position while cranking. Immediately after starting the engine, release the key and it will automatically return to the ON position.

2. TRANSMISSION CUT-OFF SWITCH

WARNING

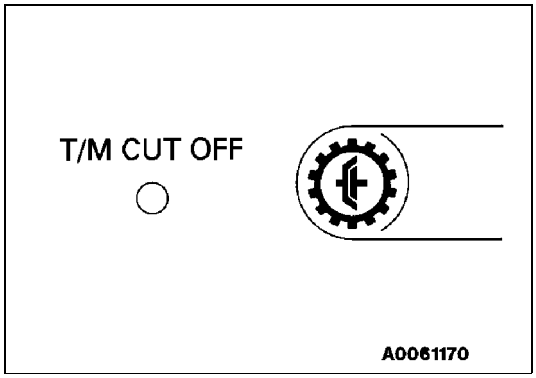
If the machine has to be started on a slope, always turn the transmission cut-off switch to OFF and depress the left brake pedal. Then depress the accelerator pedal while releasing the left brake pedal to start the machine moving slowly.

Press the push button ON and OFF. Pressing the pilot lamp lights it up. Pressing it again causes the pilot lamp to go out and the transmission cut-off turns off.

1. OFF: The left brake pedal acts as a normal brake (right brake pedal).

2. ON: The left brake pedal acts as a normal brake but also switches the transmission to Neutral.

NEUTRAL: If the switch is on, the transmission cut-off pilot lamp lights up.



3. FRONT WORKING LAMP SWITCH

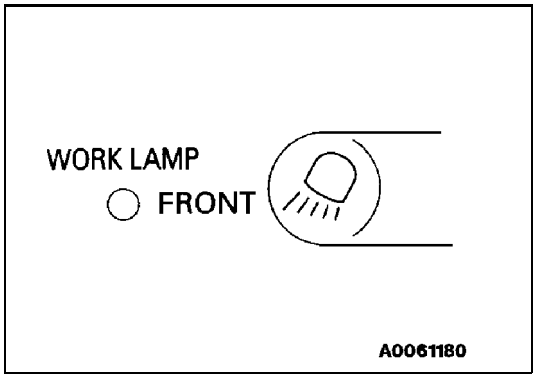
WARNING

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 sideclearance lamp or the ON position for the head lamp.

When the pilot lamp is pressed, it will light up and stay ON; if it is pressed again, the pilot lamp will go out and the working lamp will be turned off.

The working lamp will not light up if the lamp switch is not at the ON position for the side clearancelamp, or the ON position for the head lamp.



4. REAR WORKING LAMP SWITCH

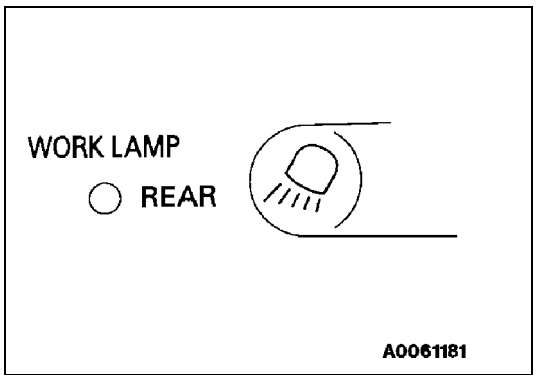
⚠ WARNING

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 the ON position for the head lamp.

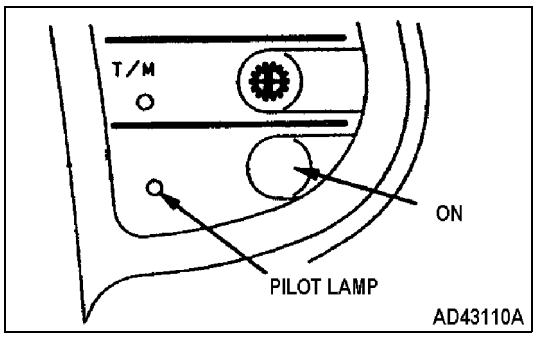
When the pilot lamp is pressed, it will light up and come ON. If the pilot light is pressed again, the pilot lamp will go out and the working lamp will be turned OFF.

The working lamp will not light up if the lamp switch is not at the ON position for the side clearance lamp, or the ON position for the head lamp.



5. TRANSMISSION SELECTOR SWITCH

This switch determines whether the manual or auto-shift mode is selected. Depressing the switch once sets the manual transmission mode (on position) and the lamp is lit. Depressing the switch again selects the off position or the auto-shift mode and the lamp is off.



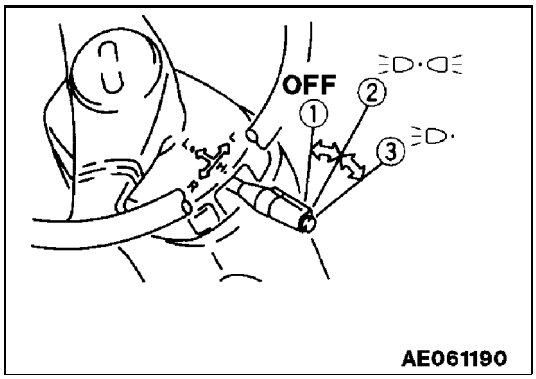
6. LAMP SWITCH/TURN SIGNAL LEVER/DIMMER

This lever performs three functions.

LAMP SWITCH

The lamp switch turns on the head lamps, side clearance lamps, tail lamps, and instrument panel lighting.

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



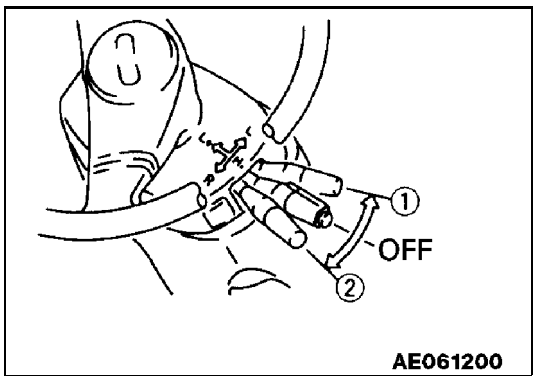
REMARKS

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

TURN SIGNAL LEVER

This lever operates the turn signal lamps.
(1) LEFT TURN: Push the lever FORWARD.
(2) RIGHT TURN: Pull the lever BACK.

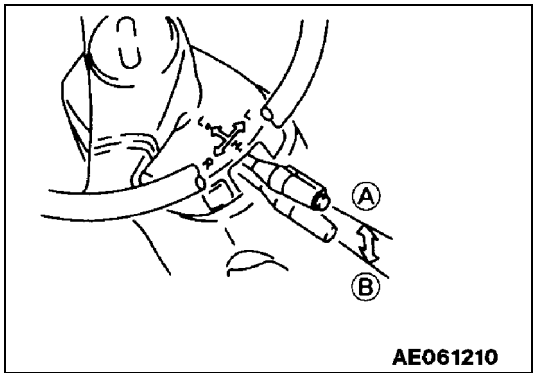
REMARKS:
Operating the lever also turns the signal pilot lamp on.
Turning the steering wheel to the neutral position, the turn signal lever will automatically return to the OFF position. If not, manually return the lever to the OFF position.



DIMMER SWITCH

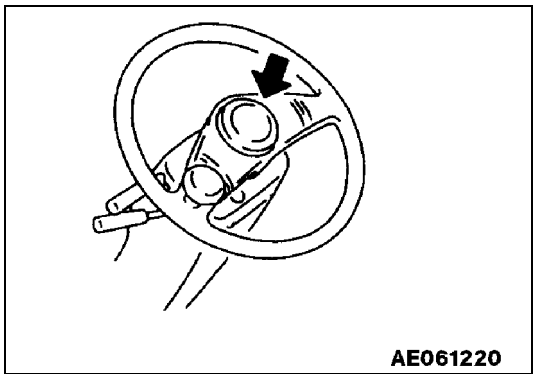
This switch turns on the high beams and low beams.

(A) Low beam
(B) High beam



7. HORN BUTTON

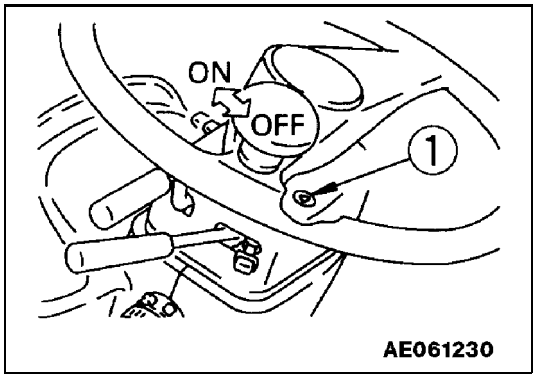
Pressing the button at the wheel's center sounds the horn.



8. HAZARD LAMP SWITCH

⚠ WARNING

Use the hazard lamps only in emergencies. Using the hazard lamps when traveling will confuse the other operators.



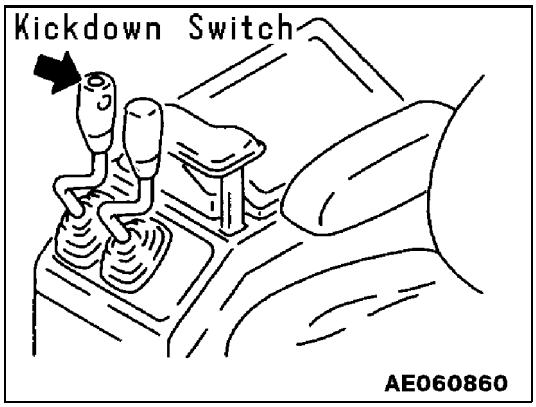
This switch is used in emergencies, such as when the machine breaks down.

ON: All turn signal lamps flash.

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

9. KICKDOWN SWITCH

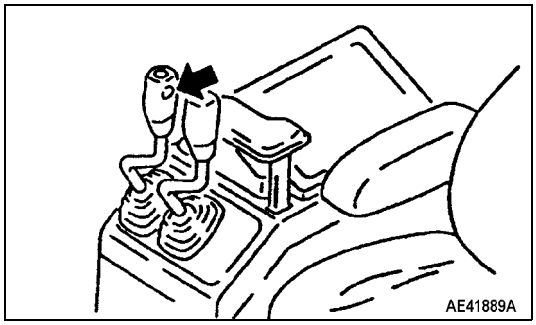
When the speed control lever is in second gear, and the switch at the top of the knob of the lift arm control lever is pressed, the transmission will down shift to first gear. This switch is used to increase the drawbar pull in digging operations.



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

10. HOLD SWITCH

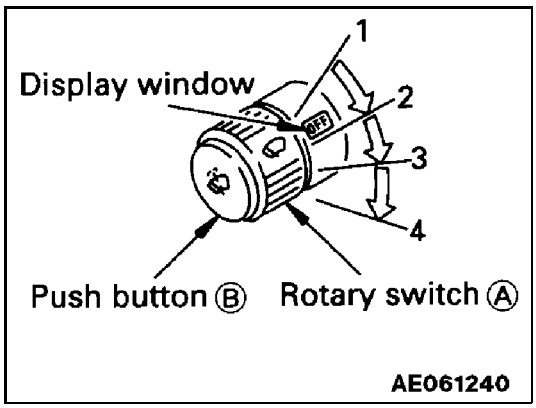
To maintain the desired transmission gear, depress the hold switch, which is located on the side of the lift lever. Depressing the switch causes the transmission indicator light on the main panel to light. Depressing this switch again releases the transmission hold function and the indicator light goes off. When the transmission hold switch is engaged, the manual speed control lever can be used to change gears. This feature is recommended to maintain travel speed while going up or down a slope.



11. FRONT WIPER SWITCH

Turn the switch (A) to operate the front wiper.

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

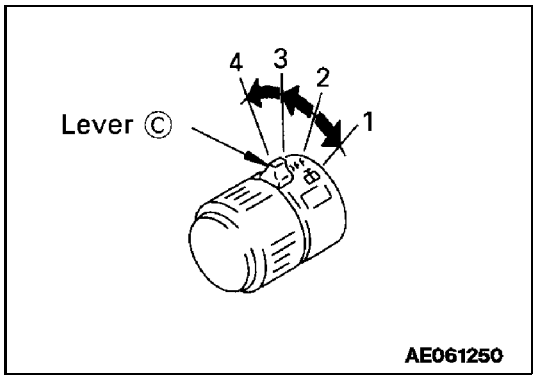


If button (B) is pressed, the washer fluid will spray out onto the front glass.

12. REAR WIPER SWITCH

Turn the lever © to operate the rear wiper.

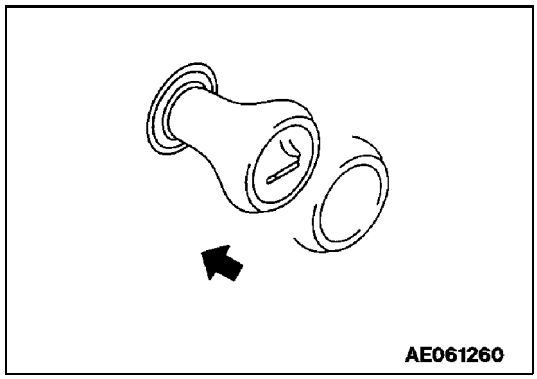
Position of switch	Display	Operation
1		Washer fluid sprayed
2	OFF	OFF
3		Wiper actuated
4		Washer fluid sprayed, wiper actuated



13. CIGARETTE LIGHTER

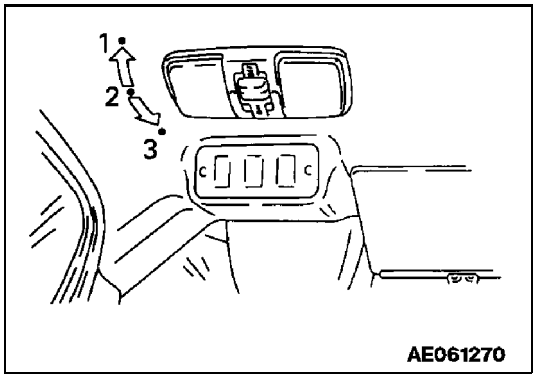
This item is used to light cigarettes. To use, push the lighter in. After a few seconds it will spring back. At that time, remove the lighter and light your cigarette.

With the lighter removed from the receptacle, the seven amp receptacle can also be used to power electrical accessories.



14. ROOM LAMP SWITCH

This switch turns on the room lamp.



ON: lights up.

Position 1: OFF
Position 2: Lights up when the cab door is opened
Position 3: Lights up

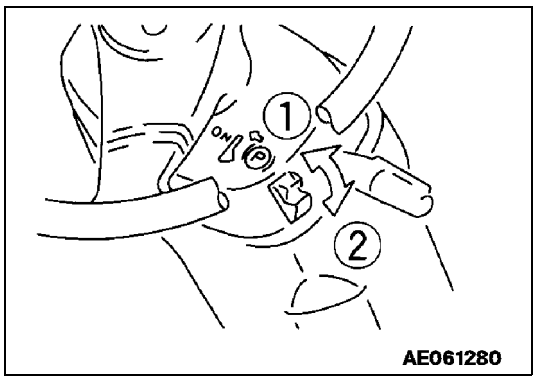
REMARKS
The room lamp lights up even when the main switch is OFF. So when leaving the operator's compartment, turn the switch to position 1 or 2.

When operating with the cab door fully open, set the switch to position 1 (OFF).

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, keep the brake pedal depressed until the parking brake pilot lamp lights.



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 OFF, the parking brake is automatically applied.

Before starting the engine, turn the parking brake switch ON, then turn it 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 stopping the machine.

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.

16. ETHER START SWITCH

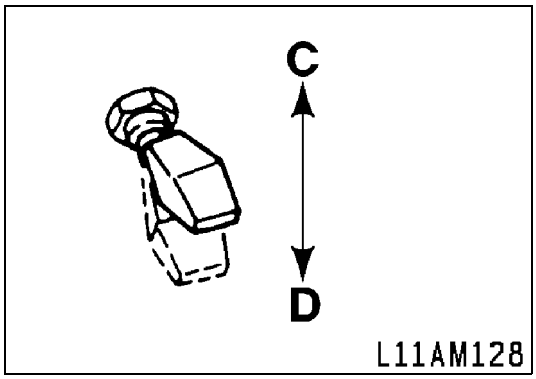
⚠ WARNING

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

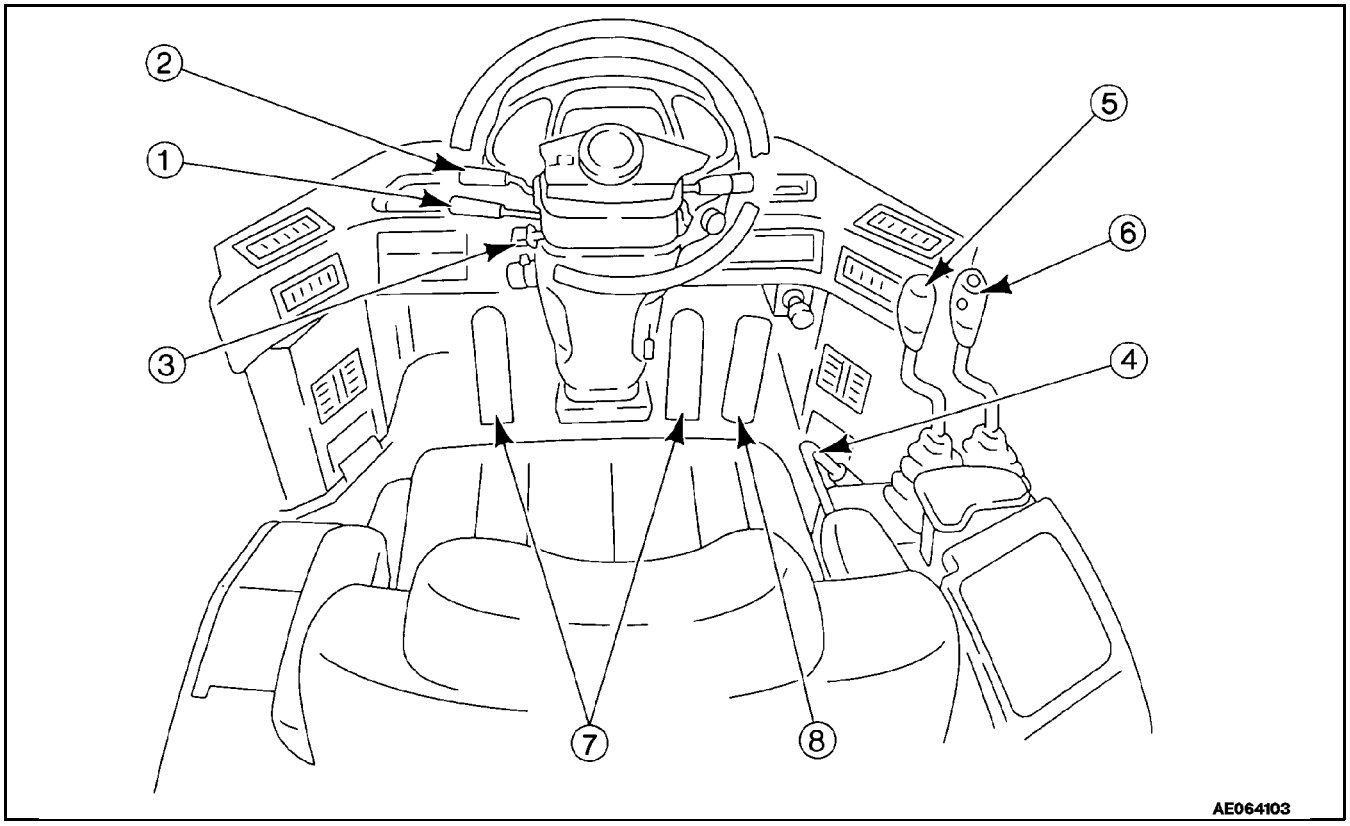
This switch is spring loaded and used when starting the engine in cold weather.

C. ON position:
Pushing this switch upward injects a fixed amount of ether (about 3 cc) into the engine air intake manifold.

D. OFF position:
Releasing this switch automatically returns it to the OFF position.



11.3 CONTROL LEVERS, PEDALS



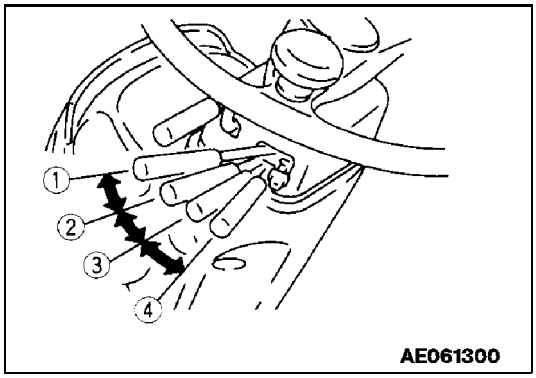
1. SPEED CONTROL LEVER

MANUAL SHIFT

This lever controls the travel speed of the machine.

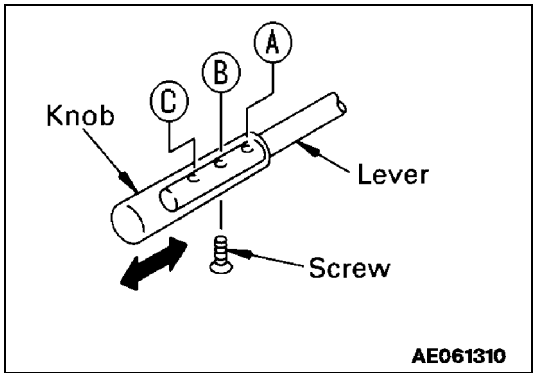
This machine has a 4-FORWARD, 4-REVERSE speed transmission. Place the speed control lever in a suitable position to obtain the desired speed range: 1st and 2nd speeds are used for working; 3rd and 4th speeds are used for traveling. However, when the speed control lever stopper is being used, it is impossible to shift to 3rd or 4th. Disengage the speed control lever stopper before trying to shift gears.

Position 1: 1st gear
Position 2: 2nd gear
Position 3: 3rd gear
Position 4: 4th gear

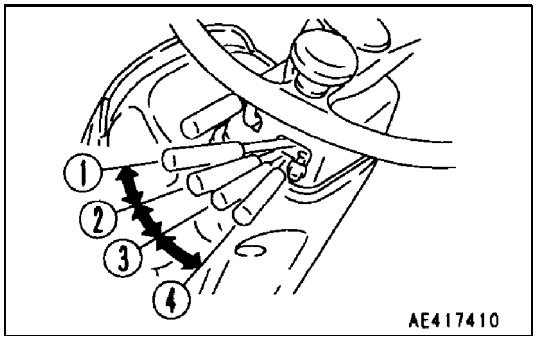


REMARKS

The length of the lever can be adjusted to 3 stages (position A, B, C). To adjust the length, remove the screw at the bottom of the lever knob and slide the knob to the desired position. Tighten the screw again. The lever is installed at position (B) when the machine is shipped from the factory.



AUTO SHIFT
Can automatically change from 2nd to 4th gear based on operating conditions.



Position 1 - 1st gear

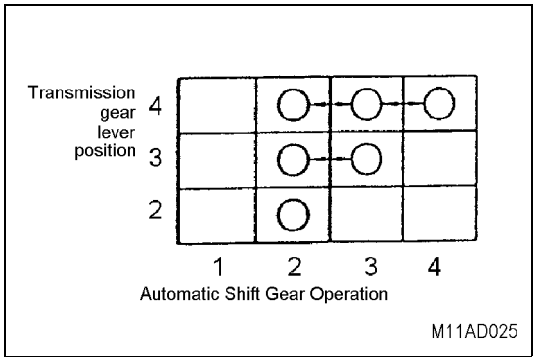
Position 2 - 2nd gear

Position 3 - 3rd gear

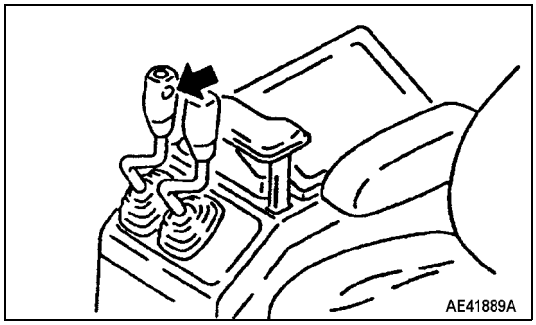
Position 4 - 4th gear

The chart at right describes the autoshift gear options based on the transmission shift lever operation.

When 1st gear is selected on the transmission gear level, the auto-shift operation doesn't operate.



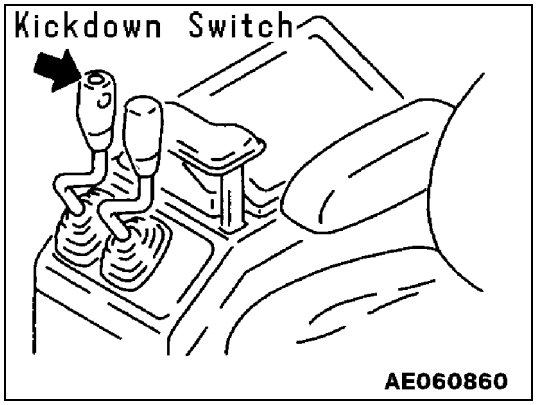
This feature maintains the same transmission gear. Recommended for use when traveling up or down a slope.



When downshifting from 2nd to 1st gear, use the kick-down switch located on the lift lever.

The kick-down switch can operate from any gear or direction, but the machine's speed should be slower than 7.5 mph (12 km/hr).

After depressing the kick-down switch and the gear changes from 2nd to 1st, the travel speed increases and the gear automatically changes to 2nd gear.



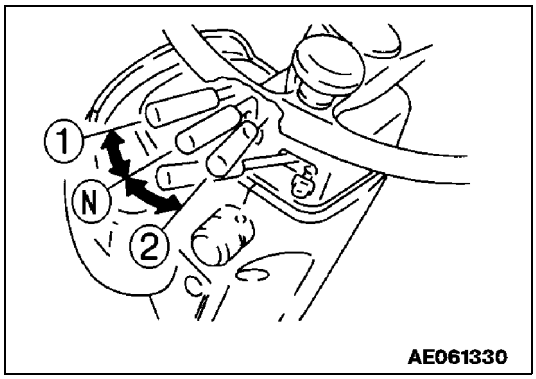
2. DIRECTIONAL LEVER

This lever changes the machine's direction of travel.
The engine cannot be started if the directional lever is not in neutral.

Position 1: Forward

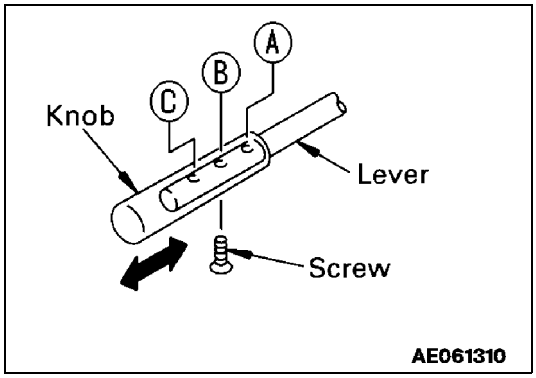
Position N: Neutral

Position 2: Reverse



REMARKS

The lever length can be adjusted to 3 stages (positions A, B, C). To adjust the length, remove the screw at the bottom of the lever knob and slide the knob to the desired position. Tighten the screw. The lever is installed to Position (B) when shipped from the factory.

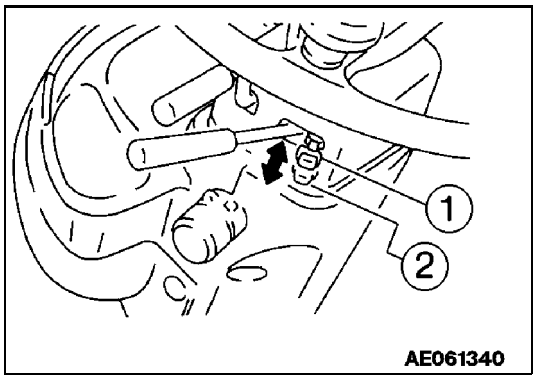


3. SPEED CONTROL LEVER STOPPER

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

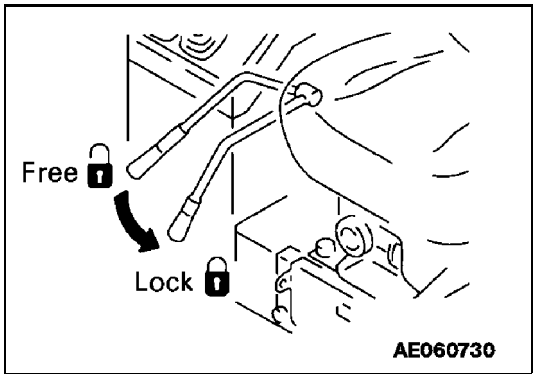
Position 1: Stopper actuated

Position 2: Stopper released



4. SAFETY LOCK LEVER

This lock works the equipment levers.
Push the lever down to apply the lock.



⚠ 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, a serious accident could result.
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 performing maintenance, always lower the bucket to the ground and apply the lock.

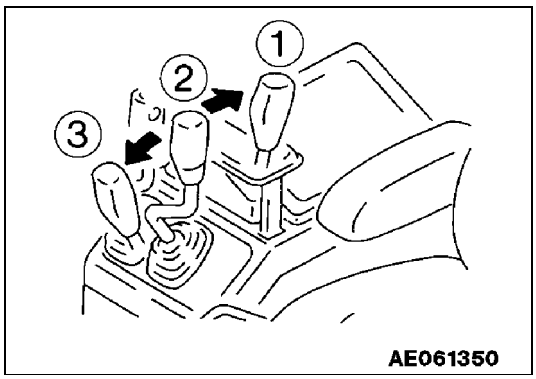
5. BUCKET CONTROL LEVER

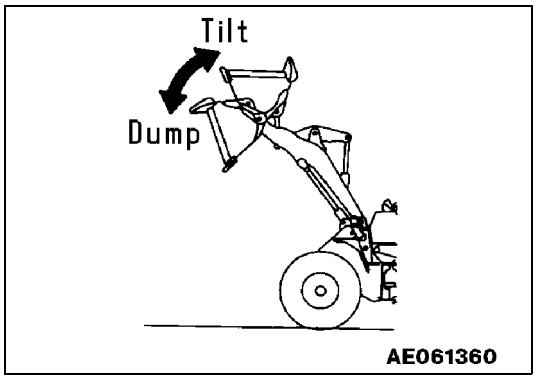
This lever operates the bucket.

(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.





6. LIFT-ARM CONTROL LEVER

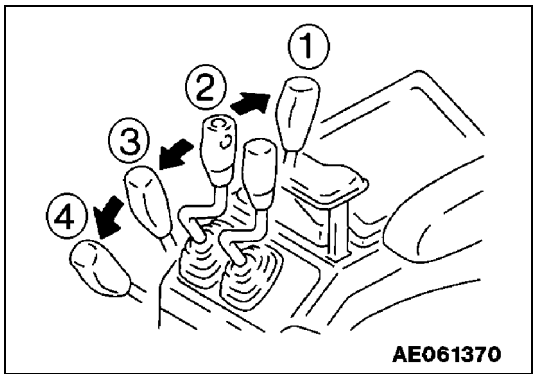
This lever operates the boom.

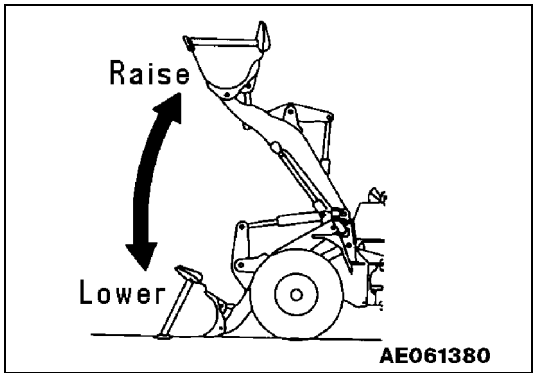
(1) RAISE ( ): When the lift arm control lever is pulled further from the RAISE position, the lever is stopped in this position until the lift arm reaches the preset position of the kick-out, and the lever is returned to the HOLD position.

(2) HOLD ( ): The lift arm is kept in the same position.

(3) LOWER( ): When the lift arm control lever is pulled further away 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.





7. BRAKE PEDALS

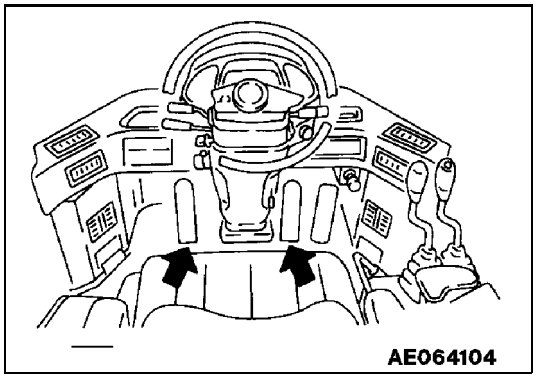
WARNING

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 used for normal braking.

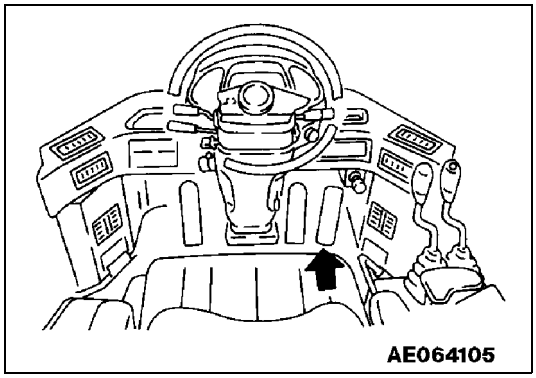
Left brake pedal
The left brake pedal operates the wheel brakes. If the transmission cut-off switch is on,it also returns the transmission to neutral. If the transmission cut-off switch is off, the left brake pedal acts in the same way as the right brake pedal.

REMARKS
When the accelerator is used for operating the work equipment, always use the left brake pedal to slow or stop the machine after placing 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.



11.4 STEERING COLUMN TILT LEVER

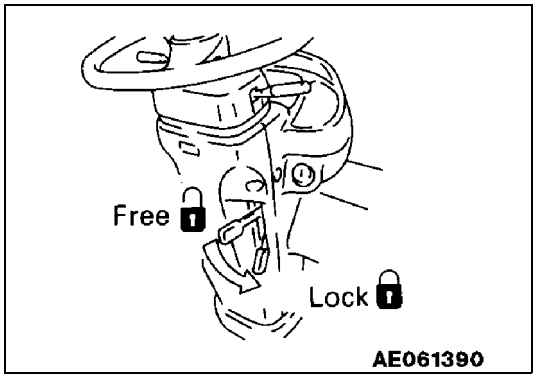
WARNING

Stop the machine before adjusting the steering wheel angle.

This lever allows the steering column to tilt forward or backward.

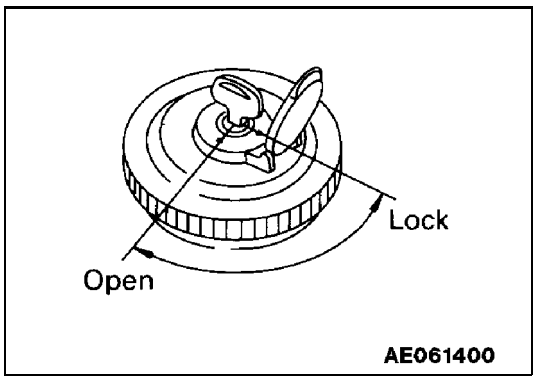
Pull the lever up and move the steering wheel to the desired position. Then push the lever down to lock the steering wheel in position.

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



11.5 CAP WITH LOCK

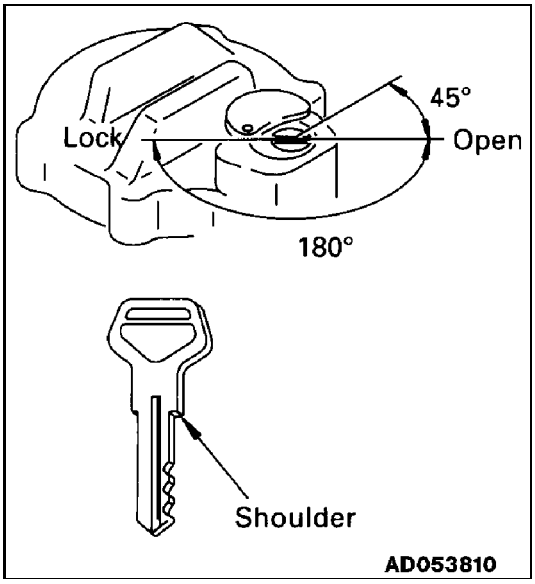
The fuel tank filler port and the hydraulic tank filler port are equipped with locks. Use the starter key to open and close the cap as follows:



11.5.1 METHOD OF OPENING AND CLOSING THE CAP WITH LOCK

TO OPEN THE CAP (fuel tank filler port)

1. Insert the key into the cap. Ensure that the key is fully inserted or the key could break.
2. Turn the key clockwise and align the mark on the cap with the rotor groove. Remove the cap.

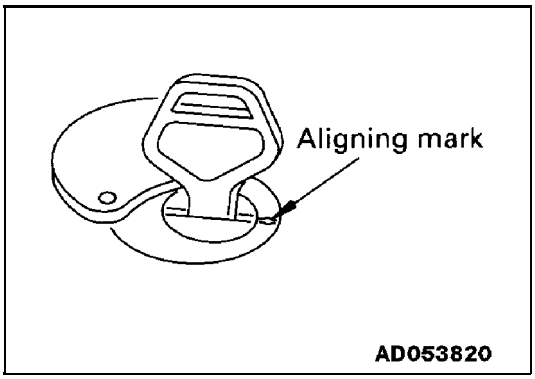


TO LOCK THE CAP

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

TO OPEN THE CAP (hydraulic tank filler port)

1. Insert the key into the cap as far as the key will go. If it is turned before inserting it all the way, the key could break.
2. Turn the key slowly counterclockwise and align the rotor groove with the mark on the cap until a clicking sound is heard.

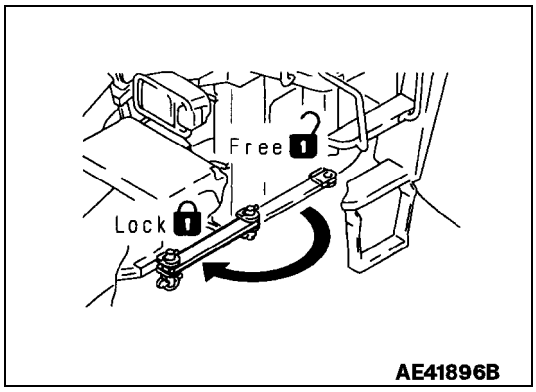


11.6 SAFETY BAR

⚠ WARNING

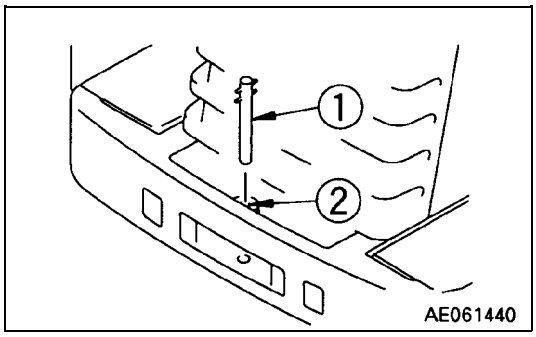
Always use the safety bar for maintenance or when transporting the machine.
Always remove the safety bar during normal travel operations.

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



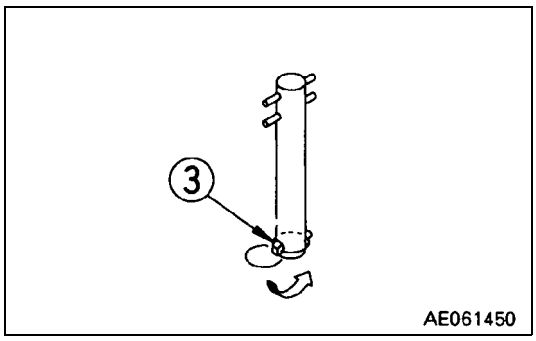
11.7 TOWING PIN

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



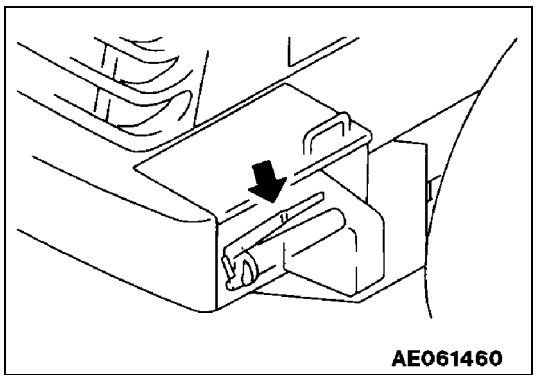
3. Insert the linch pin (3) so that the towing pin doesn't come out.

3. To remove the towing pin, reverse this procedure.



11.8 GREASE PUMP

The grease pump is stored inside the battery box at the rear of the machine. After using the pump, wipe off all the grease stuck to the outside of it and then store it in the box. The grease pump can be stored in either the left or right battery box.



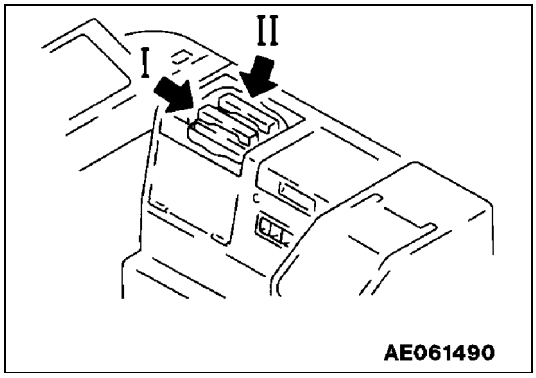
11.9 BACKUP ALARM

An alarm sounds when the directional lever is in reverse (R). The alarm warns people behind the machine that it is traveling in reverse.

11.10 FUSE

NOTICE: Before replacing a fuse, turn off the starting switch.

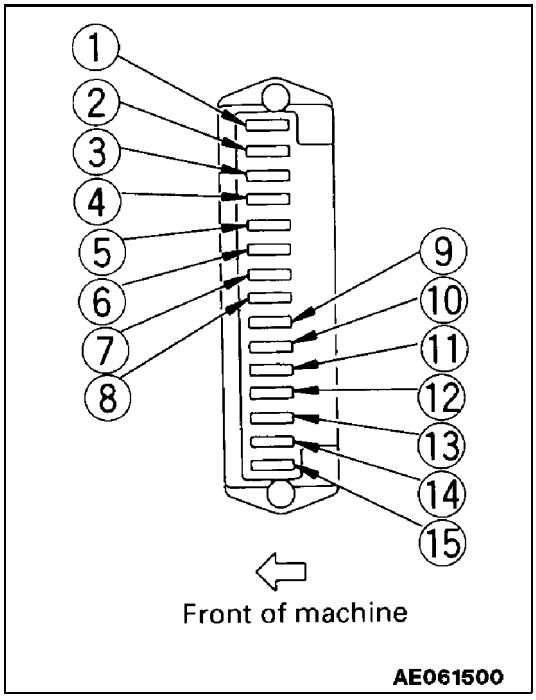
The fuses protect the electrical equipment and wiring from burning out. If a fuse becomes corroded, has white powder on it, or loose in its holder, replace the fuse.



11.10.1 FUSE CAPACITY AND CIRCUIT NAME

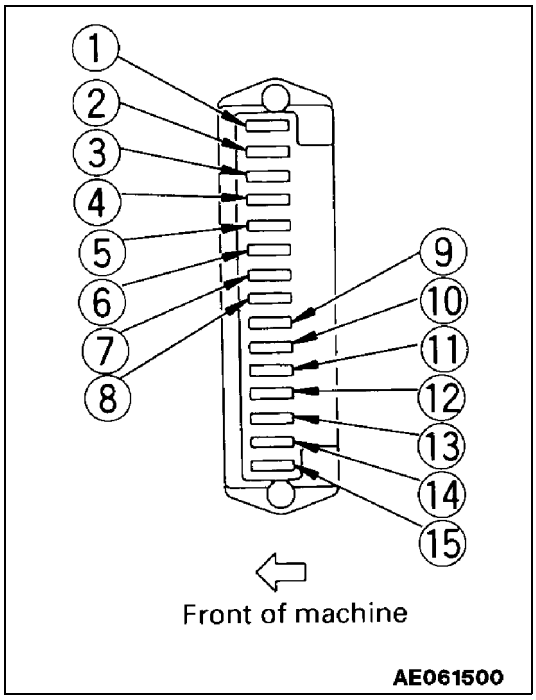
Fuse box I

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
⑭	10A	Spare
⑮	10A	Spare



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 shutoff solenoid
⑩	10A	Spare
⑪	10A	Spare
⑫	10A	Spare
⑬	10A	Spare
⑭	10A	Air suspension seat
⑮	25A	Defroster



11.11 SLOW-BLOW FUSE

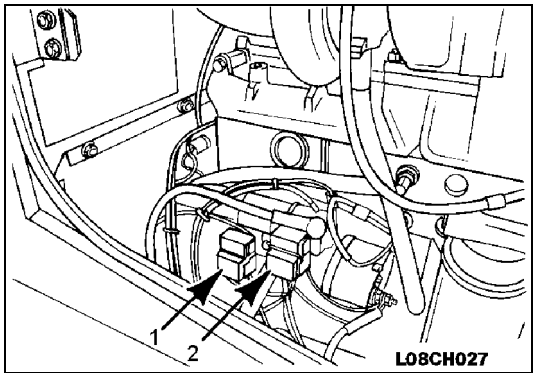
If the power does not come on when the starting switch is turned ON, the slow-blow fuse could be blown. Check it and replace, if needed.

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

SLOW-BLOW FUSE

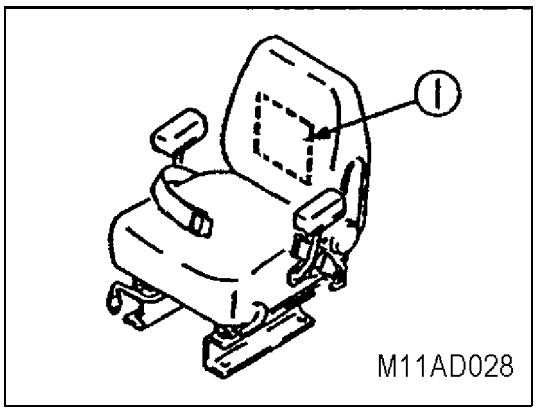
(1) 80A: Main power

(2) 30A: Battery power (starting switch, hazard)



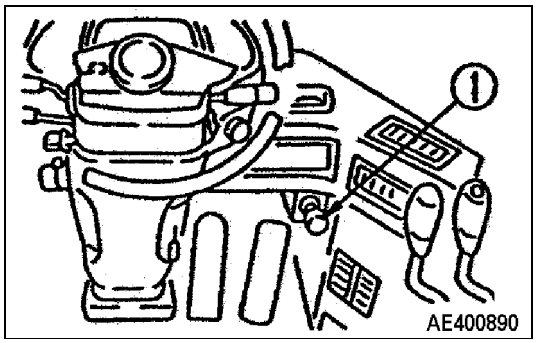
11.12 STORING THIS MANUAL

Keep this manual in the rear pocket (1) of the operator's seat so that the manual is immediately available when needed.



11.13 ELECTRIC POWER (with ROPS CAB)

Removing the cigarette lighter permits an electrical device to be plugged in. The maximum electric current is 7 amps (168 W).



12. OPERATION

12.1 CHECK BEFORE STARTING

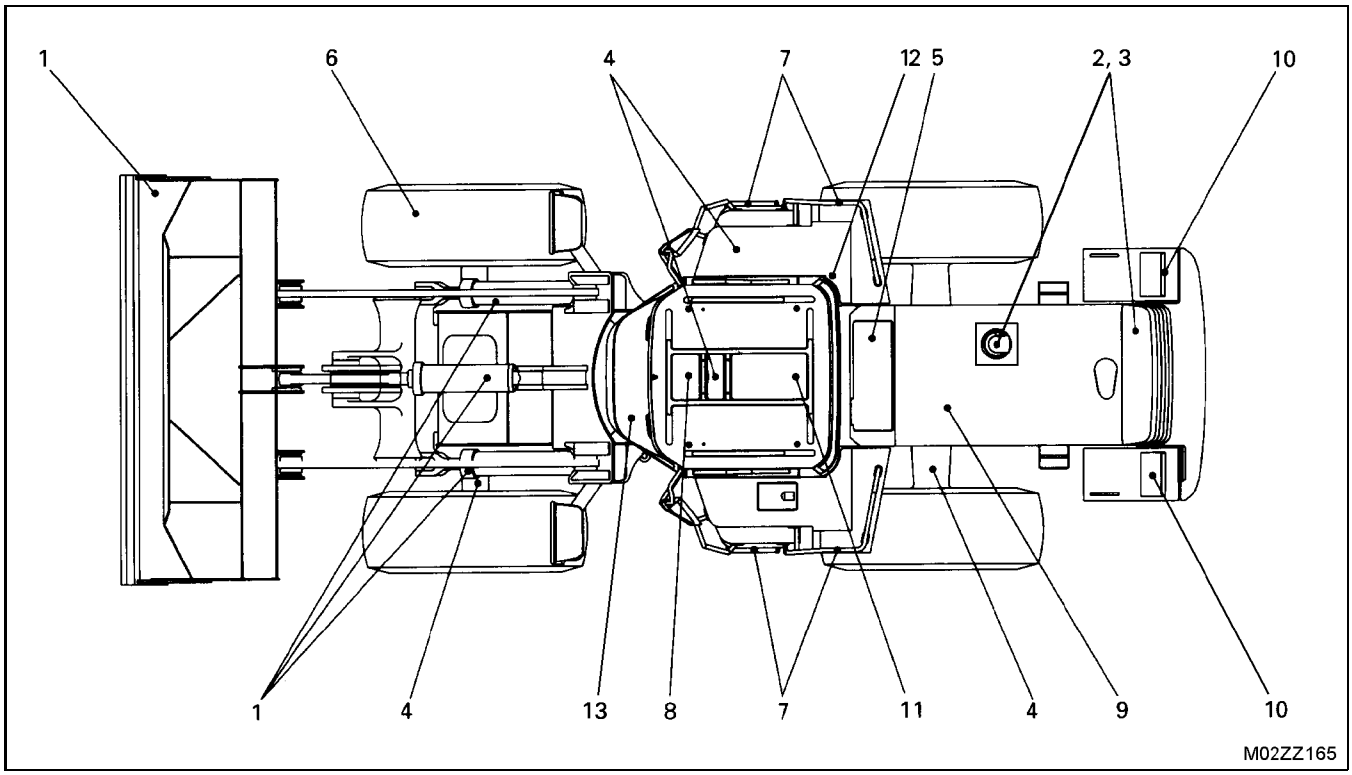
12.1.1 WALK-AROUND CHECK

WARNING

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

Before starting the engine, look around the machine and under it and check for loose nuts or bolts, and leakage of oil, fuel, and coolant. Also, check the condition of the work equipment and hydraulic system. Check also for loose wiring, play, and collection of dust on high-temperature parts.

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



1. **Check for damage, wear, or play on 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 the engine, battery, radiator**.
   Check if there is any dirt accumulation 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 such dirt or flammable material.

3. **Check for water and oil leakage around the engine**
   Check that there is no oil leakage from the engine or water leakage from the cooling system. If any leak 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 leakage is found, repair the oil leak.

5. **Check for brake line oil leakage**
   Check that there is no oil leakage. If any leak is found, repair it.

6. **Check for tire damage and wear, 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 ones.

7. **Check for damaged 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.

11. Check the seat belt

WARNING

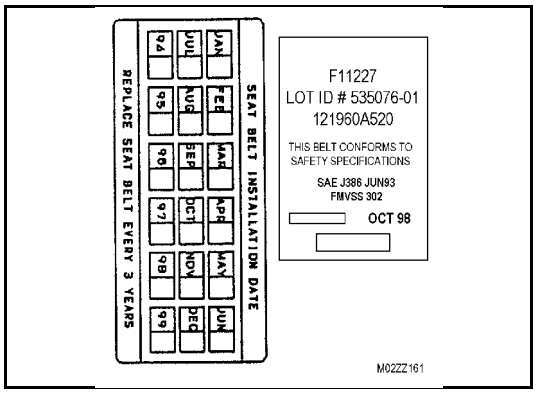
Although a seat belt may appear undamaged, replace it every three years.

The date of manufacture of the seat belt is marked on the belt.

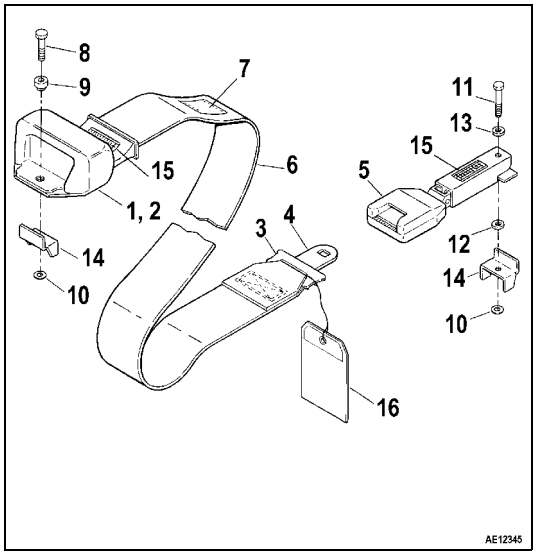
Check that there are no loose bolts on the equipment mounting the seat belt to the machine, and tighten, if necessary.

Tightening torque: 24.5 ± 4.9 N

If the belt is damaged or frayed, or if there is any damage or deformation of the seat belt holders, replace the seat belt with a new one.



1 - Retractor
2 - Boot
3 - Gripper
4 - Tongue
5 - Buckle Assembly
6 - Webbing
7 - Label
8 - Bolt
9 - Bushing
10 - Washer
11 - Bolt
12 - Washer
13 - Spacer
14 - Anti-rotation buckle
15 - Installation label
16 - Instruction tag



12. Check for loose bolts on ROPS

Check for any loose or damaged bolts. If any loose bolts are found, tighten them to 927 ± 103 N y bolts are damaged, replace them with genuine Komatsu bolts.

13. Clean the cab window

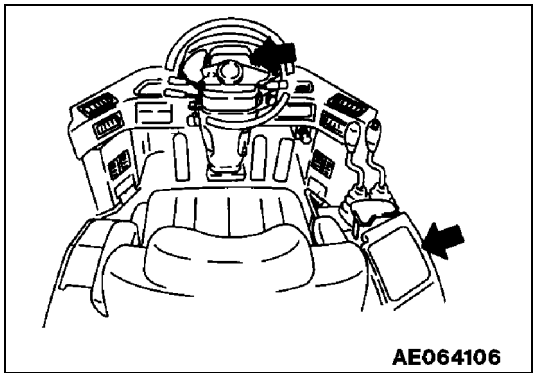
Clean the cab window to ensure good visibility when operating the machine.

12.1.2 CHECK BEFORE STARTING

1. Turn the start switch ON.

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

Do not perform the checks using just the monitor; always perform the items specified for the periodic maintenance.



Tire Inspection

WARNING

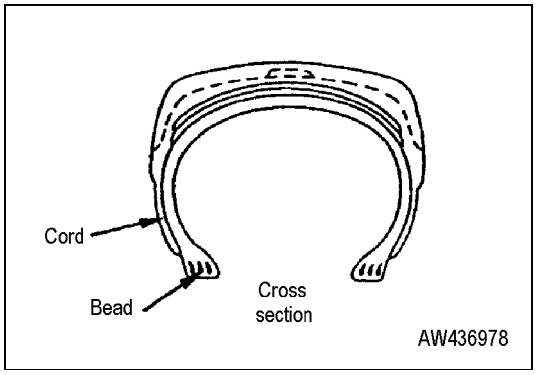
If worn or damaged tires are used, they may burst and cause serious injury or death. When tires show the following wear or damage, reject them:

Wear:

- **Tires with a tread groove of less than 15% of that of a new tire.**
- **Tires with uneven wear or with stepped wear.**

Damage:

- **Tires with damage that reaches the cords.**
- **Cracks in the rubber.**
- **Tires with cut or pulled cords.**
- **Tires with damaged bead.**
- **Tires with peeled or separated surface.**
- **Deteriorated, deformed or abnormally damaged tires that do not seem usable.**



Rim inspection

WARNING

Check the rims (wheels) and rings for deformation, corrosion, and cracks.

In particular, check the side rings, lock rings and rim flanges thoroughly.

CHECK THE COOLANT LEVEL

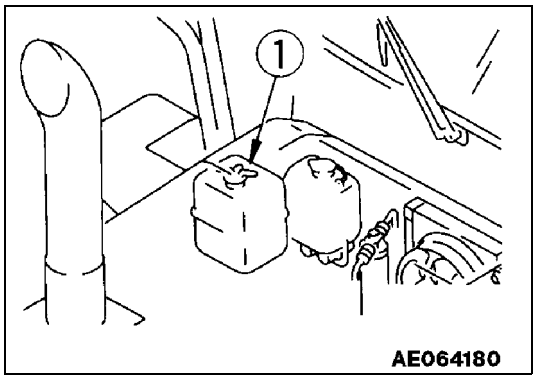
⚠ WARNING

Always wait for the engine to cool down before checking the water level. When checking the water level, check the radiator overflow subtank.

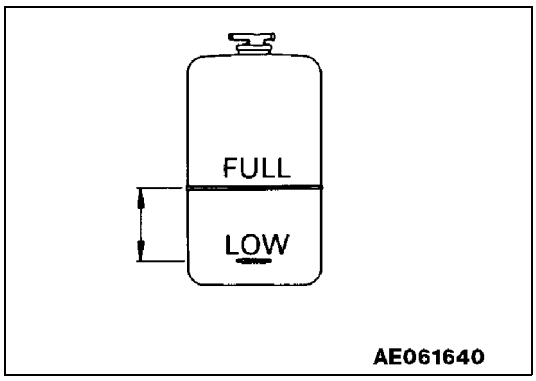
1. Open the top cover at the front of the engine hood in the middle of the machine, and check that the coolant level is between the FULL and LOW marks on the sub-tank (1). If the coolant level is low, add coolant to the FULL mark through the filler in the sub-tank.

   For complete coolant specifications SEE "20.3 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. Ensure that engine oil is not present in the coolant.

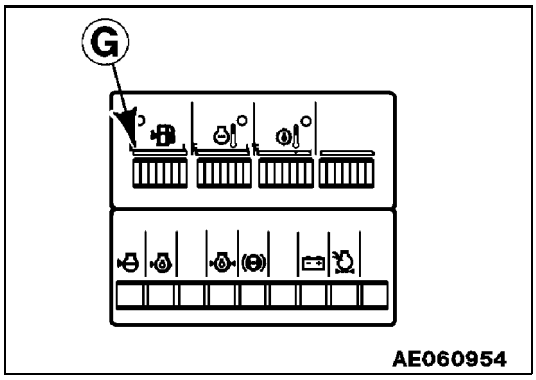


CHECK THE FUEL LEVEL

⚠ WARNING

When adding fuel, never let the fuel overflow or a fire could result. Clean up any fuel spills immediately.

1. Turn the engine starting switch to the ON position, then check the fuel level on the fuel gauge (G). After checking the fuel level, return the starting switch to the OFF position.



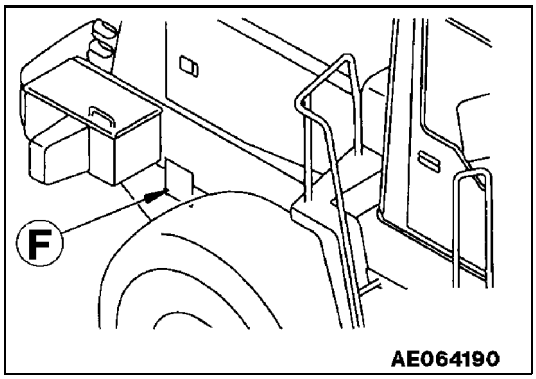
2. Add the fuel through the filler (F).

For details of the method of opening and closing the fuel cap, See **11.5 CAP WITH LOCK on page 2-28.**

3. After adding the fuel, tighten the cap securely.

FUEL CAPACITY: 248 liters (65.5 U.S. gallons)

NOTE: To eliminate moisture or corrosion in the fuel tank, fill it with fuel before storing the machine.

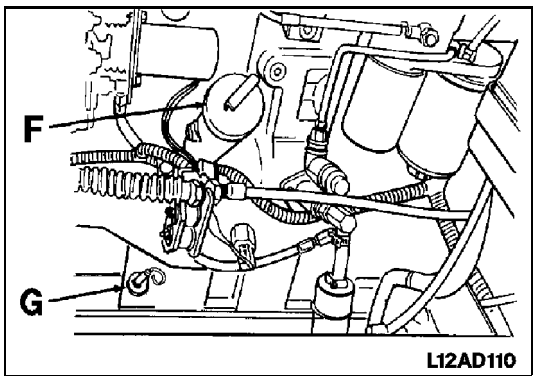


CHECK THE ENGINE OIL LEVEL

1. Open the engine side cover at the right rear side of the machine.

2. Remove the dipstick (G) and wipe off the oil with a clean cloth.

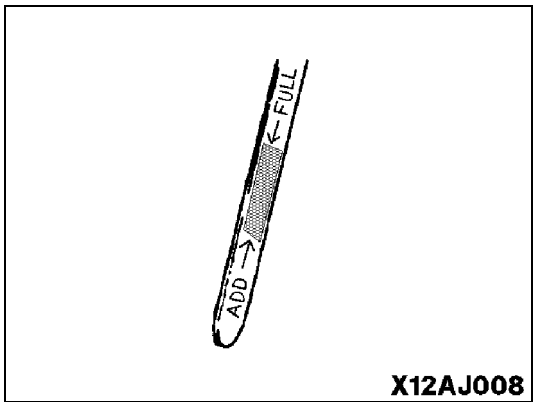
3. Reinsert the dipstick (G) fully in the tube, and then remove the dipstick again.



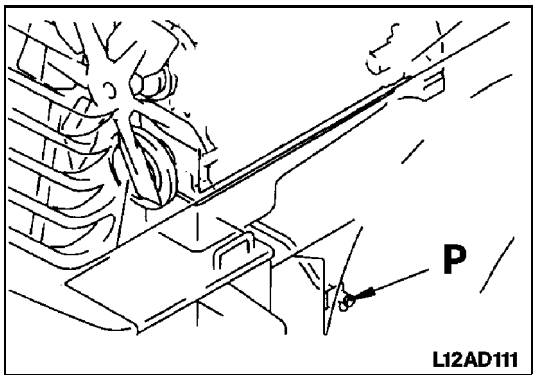
4. The oil level should be between the ADD and FULL marks on the dipstick.

5. If the oil is below the ADD mark, add the engine oil through the oil filler (F).

   Oil specifications SEE "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE" on page 3-10.



6. If the oil is above the FULL mark, drain the excess engine oil by removing the drain plug (P) and let a portion of the oil drain out. Reinsert the drain plug. Recheck the oil level.



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, position the machine on a horizontal plane before checking the oil level.

CHECK THE ELECTRICAL WIRING

WARNING

Frequently blown fuses, or if there are signs of arcing, indicates an electrical short circuit may be the cause. Locate the cause and repair it.
Accumulation of all flammable material (dead leaves, twigs, grass, etc.) around the battery may cause fire, so always remove such material.

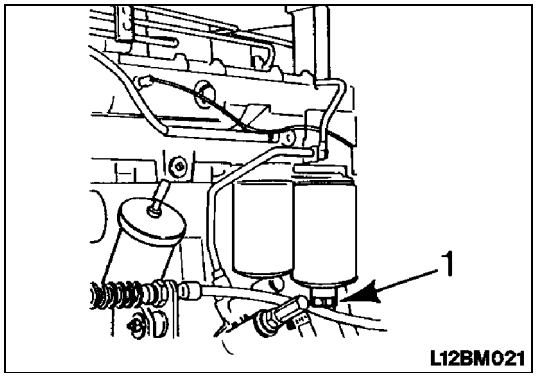
Check for damaged fuses and any sign of disconnection or short circuit in the wiring. Check also for loose parts. Check the following points carefully.

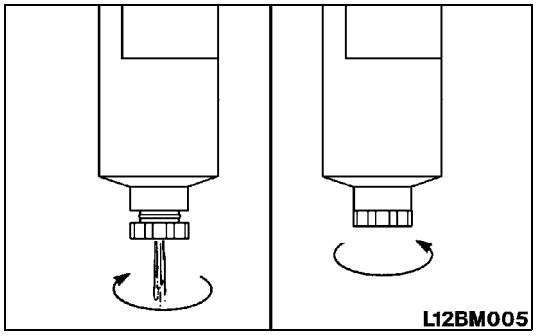
- Battery
- Starting motor
- Alternator

When performing walk-around checks before starting, always check for an accumulation of flammable material around the battery. If found, remove the flammable material. Please contact your distributor for investigation and correction of the cause.

DRAIN THE WATER FROM THE FUEL-WATER SEPARATOR

1. With the engine shut-off, open the drain valve (1).
2. Turn the valve counterclockwise about 1-1/2 to 2 turns until draining occurs. Drain the filtersump of water until clear fuel is visible.
3. Do not over tighten the valve. Over tightening can damage the threads.
4. Turn the valve clockwise about 1-1/2 to 2 turns to close the drain valve.
5. Even if a filter/water separator is installed be sure to check the fuel tank to remove water and sediment in the fuel.





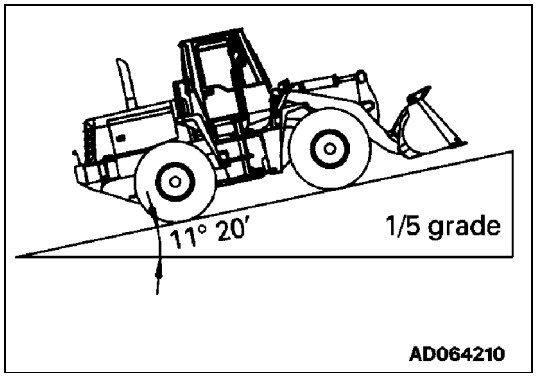
CHECK THE PARKING BRAKE

⚠ WARNING

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

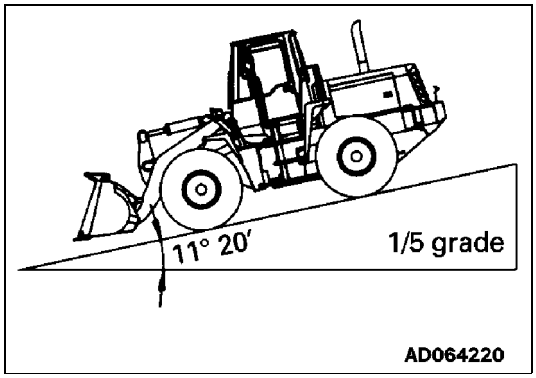
Measurement conditions

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.



CHECK THE WHEEL BRAKES

Drive the machine at a speed of 20 km/h (12.4 mph) on a dry, flat concrete road surface. After applying the brakes, check the stopping distance, which should be 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 STEERING WHEEL PLAY, CHECK OPERATION OF STEERING

CHECK DIRECTION OF REAR VIEW MIRROR, CHECK FOR DIRT OR DAMAGE

12.1.3 ADJUSTMENT BEFORE OPERATION
ADJUSTING OPERATOR'S SEAT

⚠ WARNING

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

A: Forward-backward adjustment
Pull lever (1) up, and move the seat to the desired position, then release the lever to lock in place.
For-and-aft adjustment: 120 mm (4.7 in) (16 mm (0.63 in) x 10 stages)

B: Adjusting the seat angle

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.
Range of adjustment: 13

C: Adjusting the seat weight

Turn grip (3) to adjust the strength of the suspension.
Adjustment range: (Target) 50 kg - 120 kg (110.3 - 264.6 lb)

D: Adjusting the backrest angle

Move the lever (4) and move the backrest to the front or rear.
Adjustment range: Front 24

E: Seat height adjustment

Move the lever (2) up/down, then move the seat up or down as desired. Because the lever (2) is also used for adjusting the seat angle, set the seat to the desired height while adjusting the angle.
Adjustment range: 60 mm (2.36 in)

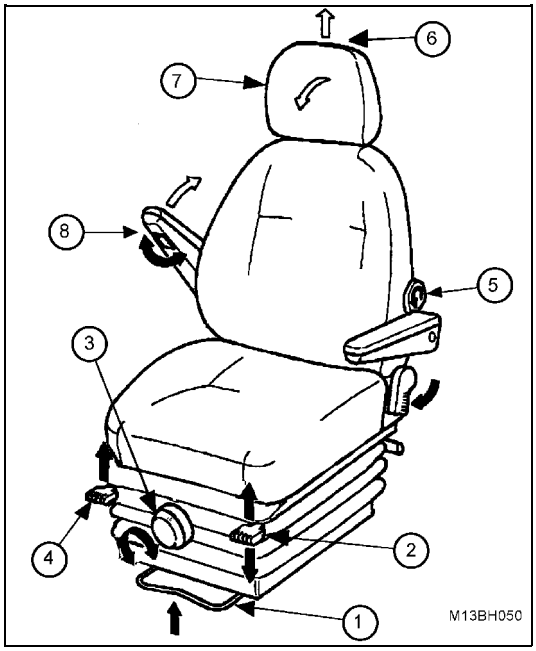
F: Adjusting the headrest height

Move the headrest up and down to the desired height.
Adjustment range: 50 mm (2 in.)

G: Adjusting the headrest angle

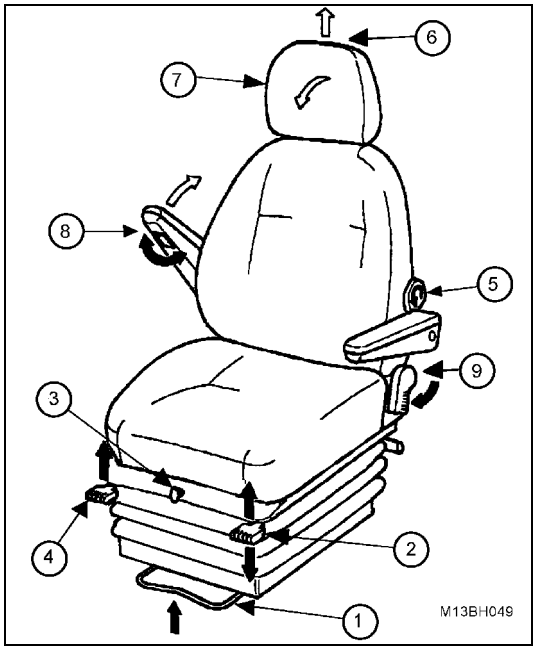
Adjustment: 60

H: Adjusting the armrest angle
Adjust angle of the armrest by rotating knob (5) (left side only).
Adjustment range: 30
Also, when the armrest is turned, it will spring up.



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, but with a few exceptions.



(1) Forward-backward adjustment

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

(2) Seat angle adjustment

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

The knob (3) controls the air suspension system's air valve. Push or pull the knob to adjust the suspension's strength and compensate for the operator's weight and/or preference.
Adjustment range fore and aft: 120 mm (4.7 in.)

(4) Height adjustment

Move the lever (4) up or down, then move the seat up or down as desired. The lever is also usedfor adjusting the seat angle. Set the seat to the desired height while adjusting the angle. Move the 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 ;
Rear (3

(5) Lumbar support adjustment

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

(6) Adjusting the height of the headrest

Move the headrest up and down to the desired height.
Adjustment range: 50 mm (1.96 in.)

(7) Adjusting the headrest angle

The headrest is adjustable through 60

(8) Armrest angle

Release the armrest with the control (8) on the left side and move the armrest to the desired position.The armrest can be moved vertically, if needed.
Adjustment range: 30 (forward 25

ADJUST THE SEAT BELT

Always install a seat belt on machines equipped with ROPS.

⚠ WARNING

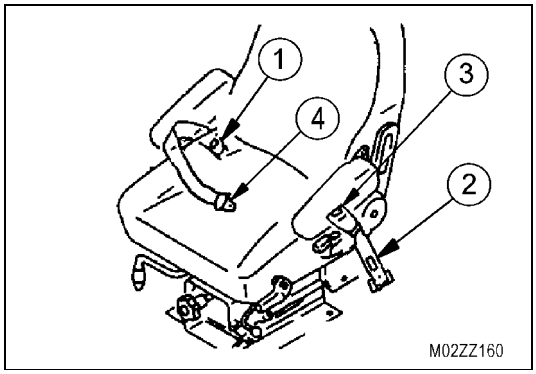
Before fitting the seat belt, check that there is no abnormality in the mounting bracket and belt mounting. If the belt is worn or damaged, replace it.
Always fasten the seat belt before starting operations.
Do not twist the left or right side of the seat belt when fastening it.

Fastening and removing the belt

1. Sit on the seat. Depress the brake pedal fully, and adjust the seat so that your back is pressed against the backrest.

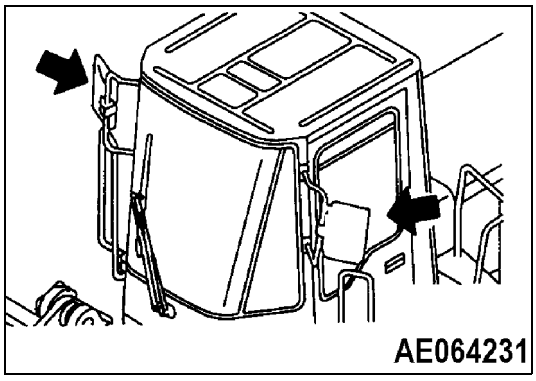
2. While still on the seat, pull the tongue end of the seat belt from the retractor (1). Insert the tongue (4) into the buckle (3). Pull the belt to check that it is securely locked.

3. To remove the belt, depress the release button on the buckle (3) and guide the tongue end of the belt into the retractor (1).

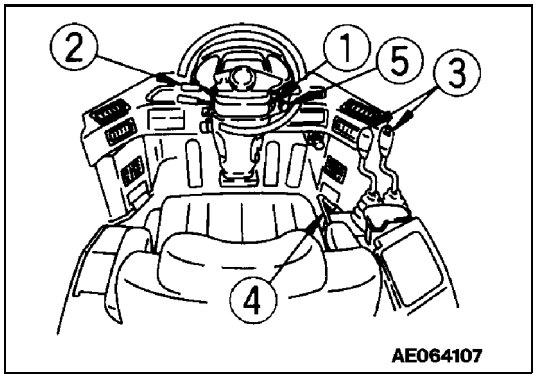


ADJUST THE REAR VIEW MIRROR

Sit in the operator's seat and adjust the rear view mirror so that you have an unobstructed view to the rear.



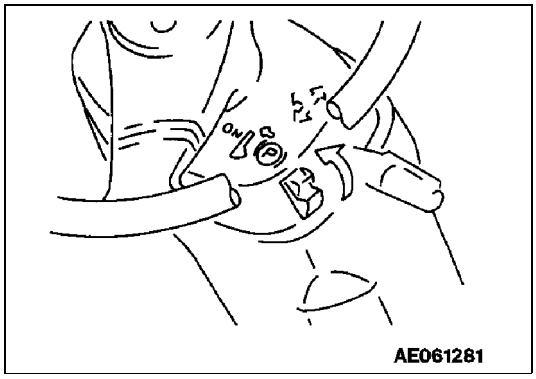
12.1.4 OPERATIONS AND CHECKS BEFORE STARTING ENGINE



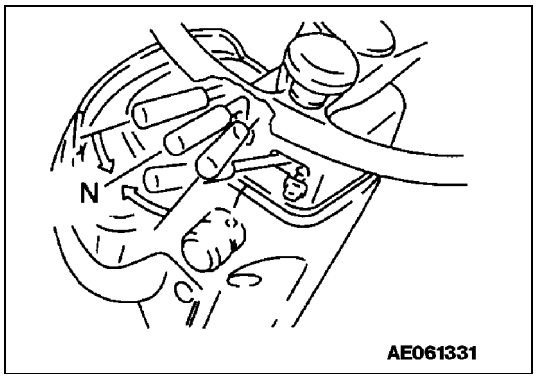
⚠ WARNING

Accidentally touching the control levers can cause the work equipment to move suddenly. When leaving the operator's compartment, always set the safety lever securely to the LOCK position. Before starting the engine, wipe off the dust atop the battery or on the starting motor and alternator with a damp cloth.

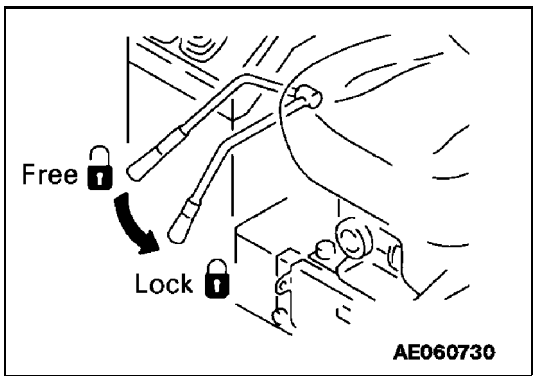
1. Ensure that the parking brake switch (1) is ON.



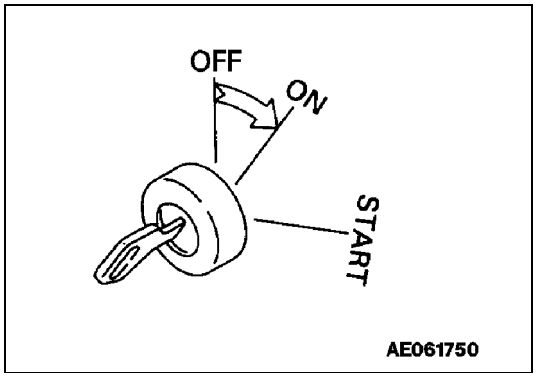
2. Check that the directional lever (2) is in the neutral position. If this lever is not in the neutral position, the engine will not start.



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



4. Insert the key in the start switch (5), and turn the keyto the ON position. Check that the pilot lamp lights up.



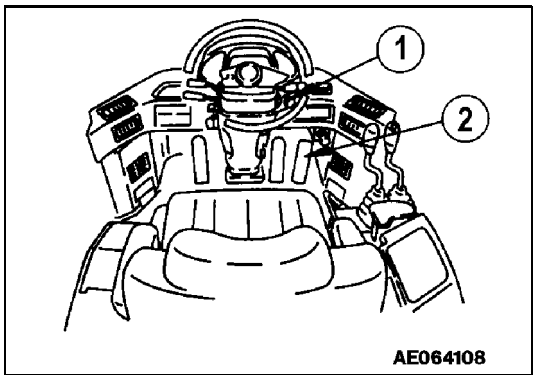
12.2 STARTING THE ENGINE

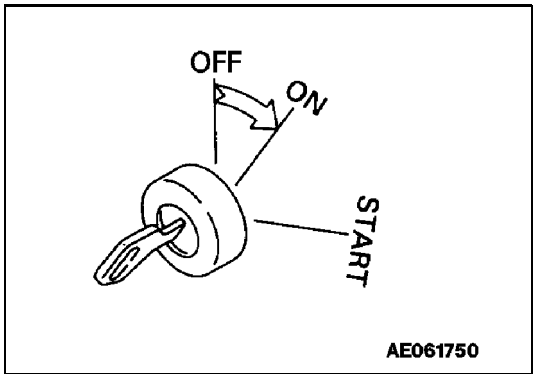
WARNING

After checking that there are no persons or obstacles in the surrounding area, sound the hound and then start the engine.

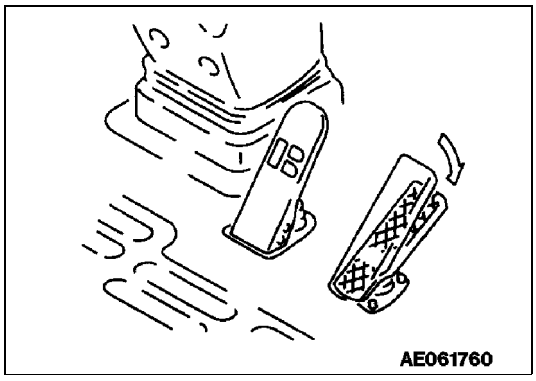
NOTE: Do not keep the starting motor rotating continuously for more than 20 seconds. If the engine will not start, wait for at least 2 minutes before trying to start the engine again.

1. With the key in the starting switch (1), turn the key to the ON position.



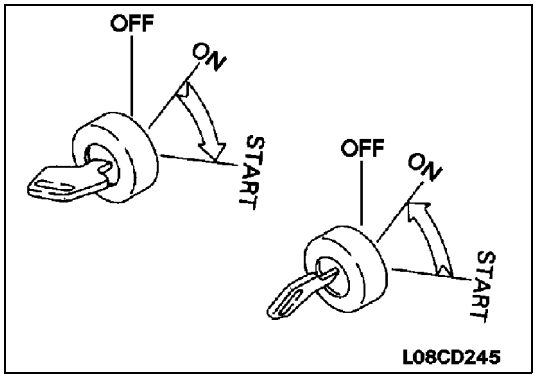


2. Depress the accelerator pedal lightly.



3. Turn the key to the START position.

4. After starting the engine, release the key and it will automatically return to the ON position.



12.2.1 COLD WEATHER STARTING

⚠ WARNING

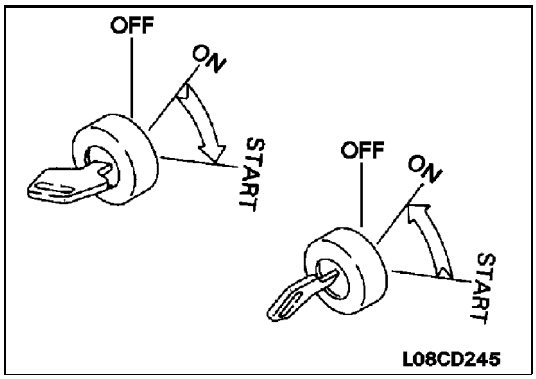
**Use the ether start switch only when starting the engine. Keep the sparks and flames away from the ether cylinder. Never throw a cylinder into a fire. Never drill a hole in the ether cylinder. Do not store an ether cylinder where the temperature will rise to 40
contact with the ether gas. Keep the ether cylinder out of the reach of children. NEVER use ether when using an air intake preheating device.**

NOTE: An ether cylinder holds 710 cc, which is enough ether for about 230 uses (3 cc is injected for each shot).

Remove the ether cylinder in warm weather and store the cylinder in a safe place where the temperature is below 40
When the ambient temperature is below 25
ether cylinder in place at room temperature.

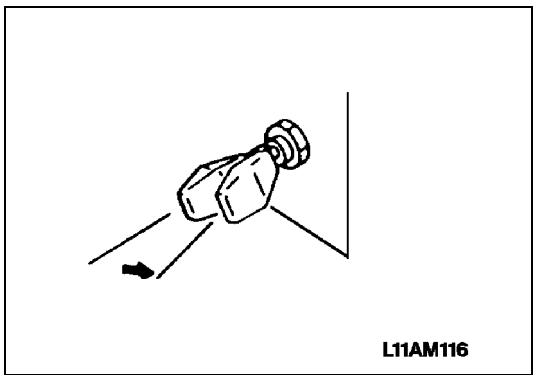
Before changing the ether cylinder, clean out the valve area where the cylinder is installed and replace the gasket at the same time.

1. Turn the key in the start switch to the ON position.
2. DO NOT depress the accelerator pedal.
3. Turn the key to the START position to start the engine.

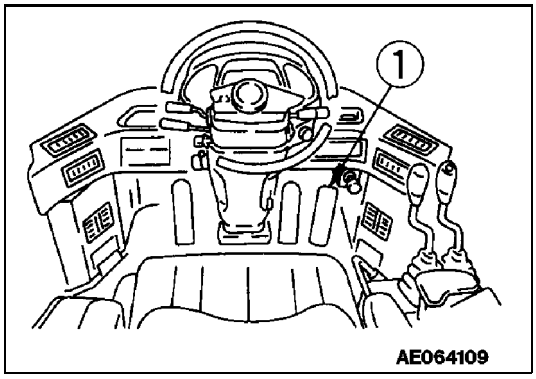


4. Move the ether start switch to the ON position, but for no more than five seconds. Holding this switch for longer than five seconds will cause the ether start valve to fail.

NOTE: If the engine does not start on the first attempt, wait two minutes before repeating this cycle. You may need to repeat this cycle 2-3 times.



12.3 OPERATIONS AND CHECKS AFTER STARTING THE ENGINE



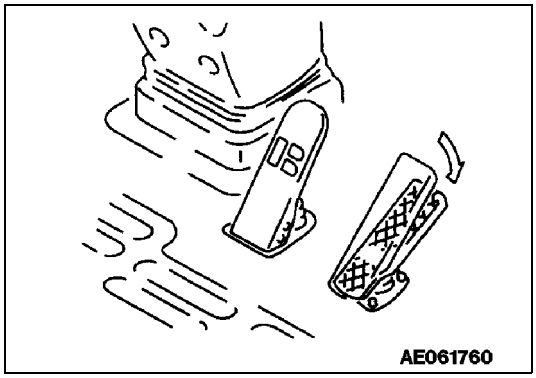
STARTING THE ENGINE

After starting the engine , do not immediately start operations. First, perform the following operations and checks.

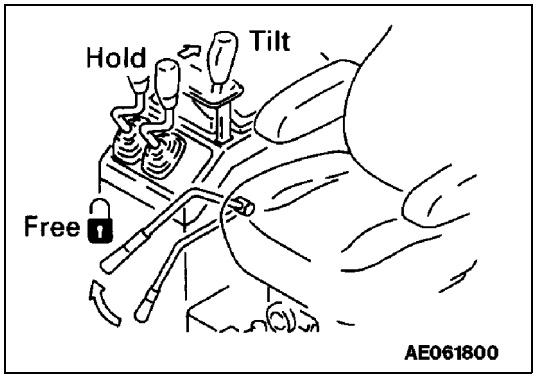
NOTE

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 it is necessary to run the engine at idle, apply a load from time to time or run the engine at mid-range speed.

1. Lightly depress the accelerator pedal (1) with no load at mid-range for about 5 minutes.

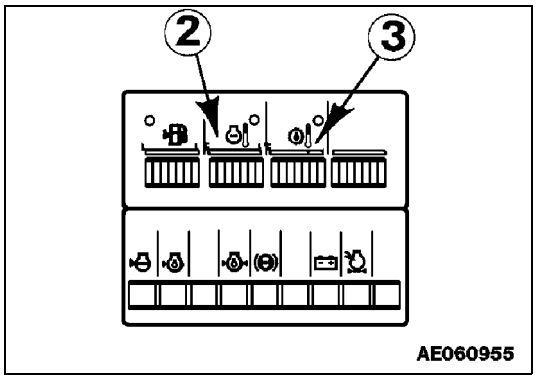


2. In cold climates, warm up the hydraulic oil. Ensure that the engine rotation is smooth. Set the safety lock on the work equipment control lever to the FREE position. Move the bucket control lever in and out of the TILT position to warm up the hydraulic oil. The relief time at the tilt position should be a maximum of 10 seconds. With this operation, the oil will reach the relief pressure and quickly warm up the hydraulic oil.



3. After performing the warm-up operation, check that the gauges and caution lamps are normal. If any defect exists, repair it.

4. Run the engine under a light load until the engine water temperature gauge (2) and the torque converter oil gauge (3) are in the green range.

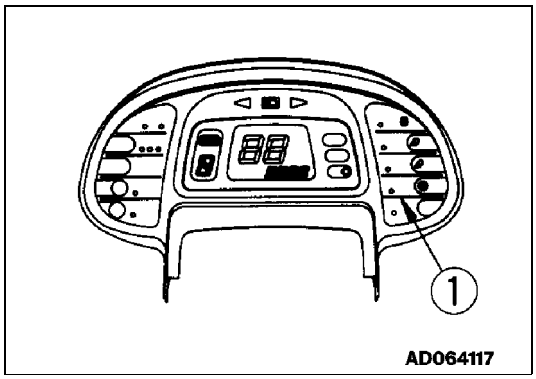


5. Check that the exhaust color, sound, or vibration is normal. If any problems exist, repair them.

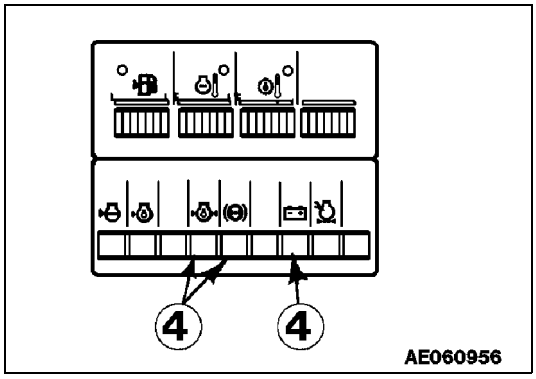
12.4 MOVING THE MACHINE

⚠ WARNING

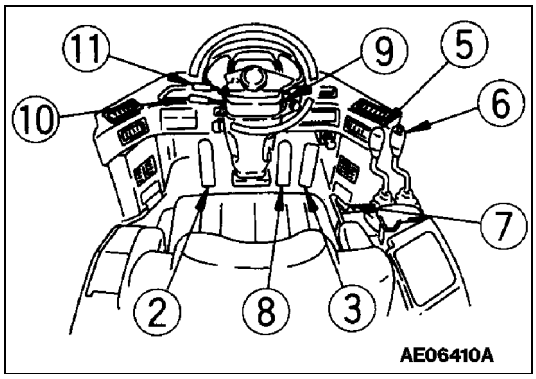
When moving the machine, check that the area around the machine is safe, then sound the horn before starting the engine. Do not allow people near the machine. A blind spot exists behind the machine, so be particularly careful when traveling in reverse. When starting the machine on a slope, set the transmission cut-off switch (1) to the OFF position, depress the left brake pedal (2) while depressing the accelerator pedal (3) , then gradually release the left brake pedal (2) to allow the machine to start.

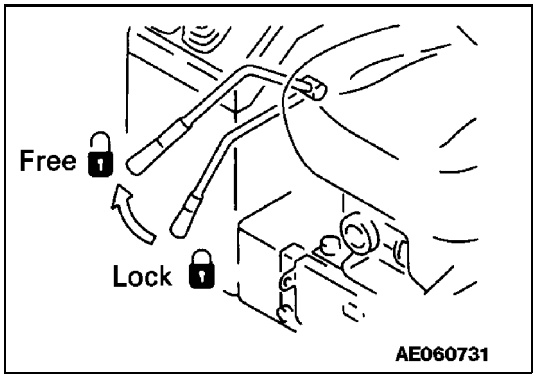


1. Check that the caution pilot lamp (4) is not lit up.

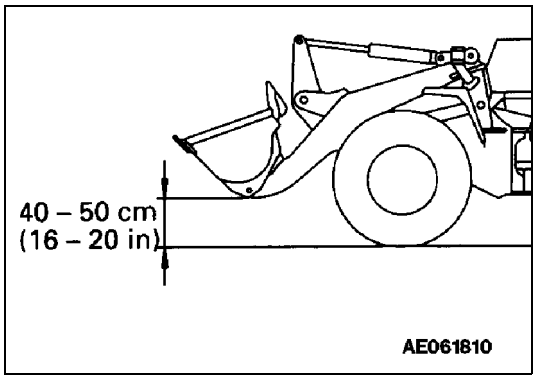


2. Set the safety lock (7) on the bucket control lever (5) and lift the arm control lever (6) to the FREE position.





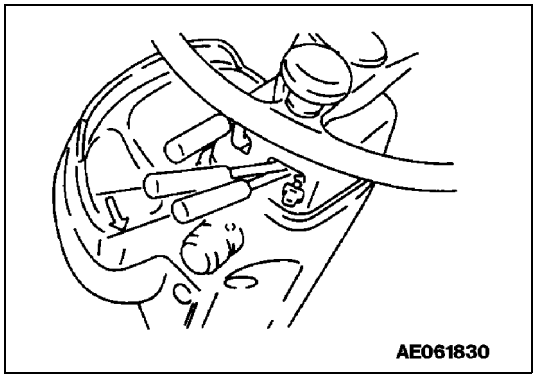
3. Operate the lift arm control lever (6) to set the work equipment to the travel mode.



4. Depress the right brake pedal (8) and turn the parking switch (9) to the OFF position to release the parking brake.

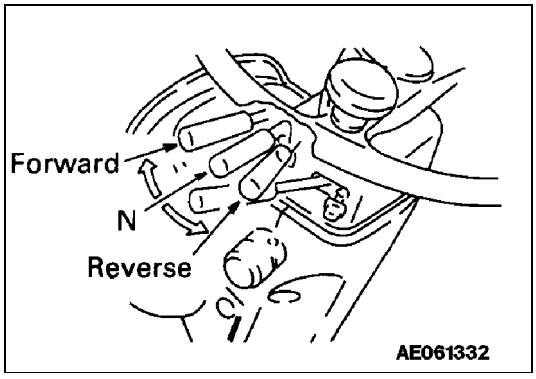
   If the parking brake remains actuated when the parking brake switch (9) is in the OFF position, turn the parking brake ON and then OFF again.

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



6. Set the directional lever (11) to the desired position.

7. Release the right brake pedal (8) and depress the accelerator pedal (3) to move the machine.

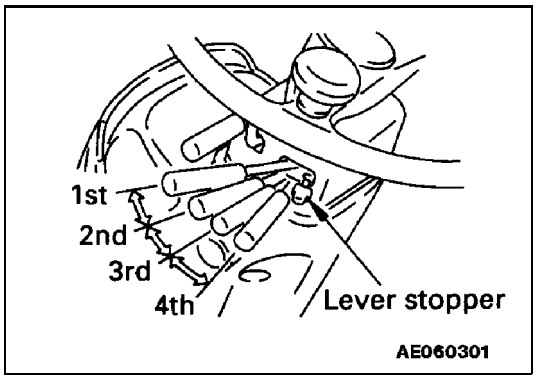


12.5 CHANGING GEAR SPEED

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 the speed control lever (1) to the desired position.
Only 1st or 2nd speeds are used for digging and loading operations, so actuate the speed control lever stopper.



REMARKS

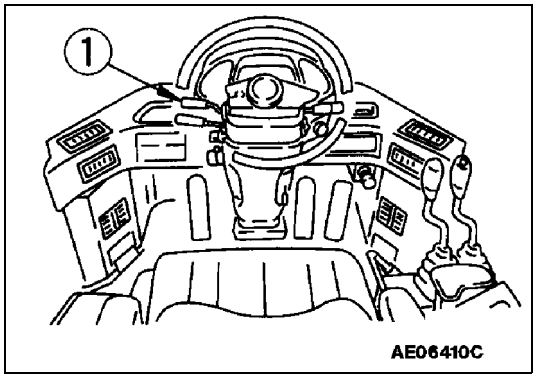
This machine is equipped with a kickdown switch that down shifts the gear to first, if the button at the tip of the lift arm control lever is pushed when the machine is traveling in 2nd gear. We recommend the use of the kickdown switch when performing digging or loading operations in first or second gear.
For details of use, **SEE "11. COMPONENT EXPLANATION" on page 2-4.**

When operating the shift lever slowly or positioning the lever movement between the detent positions, sometimes the main motor will display error message “EO3 + CALL.” This message doesn’t indicate a malfunction. Gear shifting should be within a 2 second time frame.

12.6 CHANGING DIRECTION

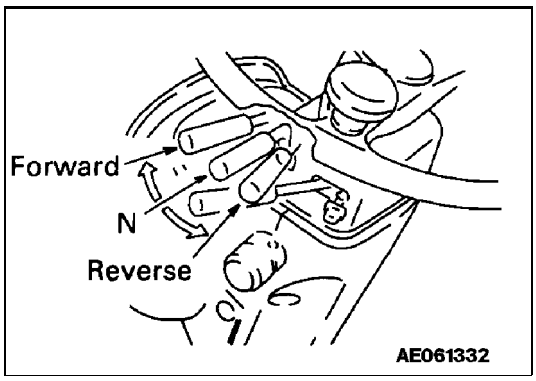
WARNING

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 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))

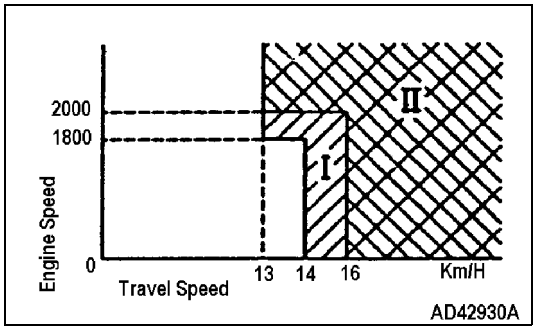


There is no need to stop the machine when switching between FORWARD and REVERSE.

Place the directional lever (1) in the desired position.



AUTO SHIFT TRANSMISSION
A warning alarm sounds for 3 seconds when changing direction while engine speed and travel speed are within Area I and II of the chart. When the alarm sounds, depress the brake pedal to reduce travel speed and then change direction. Direction change will be from F3 or R3, F4 to R4, R3 to F3, and R4 to F4.

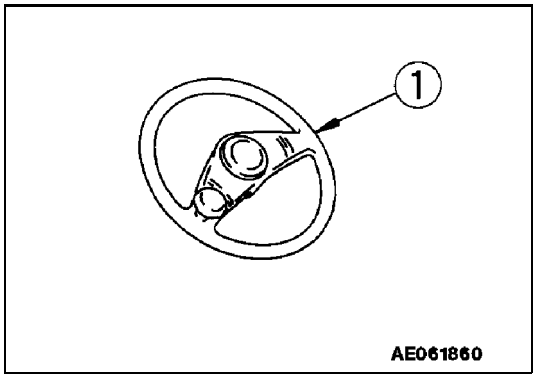


12.7 TURNING

WARNING

It is dangerous to turn the machine suddenly at high speed, or to turn on steep hills. If the engine quits while the machine is traveling, the steering wheel becomes heavy and hard to turn, so avoid killing the engine. This situation 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 the steering wheel (1) to turn the machine With this machine, the front frame is joined to the rear frame at the center of the machine by the center pin. The front and rear frames 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 turn it beyond the end of the stroke.



12.8 STOPPING THE MACHINE

WARNING

Avoid stopping suddenly. Allow ample room when stopping. Do not park the machine on the 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.
Accidentally touching the control lever could cause an 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, keep the brake pedal depressed until the pilot lamps lights up.

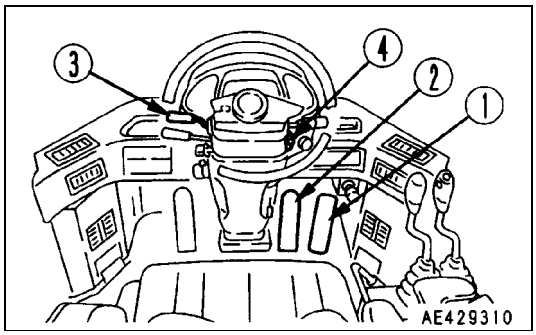
NOTE
Never use the parking brake switch to brake the machine while traveling, except in an emergency. Apply the parking brake only after stopping the machine.

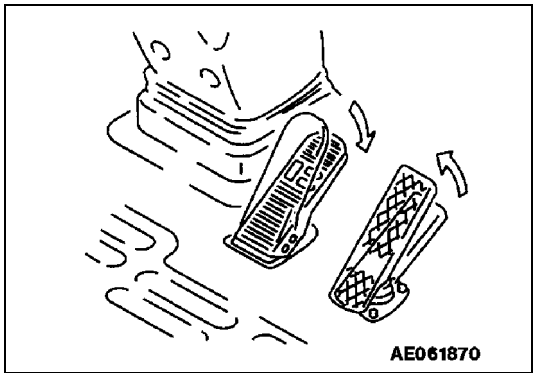
1. Release the accelerator pedal (1) and depress the brake pedal (2) to stop the machine.

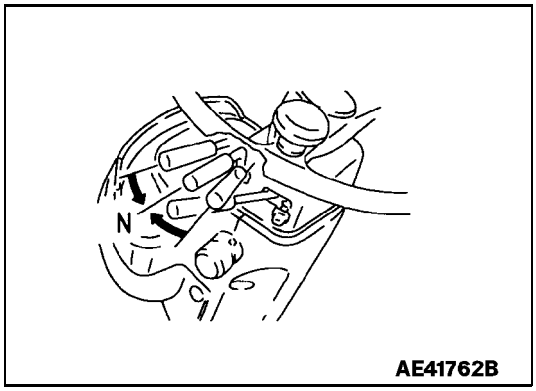
2. Place the directional lever (3) in the neutral position.

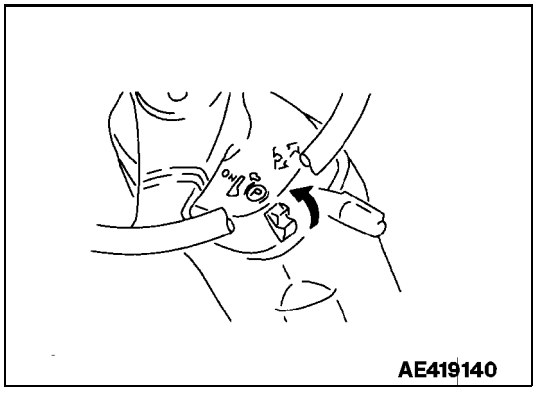
3. Turn the parking brake switch (4) ON to apply the parking brake.

REMARKS
After applying the parking brake, the transmission automatically returns to neutral.





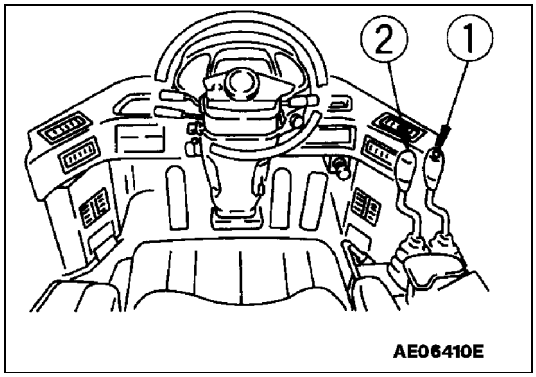




12.9 WORK EQUIPMENT OPERATION

12.9.1 STANDARD WORK EQUIPMENT CONTROLS

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



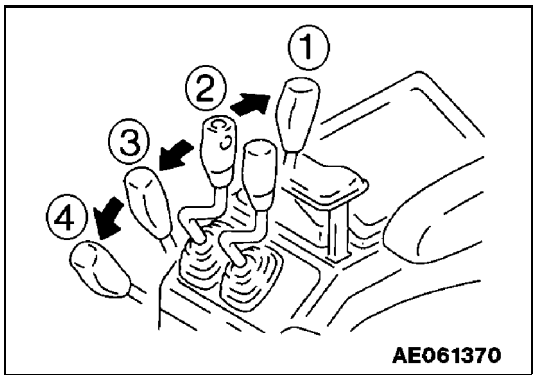
LIFT ARM OPERATION (LEVER (1))

(1) RAISE ( ):

(2) HOLD ( ): The lift arm is kept in the same position.

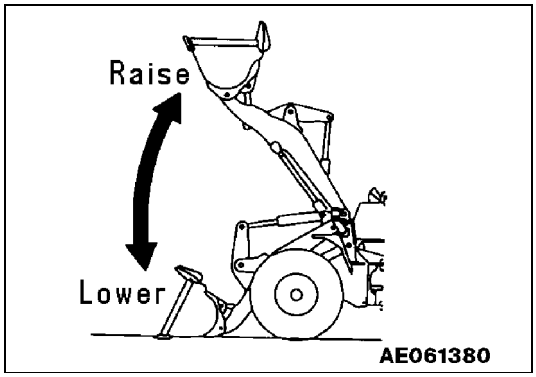
(3) LOWER ( )

(4) FLOAT ( ): The lift arm moves freely under external force.



When the lift arm control lever is pulled farther from the raised portion, the lever is stopped in this position until the lift arm reaches the preset kickout position, and the lever is returned to the hold position.

NOTE
Do not use the float position when lowering the bucket.

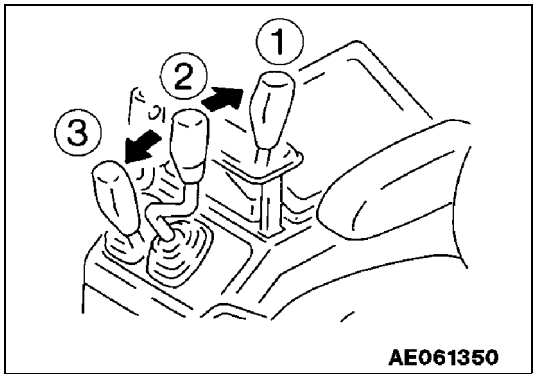


BUCKET OPERATION (LEVER (2))

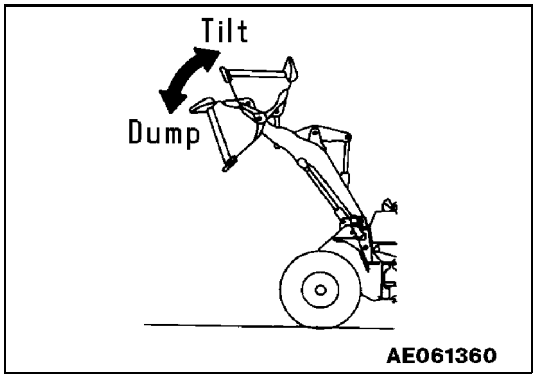
(1) TILT ( ):

(2) HOLD ( ): The bucket is kept in the same position.

(3) DUMP ( )

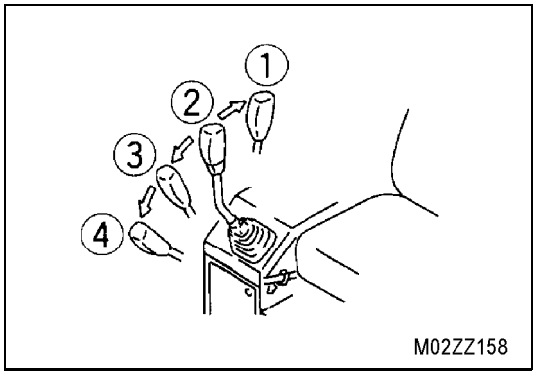


When the bucket control lever is pulled further from the tilt position, the lever is stopped in this position until the bucket reaches the preset position of the positioner, and the lever is returned to the hold position.



12.9.2 MONO-LEVER WORK EQUIPMENT CONTROLS

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



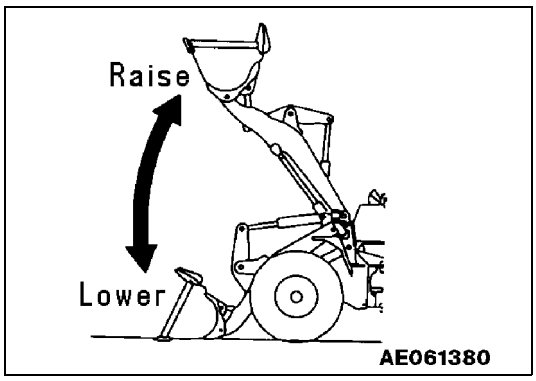
LIFT ARM OPERATION (LEVER)

(1) RAISE ( ):

(2) HOLD ( ): The lift arm is kept in the same position.

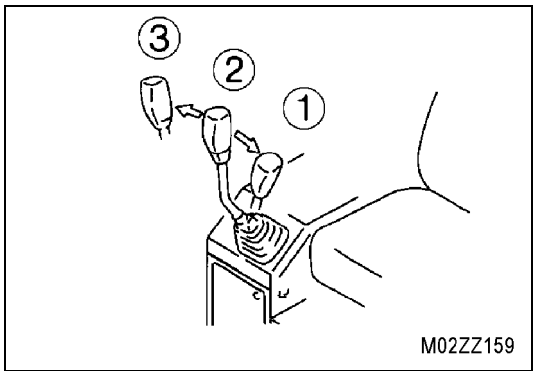
(3) LOWER ( )

(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 the hold position.

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



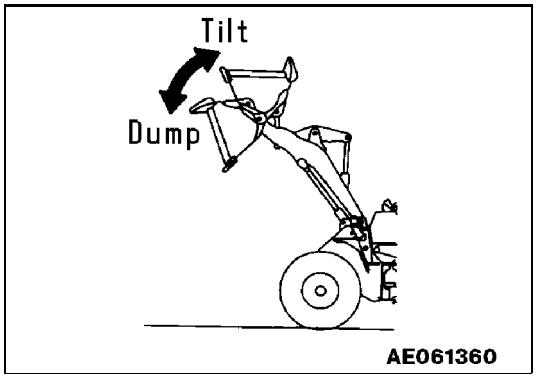
BUCKET OPERATION (LEVER)

(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.



12.10 WORK POSSIBLE USING A WHEEL LOADER

Using various attachments increases the range of applications, in addition to the following:

⚠ WARNING

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

12.10.1 DIGGING OPERATIONS

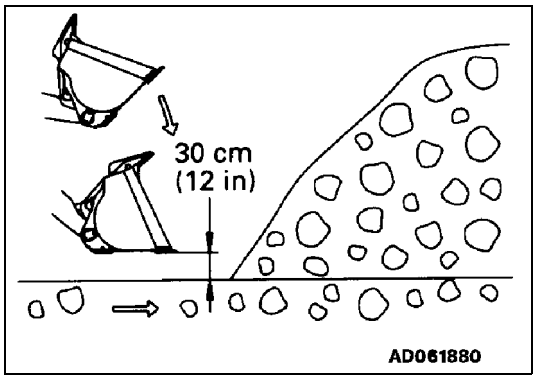
NOTE: If the tires slip, the life of the tire will be reduced, so avoid slipping or spinning the tires when operating the machine.

When loading piled soil or blasted rock, drive the machine forward as follows to load. To prevent the tires from becoming cut because of the tires slipping, be careful of the following points.

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

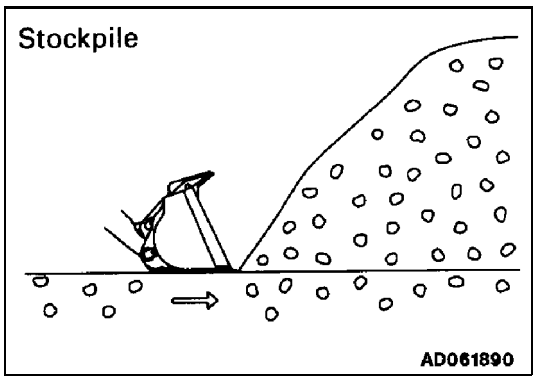
When working with stockpiles, operate the machine in 1st or 2nd; when loading blasted rock, operate in 1st.

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.

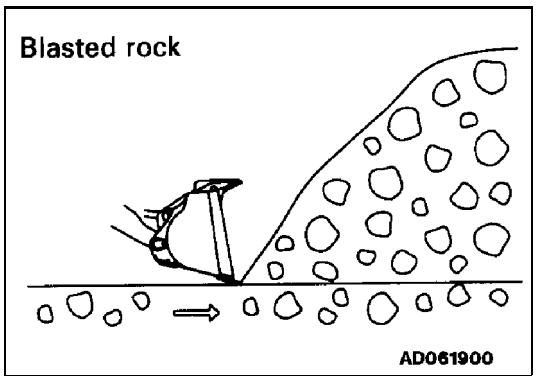
2. Shift down immediately in front of the material to be loaded. When completing the shift down, depress the accelerator pedal at the same time and thrust the bucket into the load.



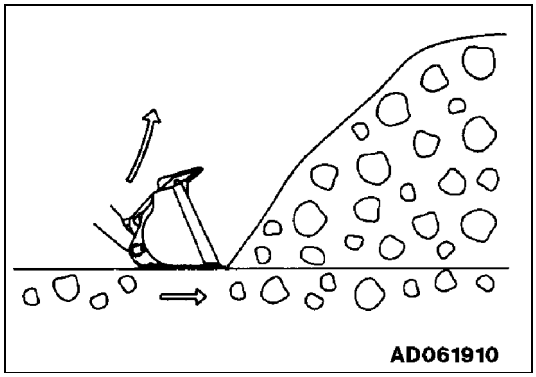
3. When the material is in a stockpile, keep the cutting edge of the bucket horizontal; when loading blasted rock, have the bucket tilted slightly down.

   Be careful not to get blasted rock under the bucket, or the front tires will come off the ground and slip.

   Try to keep the load in the center of the bucket, or the load will become unbalanced.

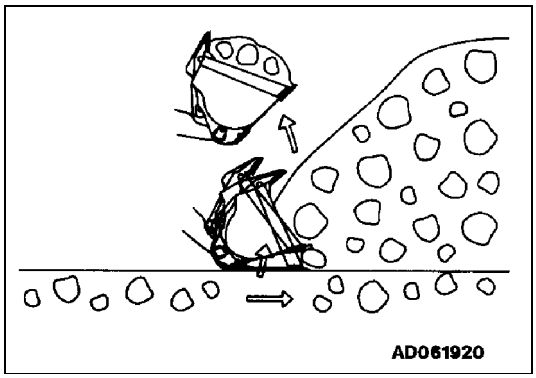


4. While thrusting the bucket into the material, raise the lift arm to prevent the bucket from going in too far. Raising the lift arm provides ample traction for the front tires.

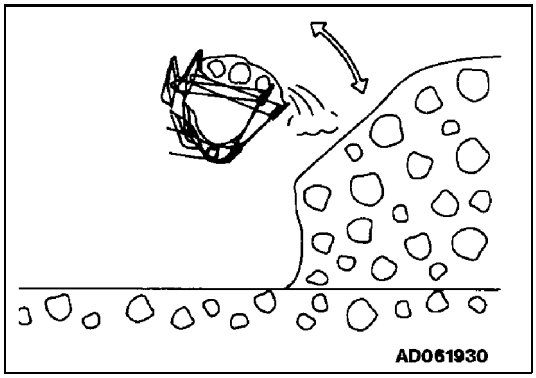


5. Check that there is enough material loaded into the bucket, then operate the bucket control lever to tilt the bucket up.

REMARKS
Moving the bucket edge up and down while pushing it in and digging could cause the front tires wheels to raise up and slip.

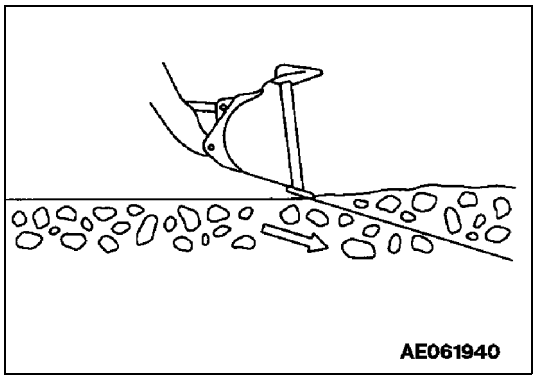


6. If too much material is loaded in the bucket, tilt and dump the bucket quickly to remove the excess load. This action prevents the load from spilling while hauling.

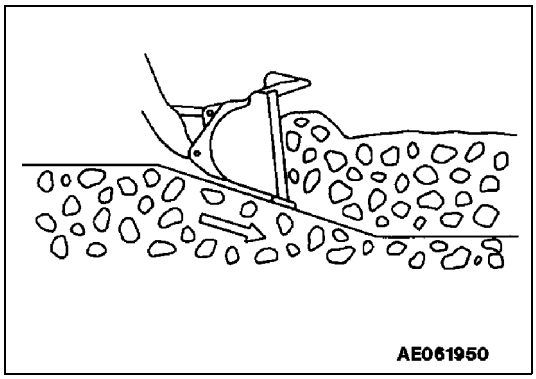


When digging and loading on level ground, set the bucket edge face down slightly and drive the machine forward. Always be careful not to load the bucket on one side, causing an unbalanced load. Perform this operation in first gear.

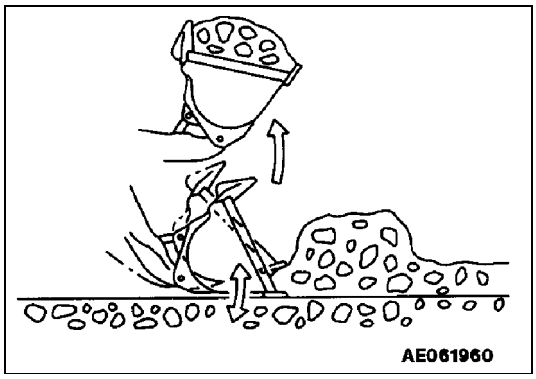
1. Set the bucket edge in a slightly face down position.



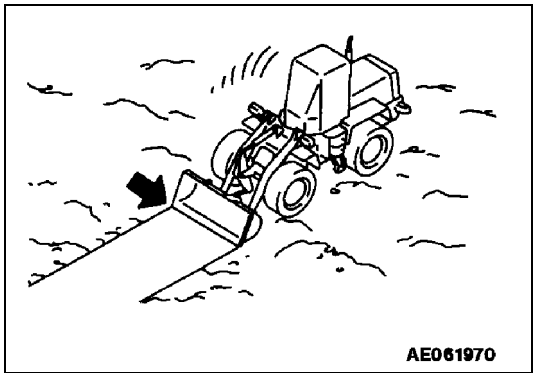
2. Drive the machine forward and operate the lift arm control lever forward to cut a thin layer of the surface each time when excavating the soil.



3. Operate the lift arm control lever slightly up and down to reduce the resistance when driving the machine forward. When digging with the bucket, avoid imposing the digging force onto only one side of the bucket.



12.10.2 LEVELING OPERATIONS



NOTE:
Always operate the machine in reverse when performing leveling operations.

If it is necessary to perform the leveling operations when traveling forward, do not set the bucket dumping angle to more than 20

1. Scoop the soil into the bucket. Move the machine backward while spreading the soil from the bucket, little by little.
2. Go over the spread soil with the bucket teeth touching the ground. Level the ground by back-dragging.
3. After scooping more soil into the bucket, put the lift arm in float and level the bucket at ground level. Smooth the ground by moving backwards.

12.10.3 PUSHING OPERATION

NOTE:
Never set the bucket to the DUMP position when performing the pushing operation.

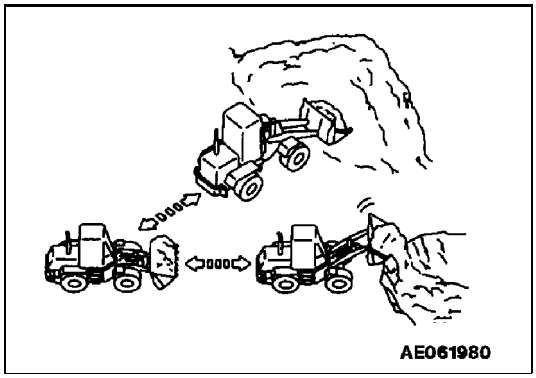
When performing the pushing operations, set the bottom of the bucket parallel to the ground surface.

12.10.4 LOAD AND CARRY OPERATIONS

WARNING

When carrying a load, lower the bucket to lower the center of gravity while 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 2-72.**

12.10.5 LOADING OPERATIONS

Select the method of operation that will give the minimum amount of turning and travel and provide the most efficient method for the jobsite.

WARNING

Select the method of operation that will give the minimum amount of turns and travel, providing the most efficient method for the jobsite.

NOTE

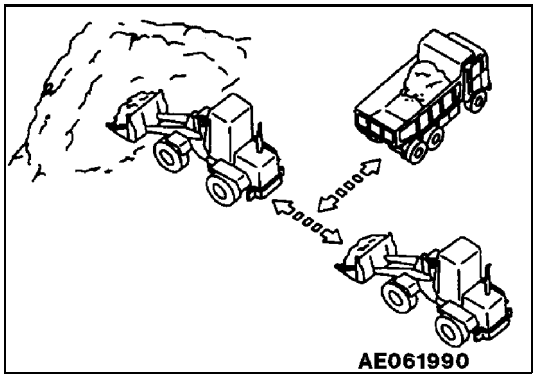
If the tires slip, the life of the tires will be reduced. Thus, avoid slipping or spinning the tires during operation.

Avoid excess 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.

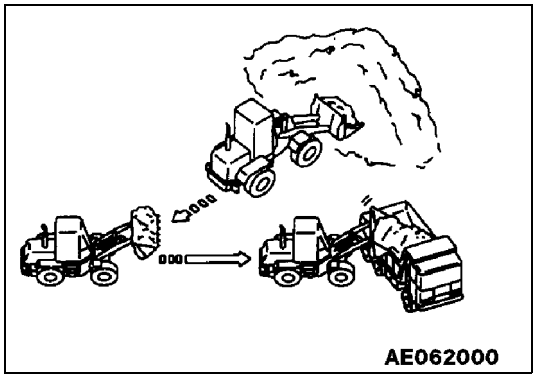


V-SHAPE LOADING

Position the dump truck so that the direction of approach of the wheel loader is approximately 60
to 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.

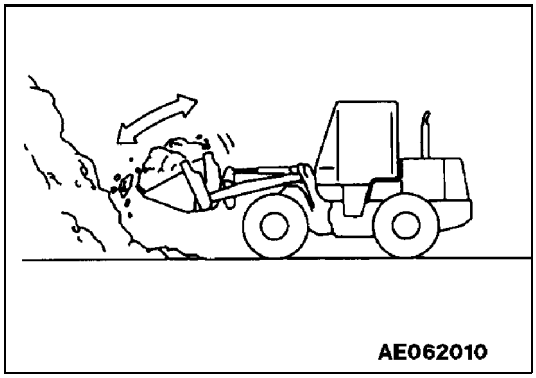
When loading a full bucket and raising it to maximum height, first shake the bucket to stabilize the load before raising the bucket This will prevent the load from spilling to the rear.



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.

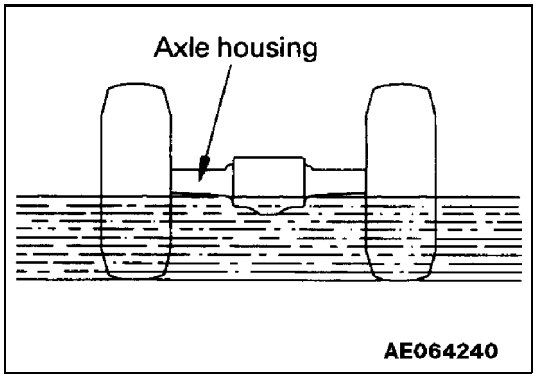
Do not set the bucket to the DUMP position when performing piling-up operations.



12.11 PRECAUTION 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 BRAKES DO 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

If the service brake is used too frequently when traveling downhill, the brake may overheat and be damaged. To avoid this problem, downshift to a lower range and make full use of the braking force of the engine.

When braking, use the right brake pedal.

If the speed control lever is not placed in a proper speed position, the torque converter oil may overheat. If it overheats, place the speed control lever in the next lower gear to lower the oil temperature.

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

IF THE ENGINE STOPS

If the engine stops on a slope, fully depress the right brake pedal. 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.

12.11.4 PRECAUTIONS WHEN DRIVING THE MACHINE

When the machine travels at high speed for a long distance, the tires become extremely hot. This situation causes premature tire wear. Thus, avoid high-speed, long-distance trips. If the machine must be driven for a long distance, take the following precautions.

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

Before driving the machine, perform 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): (3.5 kg/cm^2, 49.7 psi)

Speed: 14 km/h (8.7 mph)

Check the tire pressure before starting the trip, 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 the bucket empty.

Never put dry ballast in the tires when traveling.

12.12 ADJUSTING THE WORK EQUIPMENT POSTURE

WARNING

Stop the machine on flat ground and put the 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 makes it possible to set the bucket so that it automatically stops at the desired lifting height (lift arm higher than horizontal) and the bucket positioner makes it possible to set the bucket so that it automatically stops at the desired digging angle.

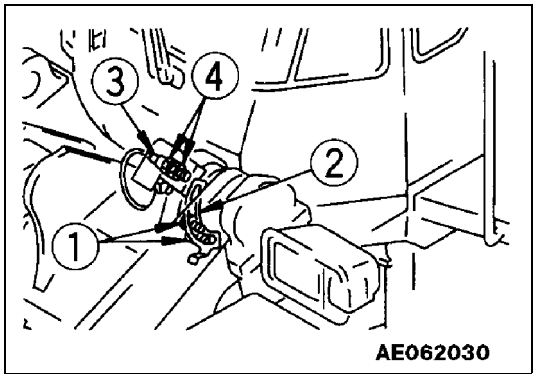
The setting can be adjusted to match the working conditions.

12.12.1 ADJUSTING THE 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 the two bolts (1), and adjust the plate (2) so that the bottom edge aligns with the center of the sensing surface of the proximity switch (3). Tighten the nuts to the plate.

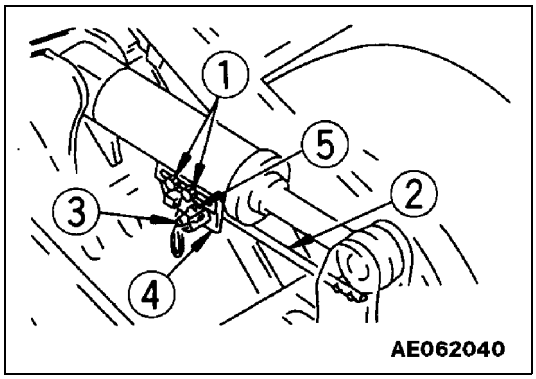
3. Loosen the two nuts (4) and make a clearance from 3 to 5 mm (0.12 to 0.20 in) between the plate (2) and the sensing surface of the proximity switch (3). Tighten the nuts.



Tightening torque: 17.2 ± 2.5 N

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

12.12.2 ADJUSTING THE 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 the two bolts (1) and adjust the mounting bracket (4) of the proximity switch so that the rear tip of the angle (2) aligns with the center of the sensing surface of the proximity switch (3). Tighten the bolts to hold the bracket in position.

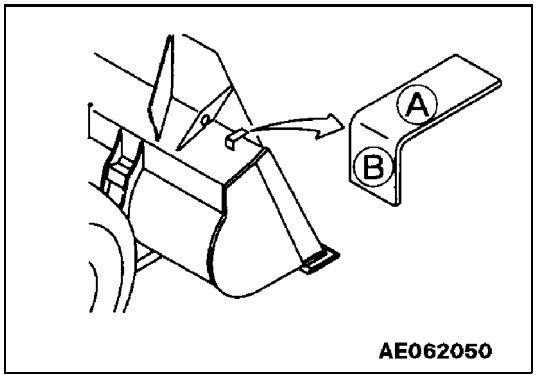
3. Loosen the two nuts (5) and adjust them to make from 3 to 5 mm (0.12 to 0.20 in) clearance between the bar (2) and the sensing surface of the proximity switch (3). Tighten the nuts.

Tightening torque: 17.2 ± 2.5 N

4. After adjusting, start the engine and raise the lift arm. Operate the bucket control lever to the DUMP position. Operate the lever to the TILT position and check that the bucket control lever automatically returns to HOLD when the bucket reaches the desired angle.

12.12.3 BUCKET LEVEL INDICATOR

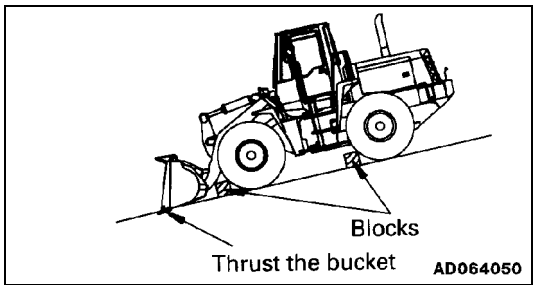
An angle iron welded to the rear of the bucket provides the operator with a visible indication of the blade angle. Side A is parallel to the cutting edge, making side B 90 g edge.



12.13 PARKING MACHINE

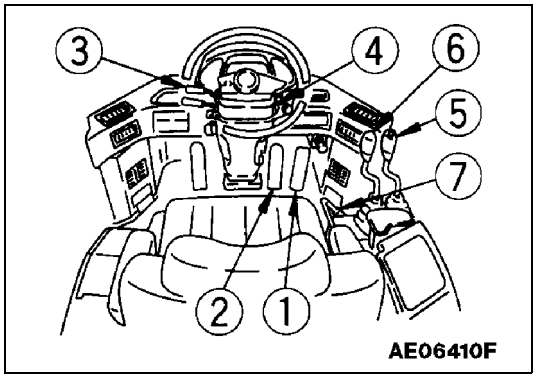
WARNING

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

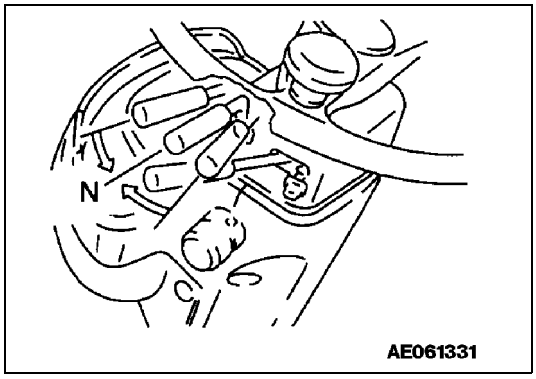


NOTE:
Never use the parking brake switch to brake the machine when traveling except in an emergency. Apply the parking brake only after the machine has stopped.

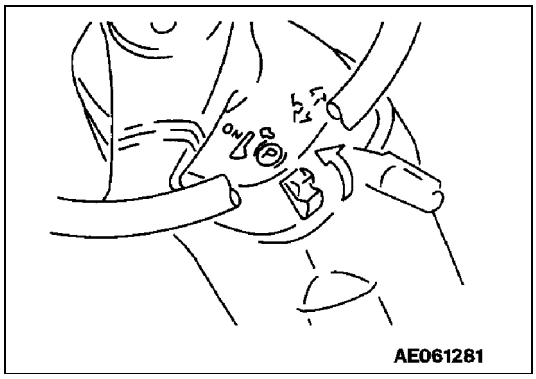
1. Release the accelerator pedal (1), and depress the brake pedal (2) to stop the machine.



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

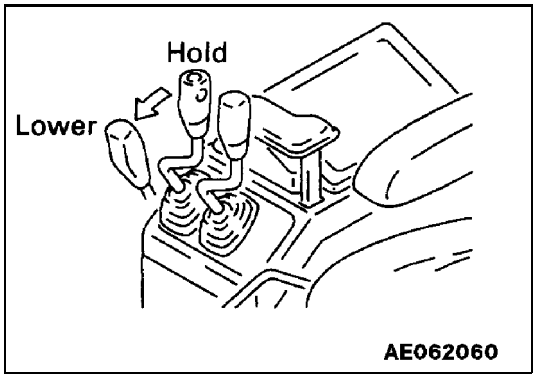


3. Turn the parking brake switch (4) ON to apply the parking brake.

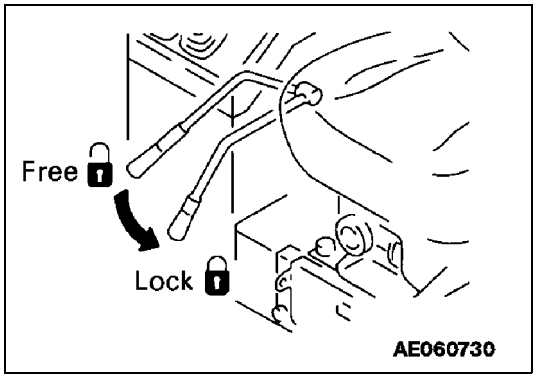


REMARKS
When the parking brake is applied, the transmission automatically returns to neutral.

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



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



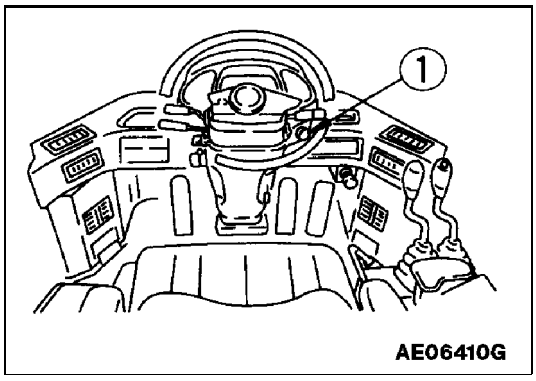
12.14 CHECKS AFTER COMPLETION OF OPERATION

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 midrange speed to allow the engine to cool down before stopping it.

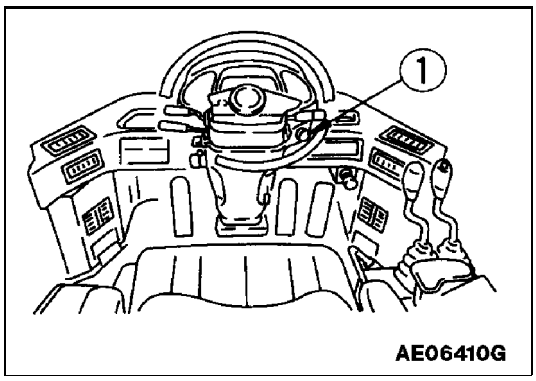
12.15 STOPPING THE ENGINE

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, EXCEPT for an emergency. If the engine has overheated, run it at medium speed to allow it to cool gradually. Once cooled down, stop the engine.

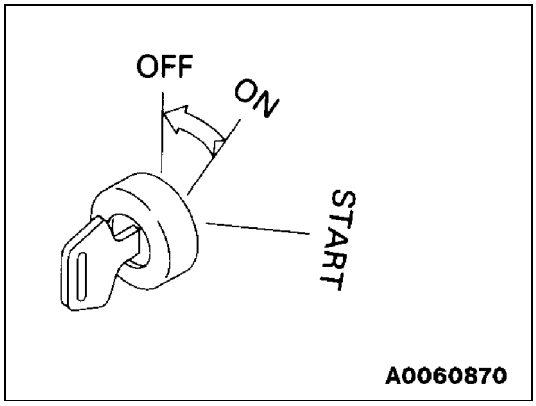
1. Run the engine at low idle for about 5 minutes to allow it to gradually cool down.



2. Turn the key in the starting switch (1) to the OFF position and stop the engine.



3. Remove the key from the starting switch (1) .



12.16 CHECK AFTER STOPPING THE ENGINE

1. Walk around the machine and check the work equipment, body work, and undercarriage and check for oil and water leaks. If any leaks exist, repair them.

2. Fill the fuel tank.

3. Remove any waste paper or leaves from inside the engine compartment because they could cause a fire.

4. Remove any mud stuck to the undercarriage.

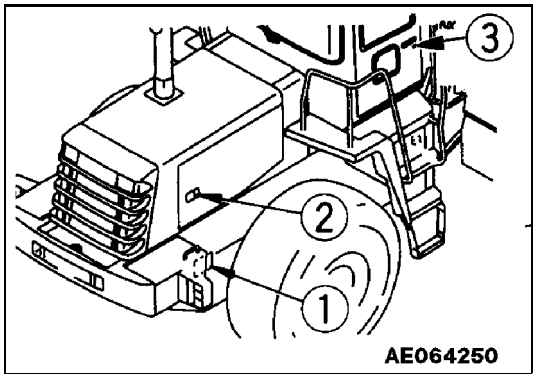
12.17 LOCKING

Always lock the following places.

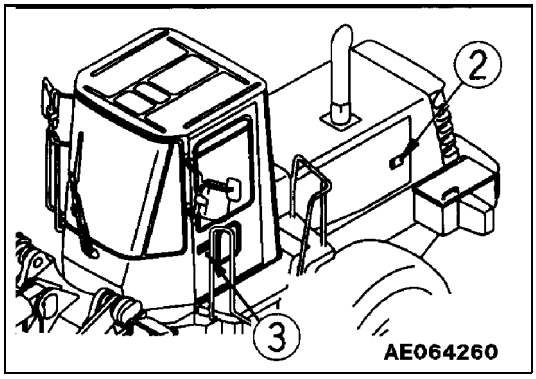
(1) = Fuel tank filler cap

(2) = Engine side panel (left, right)

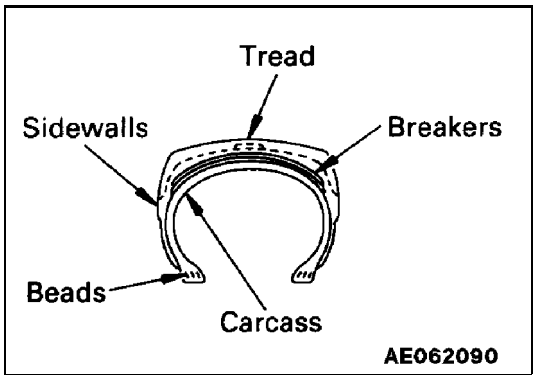
(3) = Cab door



REMARKS
The starting switch key is used also for the locks at locations 1, 2, and 3.



12.18 HANDLING THE TIRES



12.18.1 PRECAUTIONS WHEN HANDLING TIRES

If any of the following defects are found in a tire, replace it with a new one.

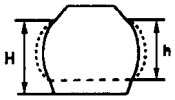
Broken or bent bead wire, or the tire is deformed.
Excessive wear and the carcass ply, excluding the breaker, is exposed for more than one-fourth of the circumference.
Separated tire layers.
Radial cracks reach the carcass.
Measure the tire pressure before driving the machine.

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 the pressure is too high, it will cause tire cuts and shock bursts. To prevent these problems, adjust the tire pressure, according to the table on the next page.

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



As a guideline, the front tire's deflection ratio (deflection/free height) when:

Carrying a normal load (lift arm horizontal): about 15-25%
Digging (rear wheels off ground): about 25 -35%

When checking the tire inflation pressure, check also for small scratches or tire peeling, for nails or pieces of metal that may cause punctures, and for any abnormal wear. Removing stones and rocks from the operating area and maintaining the surface extends tire life.

TIRE PRESSURE VARIABLES

When operating the machine on various surfaces and operations, adjust the tire pressure accordingly:

Normal road surfaces, rock digging: high end of range in air pressure chart
Stockpile operations, soft ground: average air pressure in air pressure chart
Sand, not much digging force: low end of range in air pressure chart

If tire deflection is excessive, raise the inflation pressure within the limits given in this table (see deflection ratio).

Tire size (pattern)	Ply rating	Inflation pressure (kg/cm^2)			
		Soft or sandy ground	Normal road		Shipped from factory
			Stockpile	Digging	
20.5-25 (L. rock)	16	2.6-3.8	2.8-4.5	2.8-4.5	Front tire: 3.5 Rear tire: 3.5
20.5-25 (L. rock)	20	2.6-3.8	2.8-4.5	2.8-4.5	
20.5-25 (L. traction)	16	2.6-3.8	2.8-4.5	2.8-4.5	
23.5-25 (L. traction)	20	2.6-3.8	2.8-4.5	2.8-4.5	
23.5-25 (L. rock)	12	—	2.6-3.6	2.6-3.6	Front tire: 3.1 Rear tire: 3.1
23.5-25 (L. traction)	12	2.4-3.6	2.6-3.6	2.6-3.6	

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

PRECAUTION WITH LOAD AND CARRY METHOD

When traveling continuously with load and carry operations, choose the correct tires to match the operating conditions, or the operating conditions to match the tires. Failing to match the tires and condition could result in damaged tires. Contact your distributor or tire dealer when selecting tires.

13. TRANSPORTATION

13.1 LOADING, UNLOADING WORK

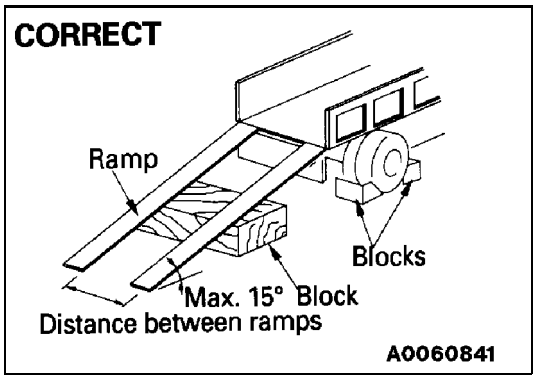
WARNING

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 fairly long distance between the road shoulder and the machine.
Remove the mud from the undercarriage to prevent the machine from slipping to the side on the 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 transporting the machine, observe all the related laws and regulations, and always assure safety.

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

1. Properly apply the brakes on the trailer and insert the blocks beneath the tires to ensure thatit does not move. Then align the ramps with the centers of the trailer and the machine. Be sure that the two sides are level with one another. If the ramp sags appreciably, reinforce it with blocks, etc.

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



REMARKS
When the transmission cut-off switch is set to the off position, 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 LOADING PRECAUTIONS

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

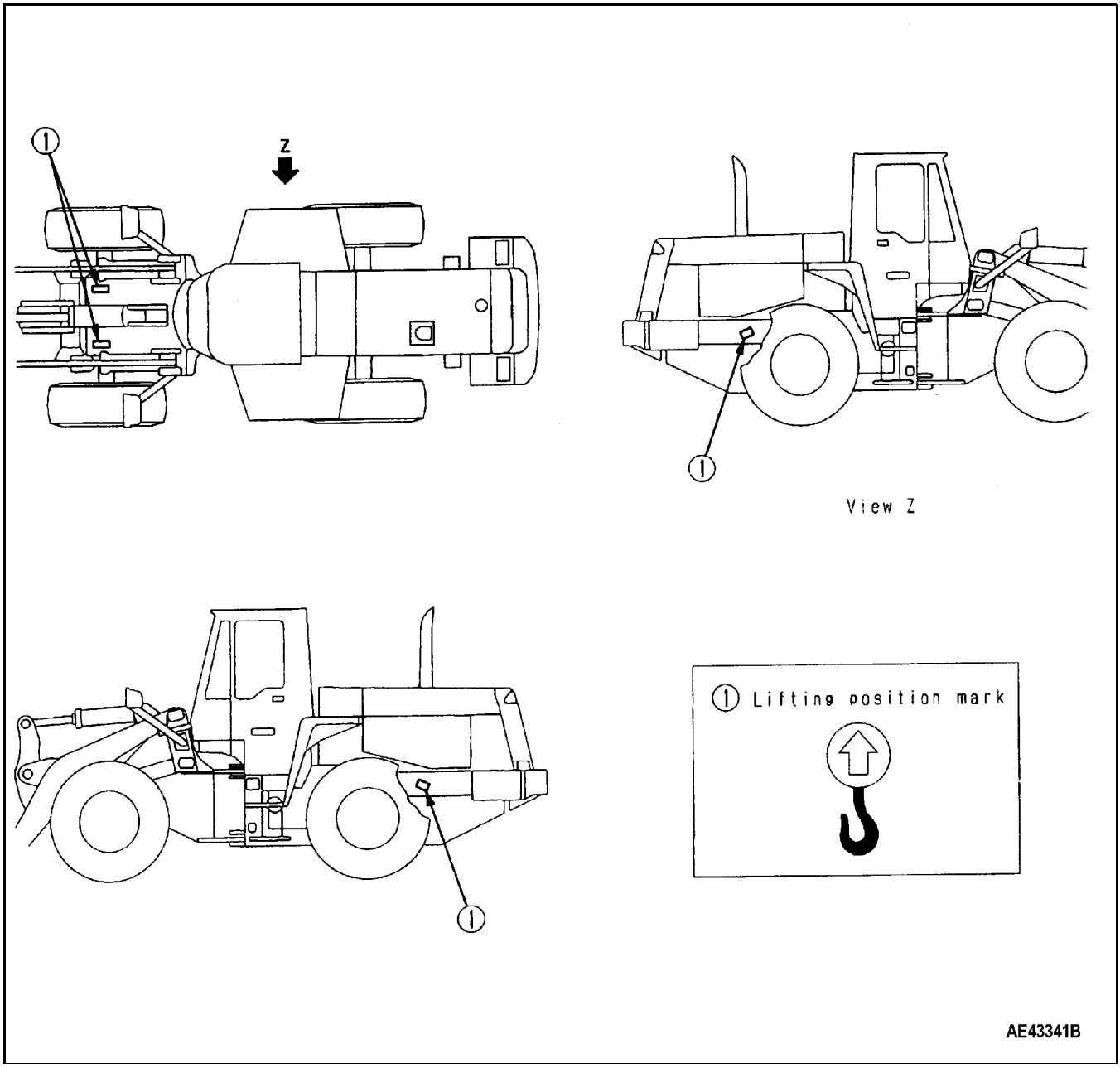
1. Lower the work equipment slowly.
2. Apply the safety lock to lock all the control levers securely.
3. Turn the starting switch to the OFF position and stop the engine. Remove the key from the starting switch.
4. Lock the front and rear frame with the safety bar.
5. Put the blocks in front of and behind the wheels. Secure the machine with chains or rope to prevent the machine from moving during transportation.
6. Always retract the cab radio antenna fully.

13.3 LIFTING THE MACHINE

⚠ WARNING

If the wire rope is not fitted correctly while lifting the machine, it may fall and cause serious injury or death.
Raise the machine 100-200 mm (3.9 - 7.9 in.) from the ground. After checking that the machine is horizontal and no slack exists in the wire rope, continue lifting the machine.
Before lifting the machine, always stop the engine and lock the brakes.
A qualified crane operator must perform all lifting operations.
Never raise the machine with any worker on it.
Always ensure that the wire rope used for lifting the machine is ample strength for the weight of the machine.
Never try to lift the machine at a position other than the one specified on the next page.

13.3.1 POSITION FOR STICKING THE LIFTING POSITION MARK



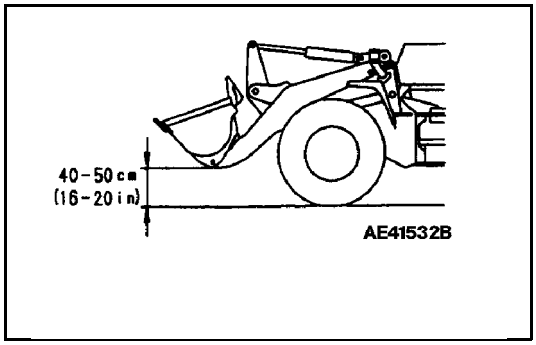
13.3.2 WEIGHT TABLE

	Operating Weight	Front wheel load	Rear wheel load	Center of gravity (from front axle)
WA380-3	17,750 kg (39, 139 lb.)	8,235 kg (18,158 lb.)	9,515 kg (20,980 lb.)	1,715 mm (5 ft. 7 in.)

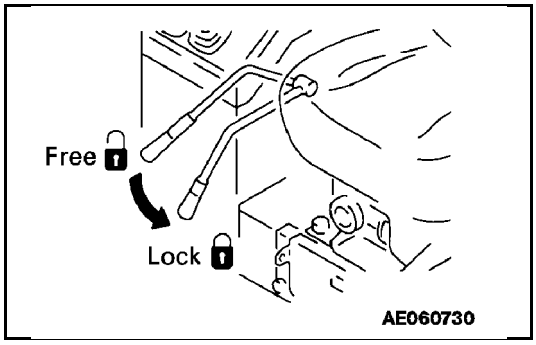
13.3.3 LIFTING PROCEDURE

Lifting work can be performed only for machines with lifting marks. Before starting the lifting operation, stop the machine in a horizontal place and then do the following.

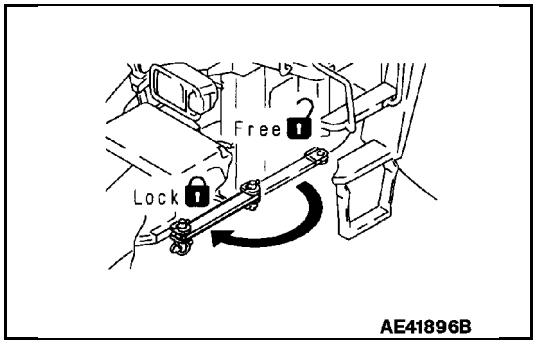
1. Start the engine, make sure that the machine is horizontal, then set the work equipment to the travel posture. For details, **See 12.4 MOVING MACHINE on page 2-52.**



2. Move the work equipment safety lock lever to the LOCK position.



3. Stop the engine and check that the area around the operator's compartment is safe. With the safety bar, lock the rear and front frame so they do not articulate.

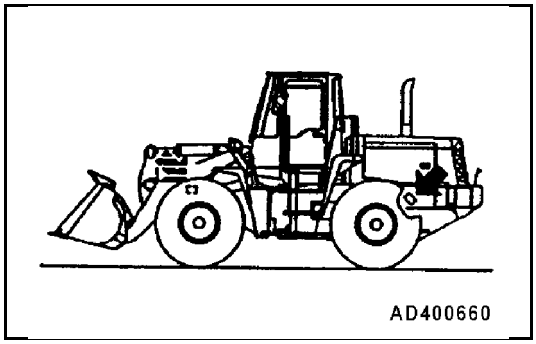


4. Fit the lifting equipment to the lifting hooks (marked by the lifting mark) at the front of the front frame and at the rear of the rear frame.

5. When the machine leaves the ground, stop for a moment and wait for the machine to stabilize, and then continue the lifting operation.

⚠ WARNING

When lifting the machine, check that no hydraulic oil leaks exist.



13.4 TRANSPORTATION PRECAUTIONS

WARNING

When determining the transportation route, the machine's width, height, and weight must be considered.

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

14. COLD WEATHER OPERATION

14.1 LOW TEMPERATURE PRECAUTIONS

14.1.1 FUEL AND LUBRICANTS

Change to fuel and oil with low viscosity forall components. For details of the specified viscosity,**See 14.1.1 USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 2-78.**

14.1.2 COOLANT

WARNING

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

NOTICE

Never use methanol, ethanol, or propanol-based antifreeze.
Never use any water-leak preventative agent, regardless if it is used by itself or mixed with an antifreeze.
Do not mix one antifreeze brand with another brand.

For details of the antifreeze mixture requirements, See 20.6 COOLANT SPECIFICATIONS on page 3-12.

14.1.3 BATTERY

WARNING

To avoid gas explosions, do not bring fire or sparks near the battery.
Battery electrolyte is dangerous. If it gets in your eyes or on your skin, wash it off with large amounts of water, and consult your doctor.

When the ambient temperature drops, the battery's capacity will also drop. If the battery's charge ratio is low, the battery electrolyte may freeze. Maintain the battery charge as close to 100 percent as possible. Insulate the battery from the cold temperatures so that the machine will start easily the next morning.

REMARKS

Measure the specific gravity and calculate the rate of charge from the following conversion table.

Rate of charge	Temperature of fluid				
	20 (68	0 (32	-10 (14	-20 (-4	-30 (-22
100%	1.28	1.29	1.30	1.31	1.32
90%	1.26	1.27	1.28	1.29	1.30
80%	1.24	1.25	1.26	1.27	1.28
75%	1.23	1.24	1.25	1.26	1.27

14.2 PRECAUTIONS AFTER WORK COMPLETION

To prevent mud and water from freezing on the machine, making it impossible for the machine to move the next morning, observe the following precautions.

Mud and water in and on the machine should be completely removed.
Park the machine on hard, dry ground or on wooden boards. The boards will help protect the machine from freezing to the soil.
Drain any water collected in the fuel system to prevent it from freezing.
Because the battery capacity drops as the temperature drops, cover the battery. Or, remove it from the machine and store it in a warm place overnight, and then reinstall it in the morning.

14.3 AFTER COLD WEATHER

When the season changes and the weather is warmer, proceed as follows.

Replace the fuel and oil with the specified viscosity of oil. For details, **See 14.1.1 USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 2-78.**

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

15. LONG-TERM STORAGE

15.1 BEFORE STORAGE

When putting the machine in storage for a long time, proceed as follows.

After every part is washed and dried, house the machine in a dry building. If the machine must be left outdoors, park it on well-drained concrete and cover it with canvas, etc.
Completely fill the fuel tank, lubricate the machine, and change the oil before storage.
Apply a thin coat of grease to the metal surface of the hydraulic piston rods.
Disconnect the battery negative terminal and cover it. Or, remove the battery from the machine and store it separately.
If the ambient temperature is expected to drop below 0
After applying the safety locks to the bucket control lever, lift arm control lever, and directional lever, apply the parking brake.

⚠ WARNING

Provide necessary ventilation, if the machine is operated indoors.

15.2 DURING STORAGE

Operate the engine and move the machine a short distance once a month. This step coats the parts and surfaces with a new oil film. Before operating the work equipment, wipe off the grease on the hydraulic piston rod.

15.3 AFTER STORAGE

NOTE:
If the machine is stored without the monthly rust prevention operation, consult your distributor for service.

Perform the following procedures after removing the machine from storage.

Wipe off the grease from the hydraulic cylinder rods.
Add oil and grease to all places.

16. TROUBLESHOOTING

16.1 WHEN THE MACHINE RUNS OUT OF FUEL

⚠ WARNING

Before cranking the engine, ensure that the area around the engine is safe.

If the machine runs out of fuel, add the fuel and bleed the air from the fuel system before starting the engine.

PROCEDURE FOR BLEEDING AIR
The air can be quickly bled from the system, if the fuel tank is completely filled with fuel.

Turn the key in the starting switch to the start position and crank the engine for 15-20 seconds. Wait 2 minutes before repeating this procedure so that the starter motor can cool. Repeat this cycle 2 - 3 times. Do not turn the starting motor for more than 20 seconds any one time.

16.2 TOWING THE MACHINE

⚠ WARNING

Towing the machine the wrong way could result in serious injury or death.

NOTE:

Towing is for moving the machine to a place where repairs can be performed, not for moving it long distances. Do not tow the machine long distances.
For detailed procedures for towing a disabled machine, contact your distributor.

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

When releasing the brakes, put blocks under the wheels to prevent the machine from moving. If the wheels are not blocked, the machine could suddenly move.
When towing a machine, tow it at a speed of fewer than 2 km/h (1.24 mph), and a distance of a few meters to a place where repairs can be performed. Tow the machine only in emergencies. If the machine must be moved 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 the 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 hill, use a tow rope or bar of a strength of at least 1.5 times the weight of the machine being towed.
Keep the tow rope angle as small as possible. Keep the angle between the center lines of the two machines to within 30
Moving the machine suddenly applies an excessive load to the tow rope or bar, and it could snap. Always move the machine slowly at a fixed 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 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 to prevent either machine from loosing control and turning over.
Towing may be performed under many different conditions. Thus, it is impossible to determine all the towing requirements for all possibilities. Towing on flat horizontal roads requires minimum rimpull while towing on slopes or uneven road surfaces requires maximum rimpull.

16.2.1 WHEN ENGINE CAN BE USED

If the transmission and steering wheel can be operated and the engine is running, it is possible to tow the machine out of the mud.
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 WHEN ENGINE CANNOT BE USED

When towing a machine with the engine stopped, use the following procedure.

1. Because the transmission oil does not lubricate thesystem, remove the front and rear drive shafts. If necessary, block the tires to prevent the machine from moving while removing the drive shafts.

2. When the steering cannot be operated, remove the steering cylinder.

3. Even if the brakes are in good condition, the braking force is reduced each time the pedal is depressed. After a specified number of brake applications, the brakes will not work.

4. Connect the towing equipment securely. When performing 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. Remove the blocks from under the tires and tow the machine.

16.2.3 RELEASING THE PARKING BRAKE

WARNING

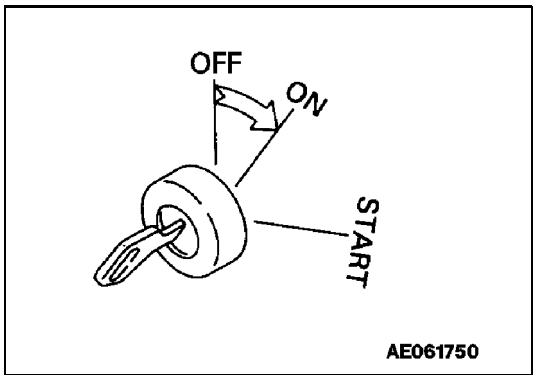
When releasing the parking brake, stop the machine on a flat surface and check that the surroundings are safe. In emergencies or when the parking brake must be released on a hill, block the tires carefully before releasing the brake.
When the parking brake is released, no braking force can be applied. Check that the situation is safe before moving the machine.

If the engine will not run, use the following method to release the parking brake and tow the machine.

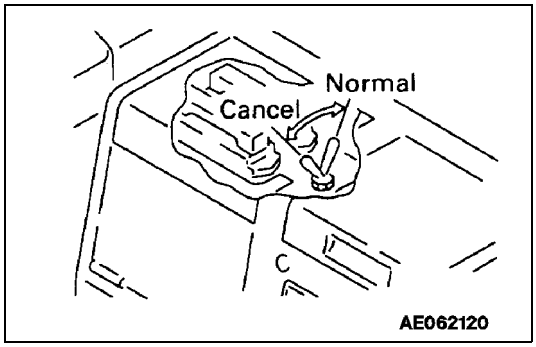
1. METHOD OF RELEASING BRAKE BY USING EMERGENCY PARKING BRAKE CANCEL SWITCH

If the brake accumulator pressure is high, perform the following steps.

1. Turn the starting switch to the ON position.



2. Turn the emergency parking brake switch to the CANCEL position. While doing this step, 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:

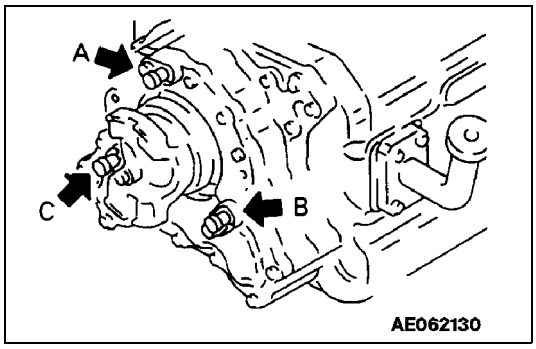
Normally, keep the switch at the NORMAL position to actuate it.

If the brake accumulator pressure is low, the parking brake caution lamp will not go out, or the alarm buzzer will sound with a continuous beep. If this situationhappens, follow the instructions in METHOD FOR CANCELING WITH ADJUSTMENT SCREW to release the brake.

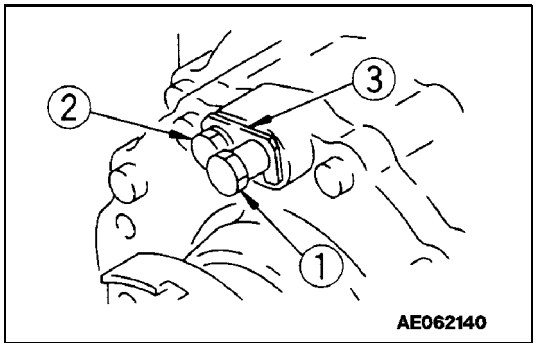
2. METHOD FOR CANCELING WITH ADJUSTMENT SCREW

If the brake pressure is low, do the following steps.

1. Loosen the adjustment screws (1) and the bolts (2) at A, B, C at the front of the transmission case.



2. After rotating the lock plate (3) to release the lock, tighten the adjustment screw (1) until it stops.
3. Performing this step simultaneously at all three places (A, B, C), releases the parking brake.



16.2.4 EMERGENCY TRAVEL OPERATION

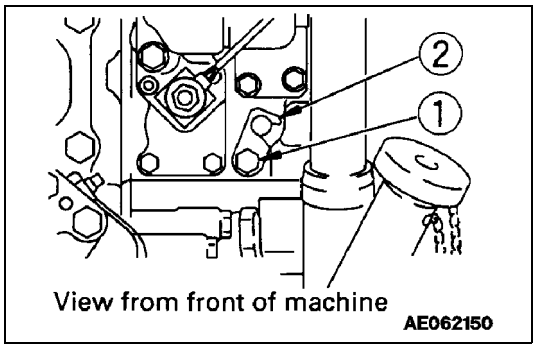
The normal gear shift operation is performed by electric signals. In the event of an electrical system failure and the machine does not move, use the following procedure to move the machine.

⚠ WARNING

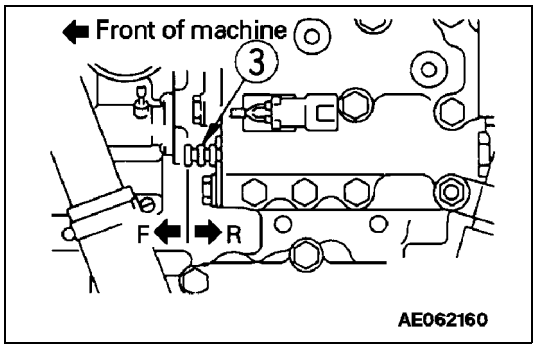
When performing this operation, always keep the engine stopped, except when starting the machine.
When starting the engine, always depress the brake pedal and check that the surrounding area is safe.
This operation enables the machine to be driven under its own power to the nearest repair shop when there is an electrical system failure. This operation must not be used for any other purpose.
Always keep the speed lever at the normal position
Install the plate (2) securely, ensuring that the spool does not come out when traveling.

Always request that your distributor perform the emergency travel operation, or consult your distributor before performing it yourself.

1. Set the parking brake switch to the ON position and set the speed lever to the neutral position.
2. After loosening the bolt (1), remove the plate (2).



3. Pull out the spool to the F position, or push it into the R position. The transmission range for this operation is 2nd.
4. After resetting, set the spool to the neutral position, then install the plate (2) and the bolt (1) to hold it into position.
5. Depress the brake pedal, start the engine, release the parking brake and let the brake pedal out slowly.



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 the engine, use a damp cloth to wipe off the dust atop the battery.
The battery generates hydrogen gas, so there is danger of explosion. Do not bring lighted cigarettes near the battery, or do anything that will cause sparks.
Battery electrolyte is dilute sulfuric acid, and it will attack your clothes and skin. If electrolyte gets on your clothes or on your skin, wash it off immediately with lots of water. If electrolyte gets in your eyes, wash it out with fresh water, and consult a doctor immediately.
When handling a battery, always wear protective goggles.
If the terminals are loose, there is danger that the defective contact may generate sparks that will cause an explosion. When installing the terminals, install them tightly.
When removing or installing the battery, check which terminal is the positive (+) terminal and which is the negative (-).

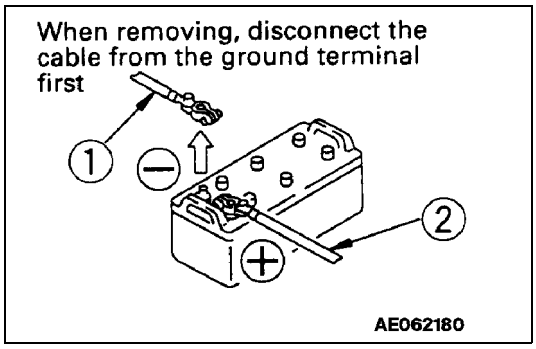
16.3.1 BATTERY INSTALLATION AND REMOVAL

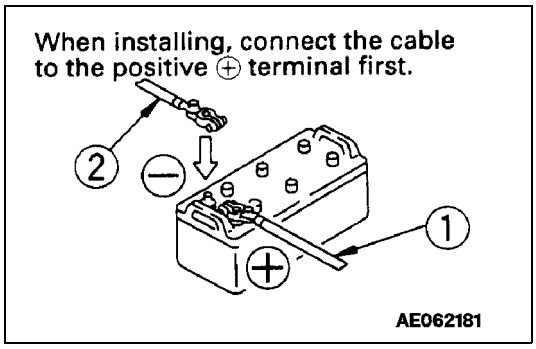
When starting the engine with a booster cable, do the following:

When removing the battery, first disconnect the cable from the ground terminal (normally, from the negative (-) terminal). When installing a battery, install the positive (+) terminal first. That way, if a tool touches the cable connecting the positive terminal and the chassis, there is no danger that sparks will ignite the hydrogen gas.

When installing the battery, connect the positive cable first and the ground cable last.

REMARKS
The batteries are on both sides of the rear of the machine. The battery used for the ground is on the left side of the machine.





16.3.2 PRECAUTION FOR CHARGING THE BATTERY

CHARGING THE BATTERY WHEN MOUNTED ON THE MACHINE

Before charging the battery, disconnect the negative (-) battery cable from the battery. This action prevents high voltage from damaging the alternator.

While charging the battery, remove all battery vents for satisfactory ventilation To avoid gas explosions, do not bring fire or sparks near the battery.

If the electrolyte temperature exceeds 113
charging the battery temporarily.

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

Do not mix the cables (positive (+) to negative (-)), or the alternator could be damaged.

When performing any service to the battery besides checking the electrolyte level or measuring the specific gravity, disconnect the cables from the battery.

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.

16.3.3 STARTING THE ENGINE WITH BOOSTER CABLE

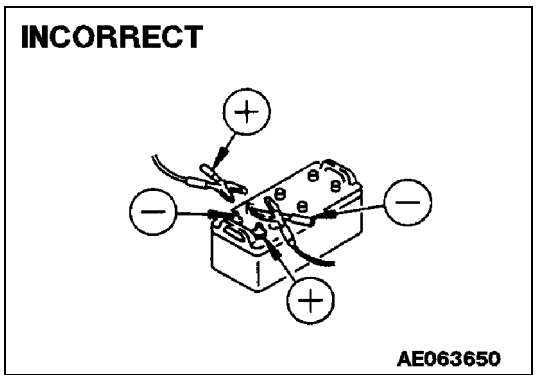
When starting the engine with booster cables, perform the following steps:

WARNING

When connecting the booster cables, never touch the positive (+) from one battery to the negative (-) terminal of another battery.
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 step 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. Making the last connection generates sparks, so make the last connection as far as possible from the battery. However, avoid connecting the cable to the work equipment, as electrical conduction is poor.
Use care when removing the cables from the machine that has been started. Prevent the cable ends from contacting each other or the machine to avoid an explosion.

NOTE
The size of the booster cable and clip 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.

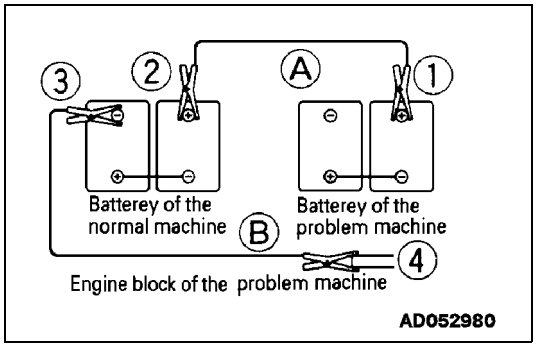
REMARKS:
The batteries are on both sides at the rear of the machine. The battery used for the ground is on the left side of the machine.



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 the 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 2 minutes or so.

DISCONNECTING THE BOOSTER CABLE

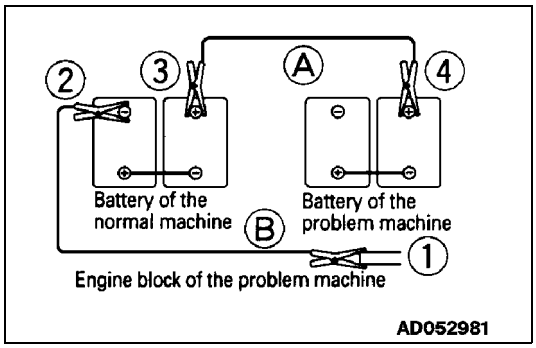
After the engine has started, disconnect the booster cables in the reverse order in which they were connected.

1. Remove one clip of the booster cable (B) from the engine block of the problem machine.

2. Remove the other clip of the booster cable (B) from the negative (-) terminal of the normal machine.

3. Remove one clip of the booster cable (A) from the positive (+) terminal of the normal machine.

4. Remove the other clip of the booster cable (A) from the positive (+) terminal of the problem machine.



16.4 OTHER TROUBLE

16.4.1 ELECTRICAL SYSTEM

( ): Always contact your distributor when dealing with these items.
In cases of abnormalities or causes that 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	Defective wiring Improper fan belt tension	(Check, repair loose terminals, disconnections) Adjust the fan belt tension For details, **See 24.8.5 CHECK TENSION OF DRIVE BELT on page 3-58.**
Lamp flickers while engine is running		
Even when the engine is running, the charge caution pilot lamp does not go out	Defective alternator Defective wiring Improper fan belt tension	(Replace) (Check, repair) Adjust fan belt tension. **See 24.8.5 CHECK TENSION OF DRIVE BELT on page 3-58.**
Abnormal noise is generated from the alternator	Defective alternator	(Replace)
Starting motor does not turn when the starting switch is turned ON	Defective wiring Insufficient battery charge Defective starting motor	(Check, repair) Charge (Replace)
Pinion of starting motor keeps going in and out	Insufficient battery charge	Charge
Starting motor turns the engine sluggishly	Insufficient battery charge Defective starting motor	Charge (Replace)
Starting motor disengages before the engine starts	Defective wiring Insufficient battery charge	(Check, repair) Charge
Preheating monitor does not light	Defective wiring Defective glow relay, glow controller, water temperature sensor Defective preheating pilot lamp	(Check, repair) (Replace) (Replace)
When engine is stopped, charge caution pilot lamp does not light up (starting switch at ON position}	Defective wiring Defective monitor	(Check, repair) (Replace)

16.4.2 CHASSIS

( ): Always contact your distributor when dealing with these items.
In case of abnormalities or causes that are not listed below, please contact your distributor for repairs.

Problem	Main causes	Remedy
TRANSMISSION		
Engine is running but machine doesn't move	Parking brake is applied Directional lever is improperly shifted Lack of transmission oil	Release parking brake Shift lever properly Add oil to specified level. **See 24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL on page 3-28.**
Even when the engine is running at full power, the machine only moves slowly and lacks power.	Lack of transmission oil Screen is clogged	Add oil to specified level. **See 24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL on page 3-28.** (Disassemble and clean)
Oil overheats	Incorrect oil level 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. **See 24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL on page 3-28.** Place in correct speed range Reduce stall time (Check engine)
Noise	Lack of oil	Add oil to specified level. **See 24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL on page 3-28.**
AXLE		
Noise generated	Lack of oil	Add oil to specified level. **See 24.2.3 CHECK AXLE OIL LEVEL, ADD OIL on page 3-29.**

CHASSIS continued (16.4.2)

Problem	Main causes	Remedy
BRAKE		
Brake is not applied when pedal is depressed	Worn disc Defective hydraulic system Lack of oil Air in brake line	(Replace disc) Add oil to specified level **See 24.5 EVERY 100 HOURS SERVICE on page 3-41.** Bleed air
Brake drags or remains applied	Vent hole of brake valve clogged	Clean
Brakes squeal	Worn disc Large amount of water in axle oil Axle oil deteriorated due to brake overuse	(Replace disc) Change axle oil Change axle oil
PARKING BRAKE		
Braking effect is poor	Worn disc	(Replace disc)
Brake drags or remains applied	Lack of transmission oil Screen is clogged	Add oil to specified level. **See 24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL on page 3-28.** (Disassemble and clean)
STEERING		
Steering wheel is heavy	Defective hydraulic system Lack of oil	Add oil to specified level. **See 24.5 EVERY 100 HOURS SERVICE on page 3-41.**
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. **See 24.5 EVERY 100 HOURS SERVICE on page 3-41.**

CHASSIS continued (16.4.2)

Problem	Main causes	Remedy
HYDRAULIC SYSTEM		
Lack of lifting power for bucket Bucket takes time to raise	Lack of oil Clogged hydraulic tank	Add oil to specified level. **See 24.5 EVERY 100 HOURS SERVICE on page 3-41.** Replace filter. **See 24.9.2 CHANGE OIL IN HYDRAULIC TANK, REPLACE FILTER ELEMENT on page 3-66.**
Excessive bubbles in oil	Low oil quality Low oil level Air in oil line	Replace with good quality oil Add oil to specified level. **See 24.5 EVERY 100 HOURS SERVICE on page 3-41.** Bleed air
Low hydraulic pressure	Low oil level, pump sucking air	Add oil to specified level. **See 24.5 EVERY 100 HOURS SERVICE on page 3-41.**
Irregular cylinder movement	Low oil level	Add oil to specified level. **See 24.5 EVERY 100 HOURS SERVICE on page 3-41.**

16.4.3 ENGINE

( ): Always contact your distributor when dealing with these items.
In case of abnormalities or causes that are not listed below, please contact your distributor for repairs.

Problem	Main causes	Remedy
Engine oil pressure caution pilot lamp	Engine oil pan oil level is low (sucking in air)	Add oil, **See 12.1 CHECK BEFORE STARTING on page 2-34.**
	Clogged air filter cartridge	Replace cartridge, **See 24.2 WHEN REQUIRED on page 3-26.**
	Defective tightening of oil pipe joint, oil leaks from damage parts	(Check, repair)
	Defective engine oil pressure sensor	(Replace sensor)
Steam is emitted from the top part of the radiator (pressure valve). Water temperature gauge is in the red range. Coolant temperature monitor lights up.	Cooling water level low, water leakage	Add coolant, repair, **See 12.1 CHECK BEFORE STARTING on page 2-34.**
	Loose fan belt	Adjust fan belt tension,**See 24.8.5 CHECK TENSION OF DRIVE BELT on page 3-58.**
	Dirt or scale accumulated in cooling system	Change cooling water, clean inside of cooling system, **See 24.9.1 COOLING SYSTEM, REPLACE COOLANT AND FLUSH on page 3-60.**
	Clogged radiator fin or damaged fin	Clean or repair, **See 24.2.5 CLEAN THE RADIATOR FINS on page 3-30.**
	Defective thermostat	(Replace the thermostat)
	Loose radiator filler cap (high altitude operation)	Tighten the cap or replace the packing
	Defective water level sensor	(Replace sensor)
Water temperature gauge is in the white range on the left	Defective thermostat	(Replace the thermostat)
	Defective monitor	(Replace)
Engine does not start when starting motor is turned	Lack of fuel	Add fuel,
	Air in the fuel system	Repair the place where the air is sucked in,**See 24.7 EVERY 500 HOURS SERVICE on page 3-48.**
	Defective fuel injection pump or nozzle	(Replace pump or nozzle)
	Starting motor cranks sluggishly	**See ELECTRICAL SYSTEM**
	Preheating pilot lamp does light up	
	Defective compression Defective valve clearance	(Adjust valve clearance)

ENGINE 16.4.3 (continued)

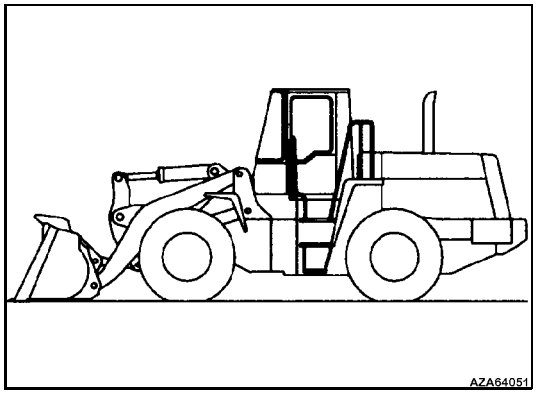
Problem	Main causes	Remedy
Exhaust is white or blue	Too much oil in the oil pan	Add oil to specified level. **See 12.1 CHECK BEFORE STARTING on page 2-34.**
	Improper fuel	Change to specified fuel
Exhaust gas occasionally turns black	Clogged air cleaner element	Clean or replace, **See 24.2 WHEN REQUIRED on page 3-26.**
	Defective nozzle	(Replace nozzle)
	Defective compression	(See defective compression above)
	Defective turbocharger	(Clean or replace turbocharger)
Combustion noise occasionally makes breathing sound	Defective nozzle	(Replace nozzle)
Abnormal noise generated (combustion or mechanical)	Low grade fuel being used	Change to specified fuel
	Overheating	Refer to "Water temperature gauge is in red range" as above
	Damage inside muffler	(Replace muffler)
	Excessive valve clearance	(Adjust valve clearance)

MAINTENANCE

17. GUIDES TO MAINTENANCE

Do not perform any inspection and maintenance operation not given in this manual.

Perform maintenance work on hard, flat ground.
Set to the inspection and maintenance posture.
Always perform an 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. This makes it easier to find parts causing problems. In particular keep grease fittings, breathers and oil level gauges clean and avoid foreign matters from getting in them.

Be careful of hot water and oil:
Draining hot oils and coolants and removing their filters immediately after the engine stops are hazardous. Allow the engine to cool. If the oil has to be drained when it is cold, warm up the oil to a suitable temperature (approx. 20 to 40

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 the places where dust is scarce to keep foreign materials away from oils.

Warning tag:
Attach the warning tag to the starting switch or other appropriate control lever to avoid someone who is not aware of the circumstances from starting the engine.
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 were heavy-duty operations are common, reduce the maintenance intervals and grease the machine more frequently.

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 CF-4 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 tank	ASTM D975 No. 2 (However ASTM D975 No. 1 is used for the winter season)
Radiator	50/50 mix 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 use given 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.

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
to a fuel that matches the temperature.

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 20.6 COOLANT SPECIFICATIONS on page 3-12.

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 anti-freeze 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 20.6 COOLANT SPECIFICATIONS on page 3-12.

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 3-22. However, when working in severe conditions, it is necessary to consider replacing the filters at shorter intervals 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.

18.2 FUEL INJECTION PUMP

⚠ WARNING

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.

18.3 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.

18.4 OUTLINE OF HYDRAULIC SYSTEM

During operation and immediately after operation is ended, the temperature of the hydraulic system still remains high. In addition, high hydraulic pressure is applied to the system. Take care when inspecting and maintaining the hydraulic system.

Stop the machine on level ground, lower the bucket to the ground, then set so that there is no pressure applied to the cylinder circuits.

Always stop the engine.

Immediately after operations, the hydraulic oil and lubricating oil are at high temperature and high pressure, so wait for the oil temperature to go down before starting maintenance. Even when the temperature goes down, the circuit may still be under internal pressure, sowhen loosening the plug or screw, or the hose joint, do not stand in front of the part. Loosen it slowly to release the internal pressure before removing it.

When carrying out inspection or maintenance of the hydraulic circuit, always bleed the air from the hydraulic tank to remove the internal pressure.

Periodic maintenance includes the inspection of the hydraulic oil level, replacement of the filter and refilling of hydraulic oil.

When a high pressure hose, etc. is removed, check the o-ring for damage. If necessary, replace it.

After the hydraulic filter element and strainer are cleaned or replaced, or after the hydraulic system is repaired or replaced or the hydraulic piping is removed, bleed air from the hydraulic circuit.

19. WEAR PARTS LIST

Wear parts such as the 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 change, genuine Komatsu parts of excellent quality should be used. When ordering parts, please check the part number in the parts book. Use the current parts book to write in the numbers.

( ): The items in parentheses are to be replaced at the same time.

Item	Part No.	Part Name	Qty.	Replacement frequency
Engine oil filter		Cartridge	1	Every 250 hours of service
Coolant corrosion resister		Cartridge	1	Every 500 hours of service
Fuel filter		Cartridge	1	Every 500 hours of service
Transmission oil filter		Element (O-ring) (O-ring) (O-ring) (Gasket)	1 (1) (1) (1) (1)	Every 500 hours of service
Transmission strainer		O-ring	1	Every 1000 hours of service
Hydraulic oil filter		Element (O-ring)	1 (1)	Every 2000 hours of service
Hydraulic tank breather		Element	1	Every 2000 hours of service
Air cleaner		Outer Element Inner Element	1 1	When required
Air conditioner air filter		Element	2	Every 100 hours of service
In-line fuel strainer		Strainer	1	Every 500 hours of service
Bucket cutting edges and mounting bolts		Center edge Side edge (Bolt) (Washer) (Nut)	1 2 (8) (8) (8)	When required

20. FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE

20.1 PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

It is not our policy to approve fuel, coolant and lubricants or to guarantee performance in service. The responsibility for the quality of the fuel, coolant and lubricant must remain with the supplier. When in doubt, consult your distributor. The specified fuel, coolant and lubricants recommended for this machine are as shown in the following table.

RESERVOIR	FLUID TYPE	AMBIENT TEMPERATURE -22 -4 14 32 50 68 86 104 -30 -20 -10 0 10 20 30 40	CAPACITY Specified	 Refill
Engine oil pan	Engine oil	SAE 30 SAE 10W SAE 10W-30 SAE 15W-40	22 5.9 gal	22 5.9 gal
Transmission case	Engine oil	SAE 10W	42 11.1 gal	40 10.6 gal
Hydraulic system			190 50.16 gal	138 36.43 gal
Front axle	Axle oil	See 20.4 DRIVE AXLE OIL SPECIFICATIONS on page 3-11	32 8.45 gal	32 8.45 gal
Rear axle				
Pins	Grease	NLGI No. 2	---	---
Fuel tank	Diesel fuel	ASTM D975 No. 2 ASTM D975 No. 1	287 75.77 gal	- -
Cooling system	Coolant	See 20.6 COOLANT SPECIFICATIONS on page 3-12.	53 14 gal	- -

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.

ASTM: American Society of Testing and Materials
API: American Petroleum Institute
SAE: Society of Automotive Engineers
NLGI: National Lubricating Grease Institute

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 provide sufficient oil flow at ambient temperatures below -5 n 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 EMA 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. The telephone number is (312) 644-6610.

20.2.2 ARCTIC OPERATION

If an engine is operated in ambient temperatures consistently below -23
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 the 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.

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.

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 could result in personal injury or death 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, as 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 contaminates or water. Contaminates or water in the system can cause severe damage to both the injection pump and nozzles.

REMARK

Below -12 2-D diesel fuel will change to wax particles and clog the fuel filters. For best results use Grade No. 1-D diesel fuel in cold weather.

For normal service above -10 e 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 or extended engine idling, use ASTM Grade No. 1-D diesel fuel. The use of lighter fuels can reduce fuel economy. Where a winterized blend of Grade No. 2-D and No. 1-D fuels is available, it may be substituted for Grade No. 1-D fuel. 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 the engine coolant and maintaining the 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, See 20.64 SUPPLEMENTAL COOLANT ADDITIVES on page 3-13. The coolant mixture must be drained and replaced at the specified service interval shown; see 23 MAINTENANCE SCHEDULE CHART on page 3-22, 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 t 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.

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

1. 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.

2. 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 the following areas:

   - Solder corrosion/bloom
   - Copper corrosion/erosion/stress cracking
   - Oil fouling
   - Cylinder liner cavitation corrosion
   - Aluminum cavitation corrosion
   - Seal and gasket degradation

Maintenance of 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 MAINTENANCE SCHEDULE CHART on page 3-22 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 MAINTENANCE SCHEDULE CHART on page 3-22.

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 23 MAINTENANCE SCHEDULE CHART on page 3-22. 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 replace, 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].

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

DCA4 Precharge and Service Filters			
System Capacity		**Precharge Filter (See NOTE 1)**	**Service Filter (See NOTE 3)**
Liters	**Gallons**		
19-26	5-7	WF-2072	WF-2070
30-38	8-10	WF-2073	WF-2071
42-57	11-15	WF-2074	WF-2071
61-76	16-20	WF-2075	WF-2071
80-114	21-30	WF-2076	WF-2072
118-190	31-50	(See NOTE 2)	WF-2073

NOTE 1 After draining and replacing coolant, always precharge the cooling system to maintain the SCA concentration between 1.0 and 2.0 units per 3.8

NOTE:

When performing service which requires draining the cooling system, discard the coolant. Reusing coolant can introduce contaminates or over concentrated chemicals, resulting in premature failure of cooling system components.

NOTE 2 To precharge cooling systems larger than 114

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 US gal) indicates an under-concentrated coolant solution. More than 2.0 units 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.

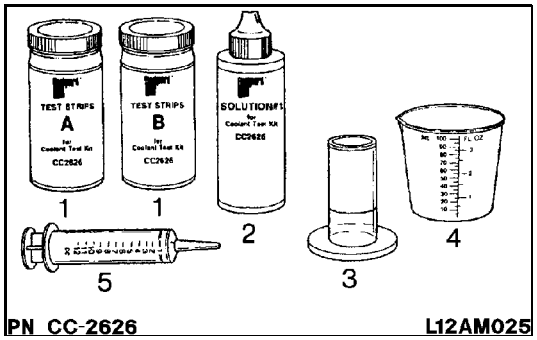
SCA Unit Concentration Guide		
Number of Solution A Drops to Cause Color Change	**Coolant Condition**	**Action Required**
0 - 10 Drops	Extremely under-concentrated - less than 0.4 SCA units per 3.8 (1 US gal)	Initially charge the system to a minimum of 1.0 SCA unit per 3.8
11 - 16 Drops	Marginally under-concentrated - 0.4 to 0.8 SCA units per 3.8 1 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 S 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.

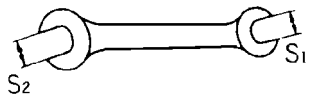
1. Test strip bottles
2. Solution #1 bottle
3. Small plastic container
4. Large plastic cup
5. Syringe



21. STANDARD TIGHTENING TORQUES FOR BOLTS AND NUTS

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	09000-3006	Width across flats 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	Cross head/flat head interchangeable type
4	Wrench	09014-10200	
5	Pliers	09036-00150	
6	Wrench	09001-03600	36 jaw
7	Tire wrench	417-98-11121	
8	Filter wrench	09019-08035	For filter change
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 based 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 them from your distributor.

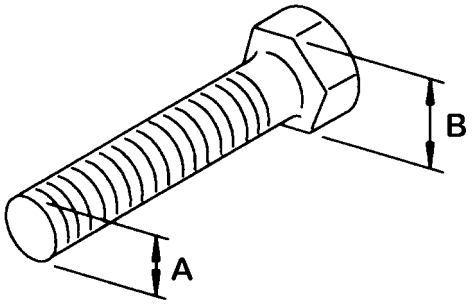
21.2 TORQUE LIST

Unless otherwise specified, tightenthe 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 necessaryto replace any nut or bolt, always use a Komatsu genuine part of the same size as the part that was replaced.

1 N



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Thread diameter of bolt (mm) (a)	Width across flat (mm) (b)	(T)	(H)
		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

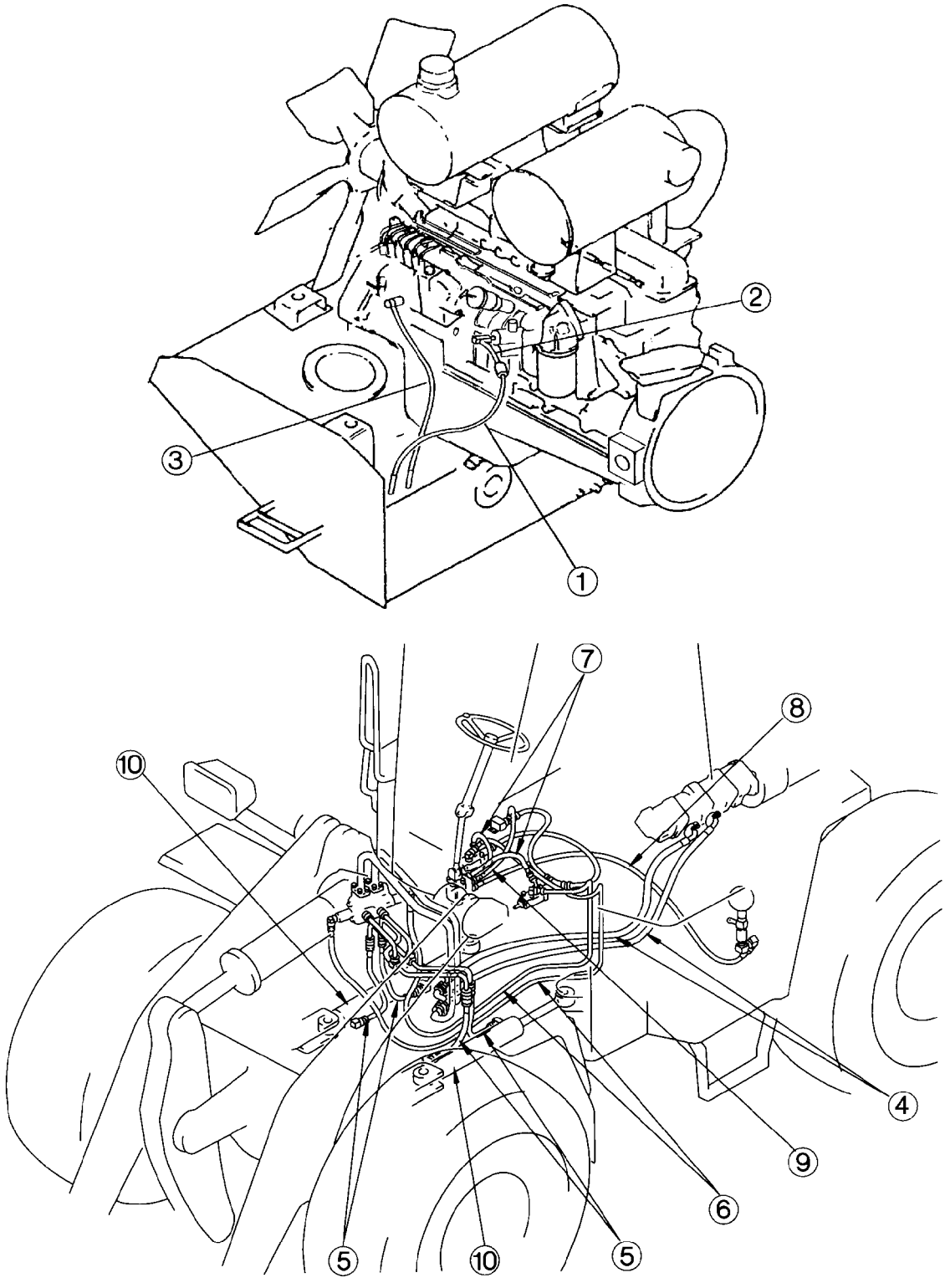
When tightening panels or other parts having fixtures made ofplastic, be careful not to use excessive tightening torque: doing so will damage the plastic parts.

22. PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

To ensure safety at all times when operating or driving the machine, the user of the machine must always perform periodic maintenance. In addition, to further improve safety, the user should also perform periodic replacement of 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 passed, or they easily wear or deteriorate. However, it is difficult to judge the condition of the parts simply by periodic maintenance, so they should always be replaced after a fixed time has passed, regardless of their condition. This step ensures 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 hose clamps show any deterioration, such as deformation or cracking, replace the clamps at the same 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	Qty.	Replacement interval
1	Fuel hose (fuel tank to strainer)	1	Every 2 years or 4,000 hours, whichever comes first.
2	Fuel hose (strainer to engine)	1	
3	Fuel return hose	1	
4	Steering hose (pump to steering valve)	2	
5	Steering hose (steering valve to steering cylinder)	4	
6	Steering hose (steering valve to stop valve)	2	
7	Steering hose (orbitrol valve to stop valve)	2	
8	Steering hose (orbitrol valve to pump accumulator)	1	
9	Steering hose (orbitrol valve to joint to tank)	1	
10	Packings, seals, o-rings of steering cylinder	2	
11	Brake hose (pump to accumulator charge valve)	2	
12	Brake hose (check valve to tandem valve)	3	
13	Brake hose (check valve to single valve)	2	
14	Brake hose (check valve to accumulator PP port)	1	
15	Brake hose (tandem valve to front brake)	2	
16	Brake hose (tandem valve to rear brake)	2	
17	Brake hose (single valve to tandem valve)	1	
18	Brake hose (tandem valve to drain block)	1	
19	Brake hose (single valve to drain block)	1	
20	Brake hose (drain block to hydraulic tank)	1	
21	Bake hose (accumulator to reduction valve)	1	
22	Brake hose (transmission valve to reduction valve)	1	
23	Brake hose (reduction valve to parking brake)	1	
24	Brake hose (parking brake to reduction valve)	1	
25	Brake hose (reduction valve to charge valve drain)	1	
26	Brake hose (charge valve drain to hydraulic tank)	1	
27	Seat belt	1	Replace every 3 years



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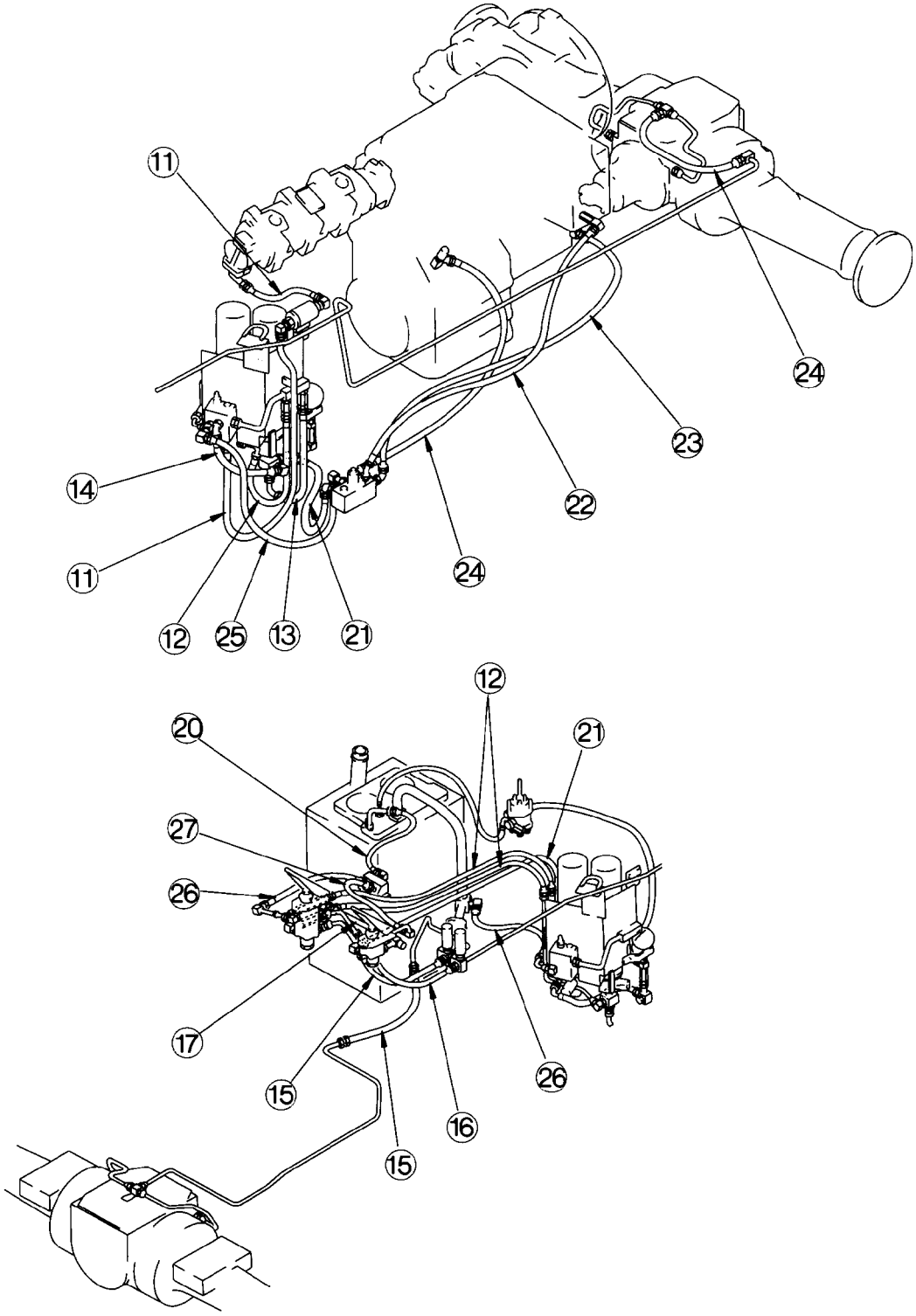

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23. MAINTENANCE SCHEDULE CHART

23.1 SCHEDULED MAINTENANCE CHART

24. SERVICE PROCEDURE

24.1 INITIAL 250 HOURS SERVICE

Carry out the following maintenance only after the first 250 hours.

24.1.1 FUEL FILTER CARTRIDGE

For details of the method of replacing, see 24.7 EVERY 500 HOURS SERVICE on page 3-48.

24.1.2 TRANSMISSION OIL FILTER ELEMENT

For details of the method of replacing, see 24.7 EVERY 500 HOURS SERVICE on page 3-48.

24.1.3 HYDRAULIC TANK FILTER ELEMENT

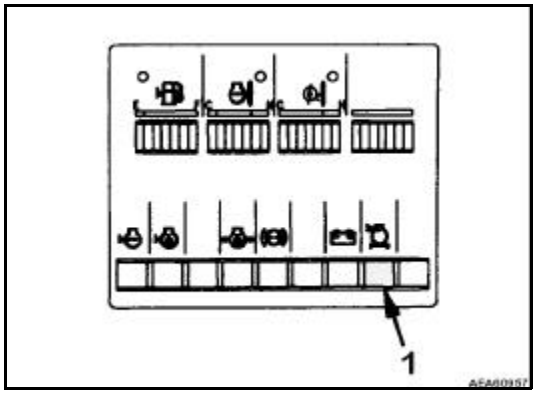
For details of the method of replacing, see 24.9 EVERY 2000 HOURS SERVICE on page 3-60.

24.2 WHEN REQUIRED

24.2.1 CLEAN OR REPLACE AIR CLEANER ELEMENT

⚠ WARNING

Never clean or replace the air cleaner element while the engine is running. When using pressurized air to clean the element, wear safety glasses or goggles to protect the eyes.



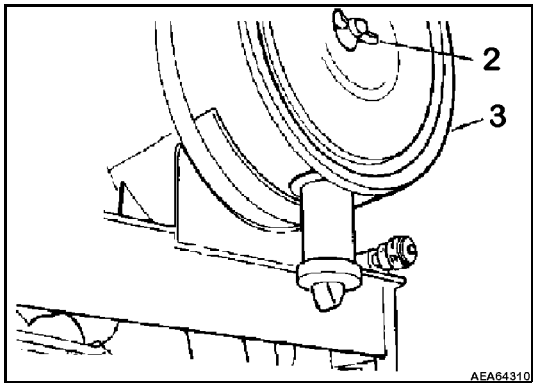
Checking

If the air cleaner clogging caution lamp (1) on the maintenance monitor flashes, clean the air cleaner element.

Cleaning or Replacing Outer Element

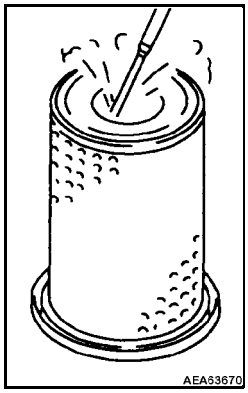
1. Remove the wing nut (2) and cover (3), and remove the outer element.

2. Clean the inside of the air cleaner body.

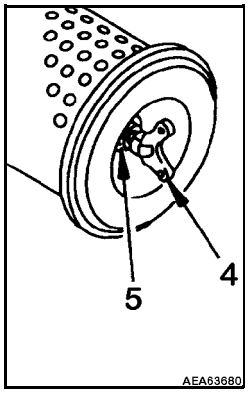


3. Direct dry, compressed air, less than 7 kg/cm^2 (100 psi), to the element from the inside along its folds. Then direct it from the outside along its folds and again from the inside.

    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 is red immediately after the outer element has been cleaned, replace both the inner and outer elements, especially if the outer element has not been cleaned six times.

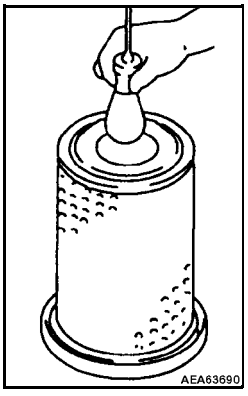


    4) Check the inner element mounting nuts for looseness and, if necessary, retighten them. Replace the seal washer (5) or wing nut (4) with new parts, if they are broken.



NOTE: After cleaning and drying the element, shine a light through it. If any small holes or thin cracks are found, then 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 the element, reinstall it.



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.

   Do not clean and reinstall an inner element.

5. Install the outer element.

Using Water

Wash the filter element with water at less than 3 kg/cm² (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.

REMARK

Using warm water about 40 y water may also be effective in cleaning the element. To speed up the drying process, blow air with less than 7 kg/cm² (100 psi), of force to the inside of the element.

NOTE: Do not attempt to heat the element.

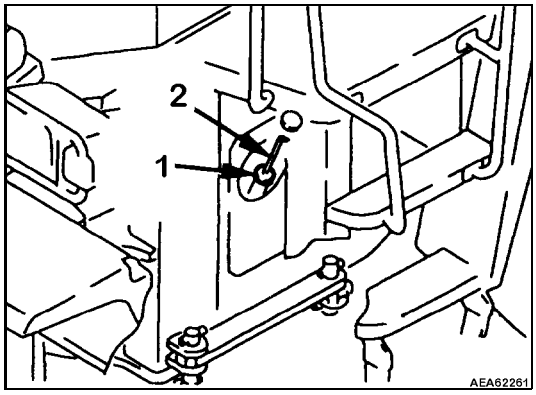
24.2.2 CHECK TRANSMISSION OIL LEVEL, ADD OIL

⚠ 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.

Perform this procedure, if any oil is on the transmission case, or if there is oil mixed with the cooling water.

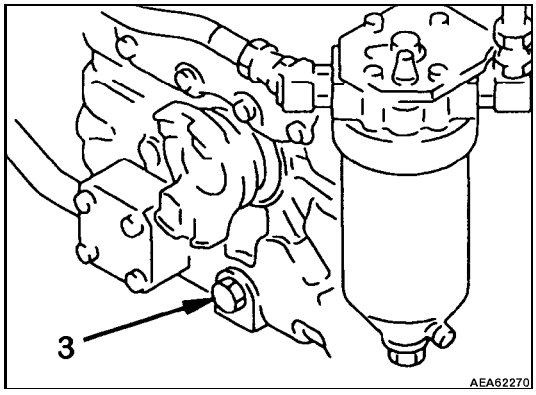
1. Start the engine and run it for at least 5 minutes.
2. Open the cap of the oil filler port (1), remove the dipstick (2), and wipe the oil off with a cloth.
3. Insert the dipstick (2) fully into the oil filler pipe, then remove it.
4. The oil level should be between **H** and **L** on the dipstick



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 3-9.**

5. If the oil is above the **H** mark, drain the excessive oil by removing the drain plug (3). Check the oil level again.
6. If the oil level is correct, insert the dipstick back into the filler and tighten the cap.

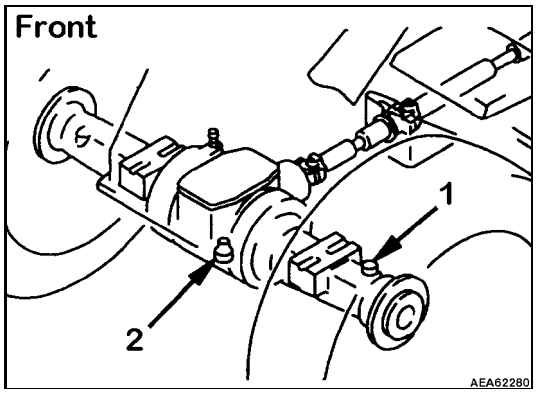


24.2.3 CHECK AXLE OIL LEVEL, ADD OIL

⚠ WARNING

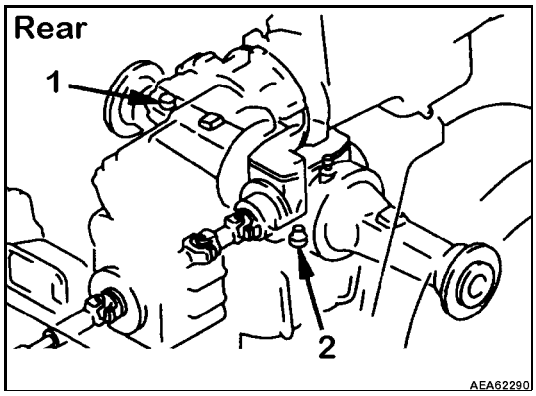
When checking the oil level, apply the parking brake and lock the front and rear frames with the safety bar and pin. The oil is at a high temperature after the machine has been operated. Always wait for the temperature to go down before performing this procedure.

Perform this procedure if there is any sign of oil on the axle.



Perform 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.

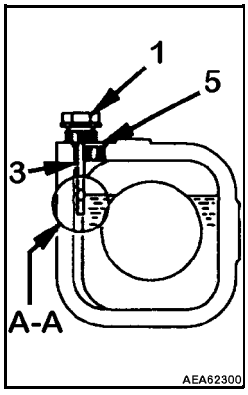
1. Turn OFF the engine and remove the oil level plug (1).
2. Wipe off the gauge attached to the plug with a cloth.
3. Set the oil level gauge (3) as shown in the diagram.
4. The oil level is correct when it is between the two lines (4) provided on the oil level gauge. If the oil does not reach the lower line, add oil through the filler port (5).

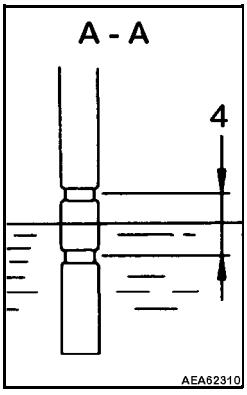


For details of the oil to use, **see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**

5. If the oil is level is above the upper line, drain off the excess oil through the drain plug (2). Check the oil level again.
6. If the oil level is correct, install the plug (1).

N•m Oil level plug . . . . . 132 ± 39 N



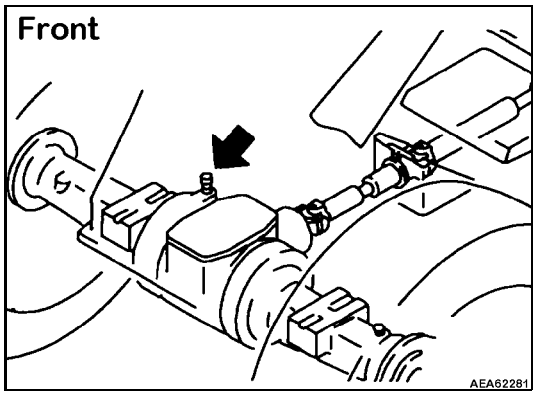


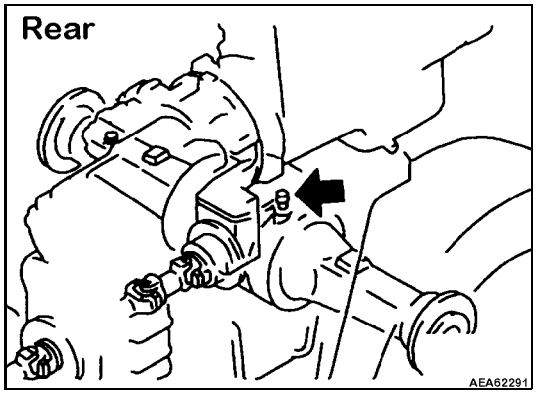
24.2.4 CLEAN THE AXLE CASE BREATHER

⚠ 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).

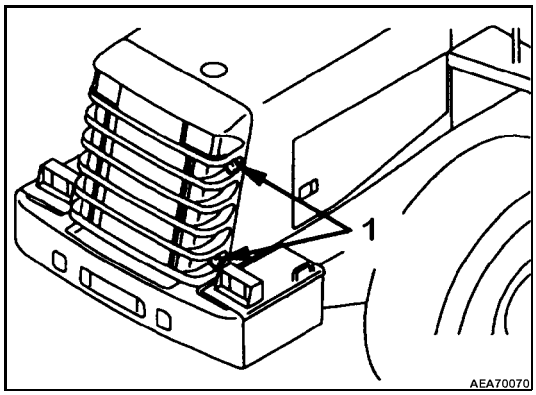




24.2.5 CLEAN THE RADIATOR FINS

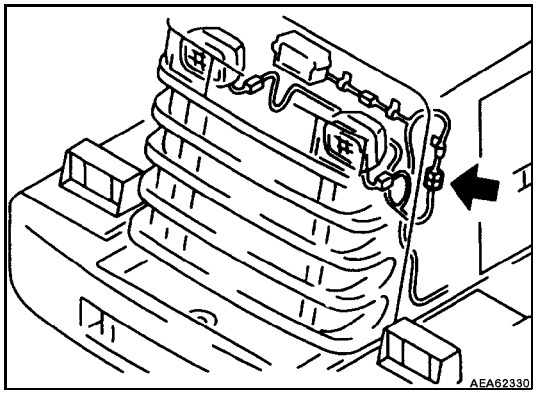
Perform this procedure if there is any dirt, mud, leaves, insects stuck to the radiator.

1. After removing the bolt (1), 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 ageing, and if any of the clamps are loose.



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.

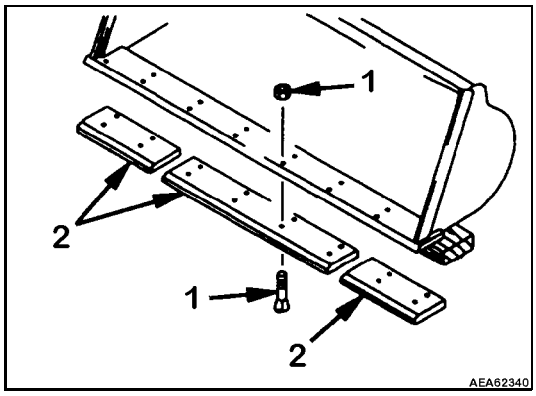
Turn or replace the cutting edges before the wear reaches the edge of the bucket.

1. After raising the bucket to a suitable height, position the bucket so that the bottom surface of the bucket is horizontal. Place blocks under the bucket to prevent it from coming down.

2. After removing the nuts and bolts (1), remove the cutting edge (2).

3. Clean the mounting surface of the cutting edges.

4. Flip the cutting edges (2) over and reassemble the end edges by placing them to the opposite side (left edge to the right side, right edge to the left side).



If both sides of the cutting edge are worn then replace it with a new one.

NOTE: If the wear extended 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.

N·m Mounting nuts . . . 1040 ± 157 N

6. Retorque the mounting bolts again after operating the equipment for several hours.

24.2.7 REPLACE BUCKET TEETH

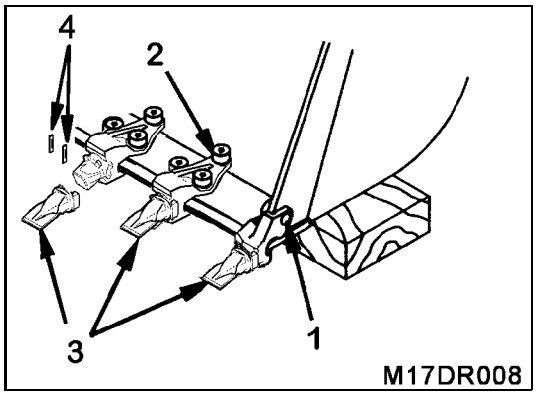
⚠ WARNING

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 to the LOCK position.

When the bucket teeth are worn, replace them as follows.

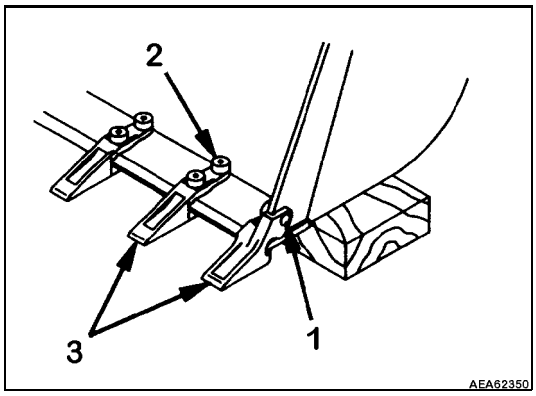
1. Raise the bucket to a suitable height, then position the bucket so that the bottom surface of the bucket is horizontal and put blocks under it to prevent it from coming down.

2. For one-piece bucket teeth, proceed to step 3. To replace the Super V-type removable bucket teeth points, proceed as follows.
   A. Remove the clips (4) with the special tod provided.
   B. Remove the points (3) from the adapters. Remove the adapters after removing the bolts and nuts.
   C. After cleaning the adapter, install the new points (3) on the adapters and secure them with the clips (4) previously removed.
   D. Proceed to step 6.



3. After removing the nuts and bolts (1) and (2), remove the teeth (3).

4. Clean the mounting surface of the bucket teeth.



If the mounting surface is worn, repair 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.

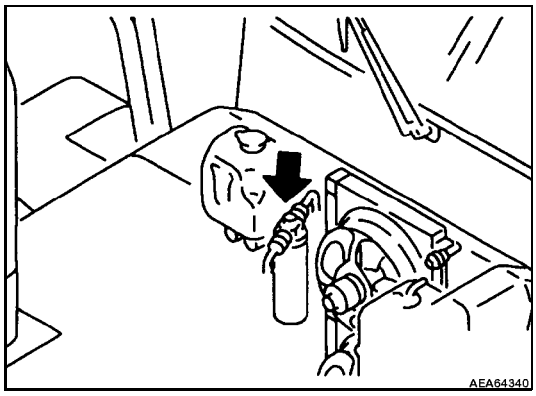
Minimum clearance . . . . . less than 0.5 mm (0.02 in.)

6. To prevent any gap from occurring between the tooth and the tip of the bucket, tighten the hardware. Hit thetip of the tooth with a hammer.

Mounting nuts . . . . . 1265 ± 69 N

7. Retorque the mounting bolts again after operating the equipment for several hours.

24.2.8 CHECK AIR CONDITIONER



Check twice a year, spring time and autumn.

Check Levels of Refrigerant (Gas)

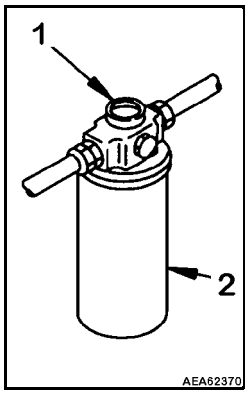
⚠ WARNING

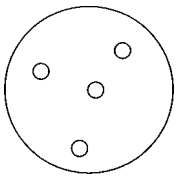
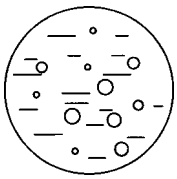
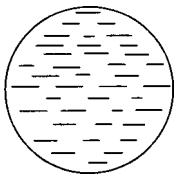
If the refrigerant used in the system gets into your eyes or on your hands, it could cause loss of sight or frostbite, so NEVER loosen any part of the refrigerant circuit.

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.



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

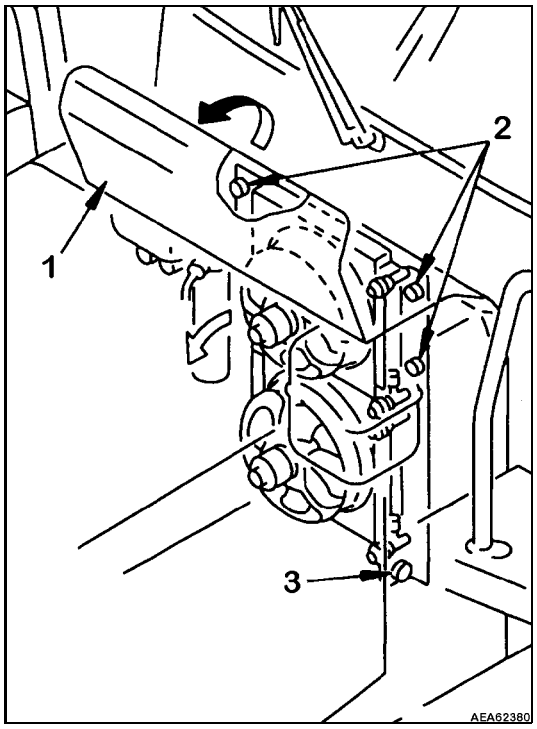
⚠ WARNING

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.

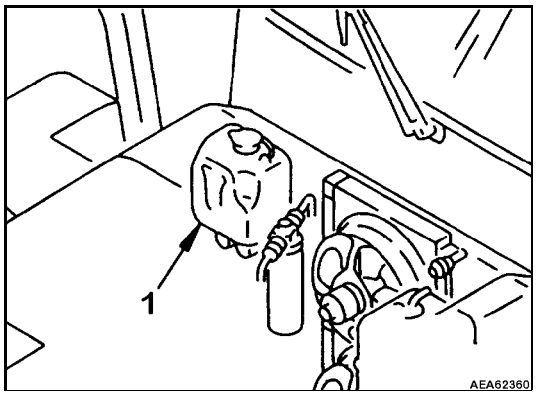
Washing Method

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



24.2.10 CHECK WINDOW WASHING FLUID, ADD FLUID

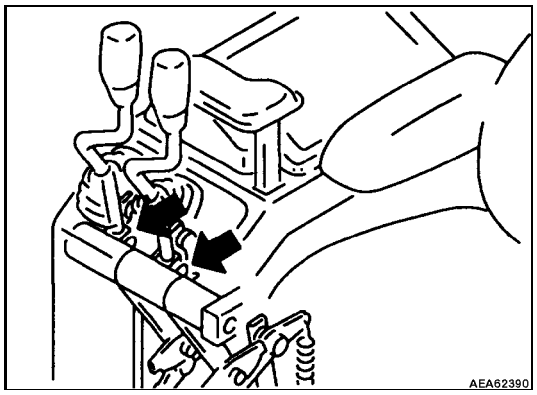
Check the washing fluid level in washer tank (1). When the fluid is low, add automotive window washing fluid. To prevent the nozzle from clogging, be careful not to let dust get into the fluid.



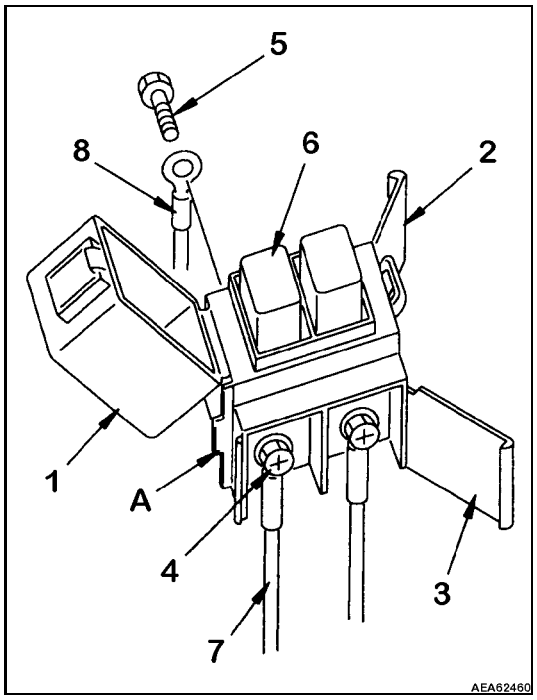
24.2.11 LUBRICATE WORK EQUIPMENT CONTROL VALVE LINKAGE (2 PLACES)

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.



24.2.12 REPLACE SLOW BLOW FUSE

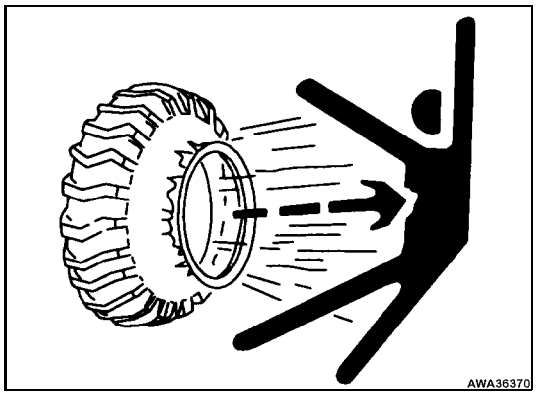


NOTE

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.

24.2.13 SELECTION AND INSPECTION OF TIRES



⚠ WARNING

If a tire or a rim is handled wrongly, the tire may burst or may be damaged and the rim may be broken and scattered, and that can cause serious injury and 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

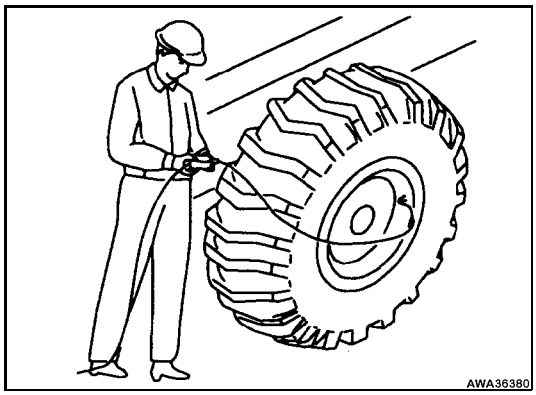
Select the tires according to the conditions of use and attachments of the machine. Use the following table. Since the indicated speed varies with the tire size, consult your distributor when using optional tires.

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.

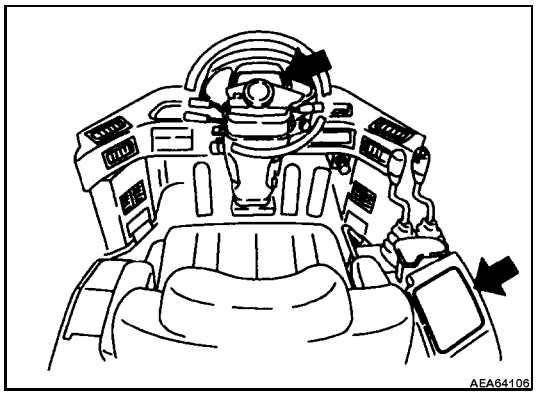
Inflation of tires

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.

NOTE

The appropriate tire inflation pressue differs according to the type of work, so see 12.18 HANDLING THE TIRES on page 2-73.

24.3 CHECK BEFORE STARTING

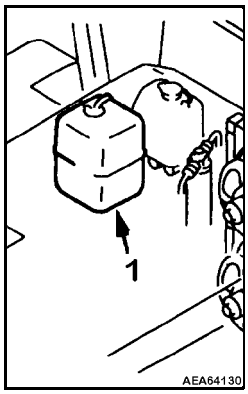


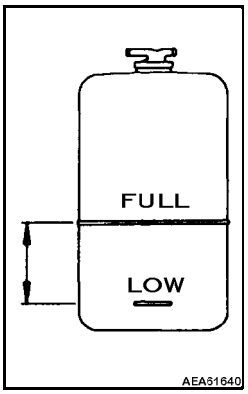
24.3.1 CHECK MONITOR PANEL

Turn the starting switch to ON. 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 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

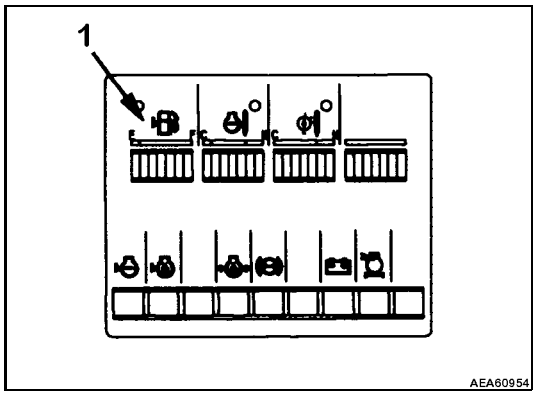




Normally, do not open the radiator cap. Always wait for the engine to cool down before checking the water level, and check using the subtank.

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 subtank (1). If the coolant level is low, add water to the FULL level through the water filler in subtank. After adding water, tighten 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



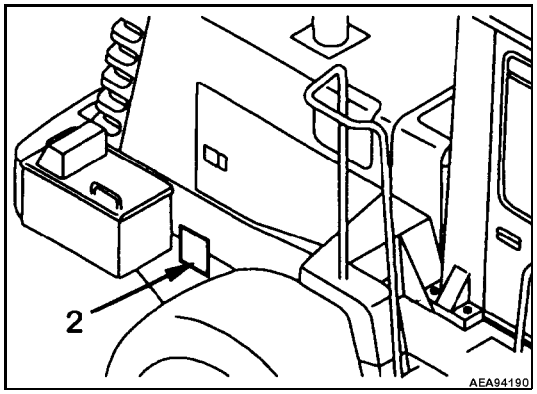
⚠ WARNING

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 the filler (2) until the fuel tank is full.

For details of the method for opening and closing the cap, **see 11.5 CAP WITH LOCK on page 2-29.**

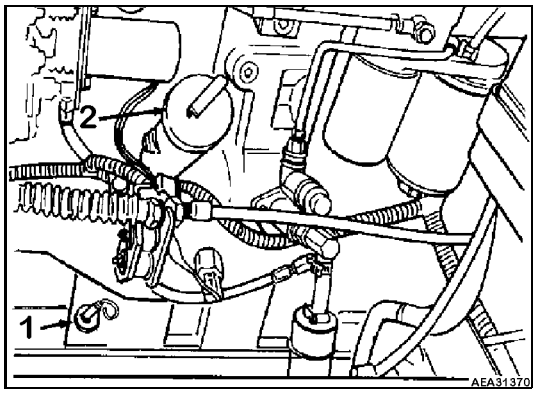


For details of the fuel to use, **see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**

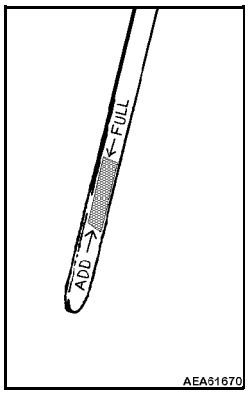
3. After adding fuel, tighten the cap securely.

Fuel capacity 248

24.3.4 CHECK OIL LEVEL IN ENGINE OIL PAN, ADD OIL

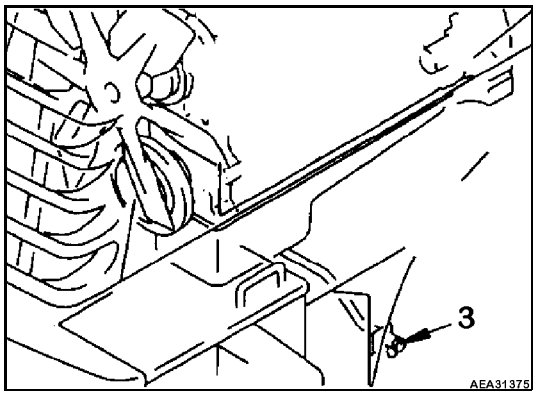


1. Open the engine side cover at the rear right side of the machine.
2. Remove dipstick (1) and wipe the oil off with a cloth. Inset dipstick fully in the oil filler pipe, then take it out again.



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 FUL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**



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.

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.

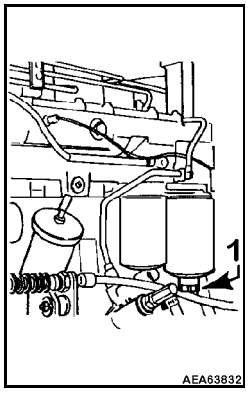
Keep the top surface of the battery clean and check the breather hole in the battery cap. If it is clogged with dirt or dust, wash the battery cap to clear the breather hole.

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

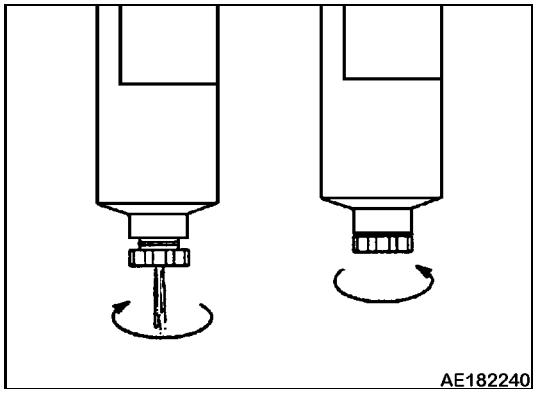
With the engine shut off, open the drain valve (1). Turn the valve counterclockwise approximately 1-½ to 2 turns until draining occurs. Drain the filter sump of water until clear fuel is visible.



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

Turn the valve clockwise approximately 1-½ to 2 turns to close the drain valve.

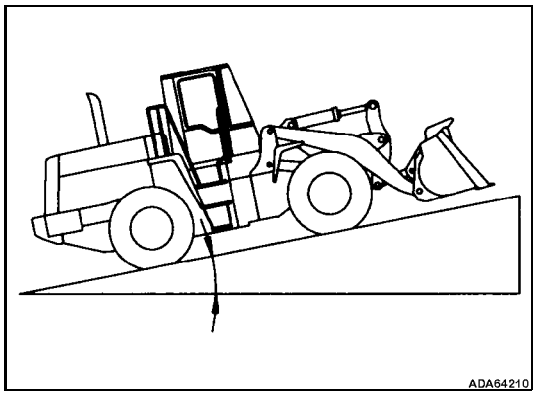
Even if a water separator filter is installed be sure to check the fuel tank to remove water and sediment in the fuel.



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.

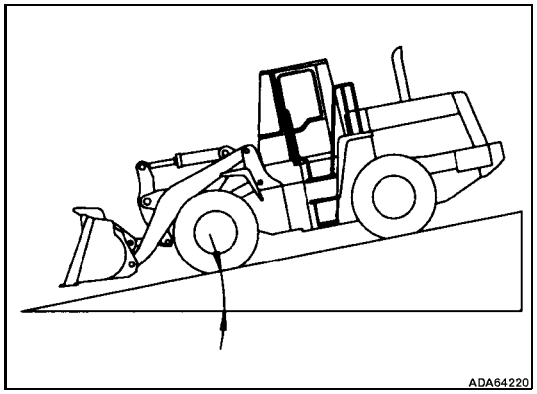


Measurement Conditions

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

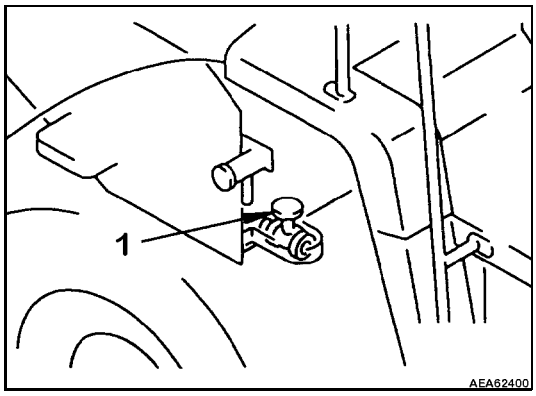
24.3.13 CHECK PLAY OF STEERING WHEEL, CHECK OPERATION OF STEERING

24.3.14 CHECK DIRECTION OF REAR VIEW MIRROR, CHECK FOR DIRT OR DAMAGE

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 OF 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

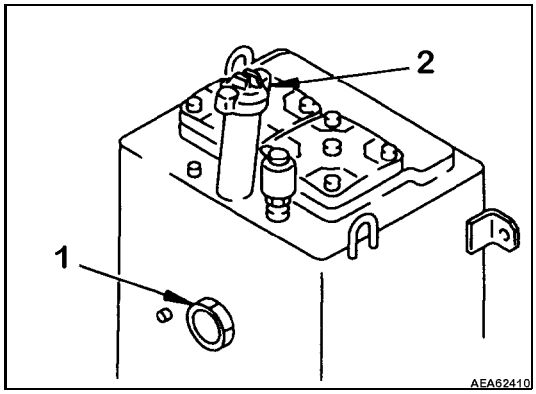
⚠ WARNING

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 (1). 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 trough oil filler port (2).



For specification of the oil to use, **see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**

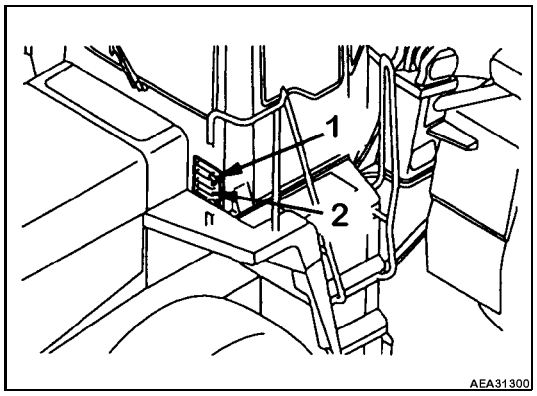
24.5.2 CLEAN ELEMENT IN AIR CONDITIONER FRESH AIR FILTER

⚠ WARNING

When using compressed air, wear safety glasses and other things required to maintain safety.

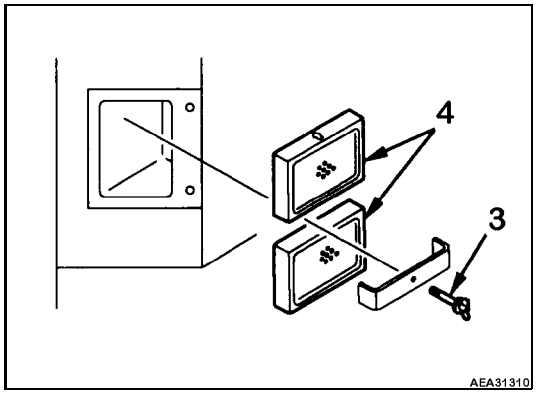
If the air conditioner has been used, thenits air filter element could need cleaning. Before cleaning the elements, turn the air conditioner OFF.

1. Loosen the thumb screws (1) and remove cover (2).



2. Unsnap the two clips (3) holding the element, and remove element (4) to clean it.

3. Direct compressed air, less than 7 kg/cm^2 (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

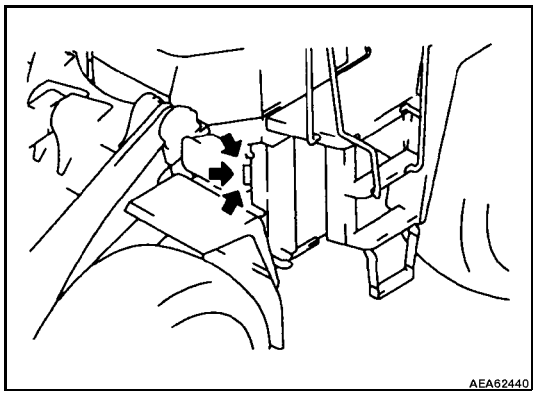
When reassembling the element, install it so that the arrow on top of the filter is facing the inside of the cab.

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.



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

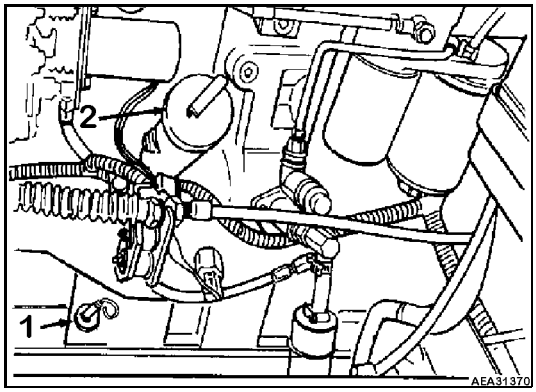
⚠ WARNING

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.

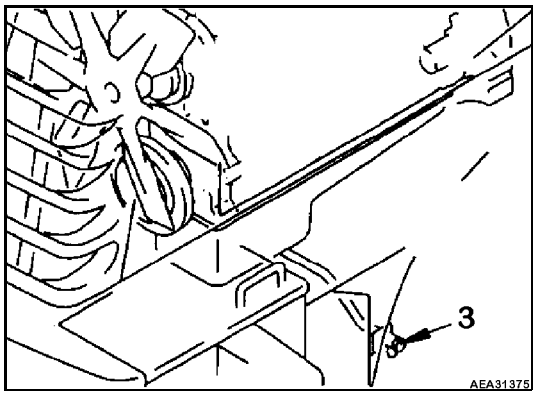
Prepare the following.

- Oil catch container . . . . . Min 22
- Filter wrench 09019-08035
- Refill capacity 19

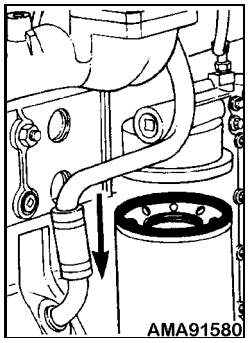
For details of the oil to use and refill capacity, **see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**

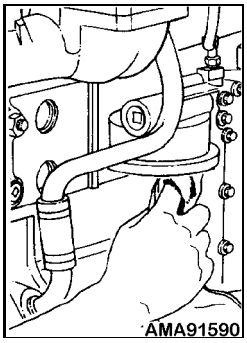


1. Warm up the engine to operating temperature and then turn the engine OFF.
2. Open the engine hoods and lock in position.
3. Open oil filler (2) and remove drain plug (3) to drain oil. After draining, tighten the drain plug.

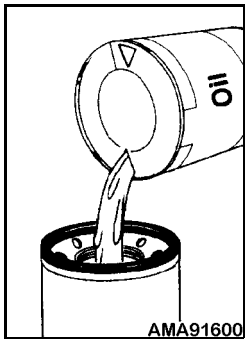


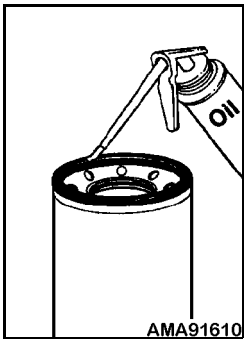
4. Clean the area around the oil filter.
5. Using a filter wrench, remove oil filter cartridge by turning it counterclockwise.
6. Clean the filter gasket surface of the filter header.





7. Fill a new oil filter with engine oil. Then, apply engine oil or a thin coat of grease to the seal.

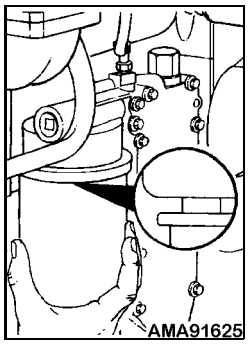


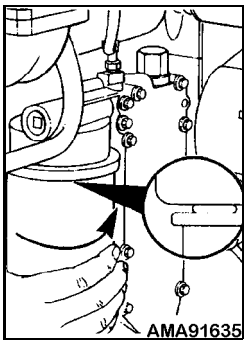


8. To install filter, bring its seal surface into contact with sealing surface of filter base and then tighten the filter ½ to ¾ turn by hand.

   Be careful not to tighten it up excessively.

   Be sure to use a genuine filter.





9. After replacing the filter, pour in the specified quantity of engine oil at oil filler (2).

10. After refilling with oil, start the engine and idle it for a while. Inspect for oil leaks at the filter and drain plug. Then stop the engine and check the oil level. Wait for five minutes before checking.

11. 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.

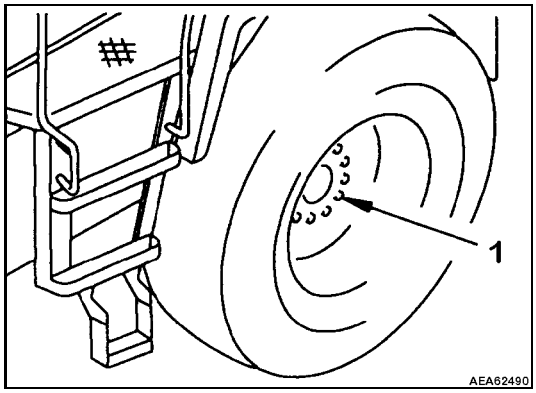
24.6.2 CHECK FOR LOOSE WHEEL HUB BOLTS, TIGHTEN

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.

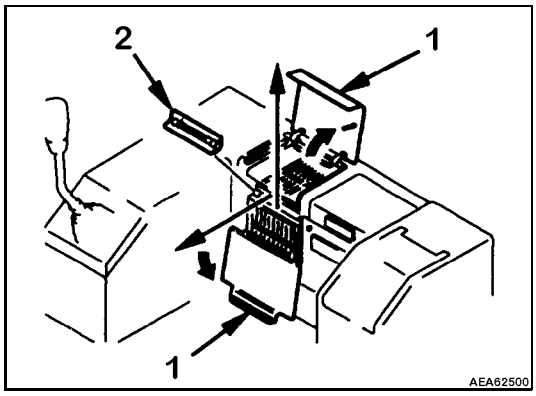
N•m Bolt torque . . . . . 927 ± 103 N

If any wheel bolt is broken, replace all bolts for that wheel.

Always rotate in the direction of tightening when checking for loose bolts.



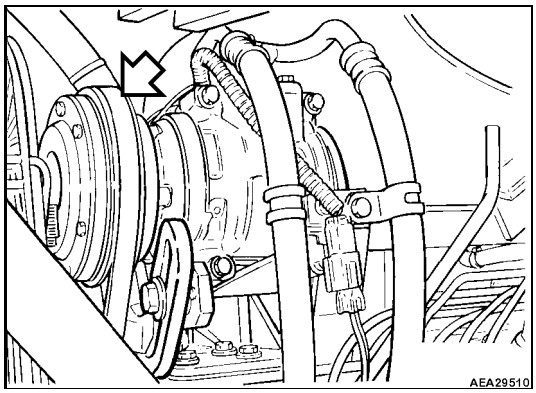
24.6.3 CLEAN ELEMENT IN AIR CONDITIONER RECIRCULATION FILTER



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^2 (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

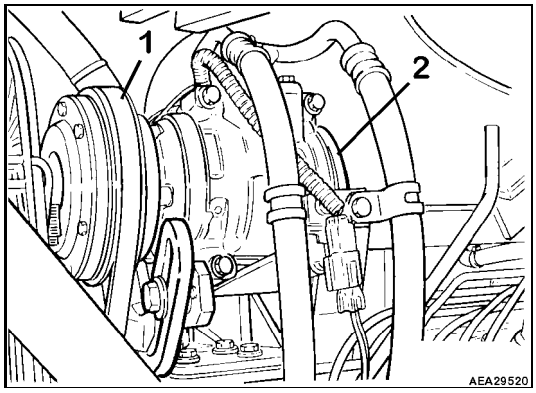


Checking

The deflection of the belt should be
when pressed with the thumb force of t
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 Changing the V-Belt



The deflection of the belt should be
in) 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 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.

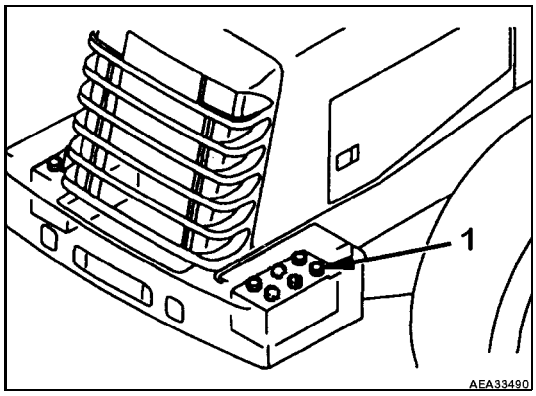
Replace the v-belt if it has stretched, leaving no allowance for adjustment, or if there is any cut or crack on belt.

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, do not bring fire or spark near the battery.
Battery electrolyte is dangerous. If it gets in your eyes or on your skin, wash it off with lots of water, and consult your doctor.



Perform 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.

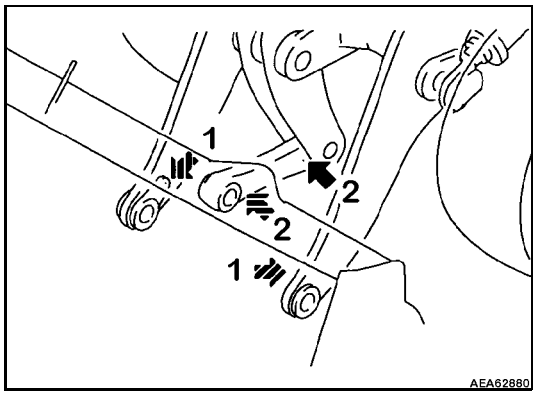
NOTE: When adding distilled water in cold weather, add it just before operating the machine, to prevent the electrolyte from freezing.

24.6.6 LUBRICATING

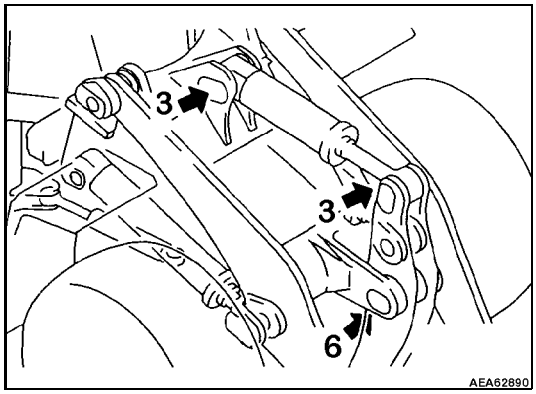
WARNING

Set the work equipment in a stable condition, then tum OFF the machine and apply the lock for the work equipment control levers.
Apply the parking brake, and lockthe front and rear frames with the safety bar and pin.

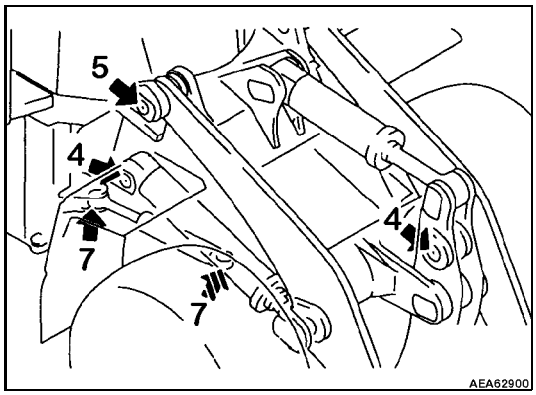
Use a grease pump to pump in grease through the grease fittings marked by the arrows. After greasing, wipe off any old grease that was pushed out.



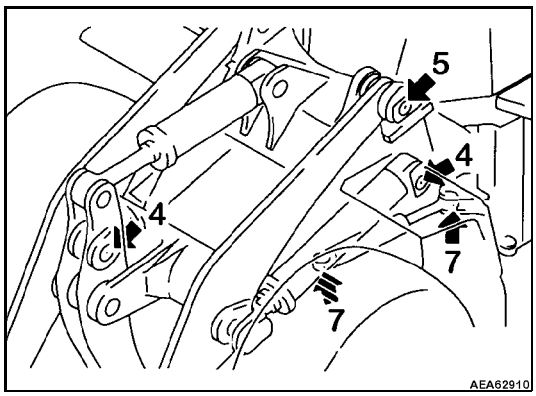
1. Bucket pin (2 places)
2. Bucket link pin (2 places)
3. Dump cylinder pin (2 places)



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)

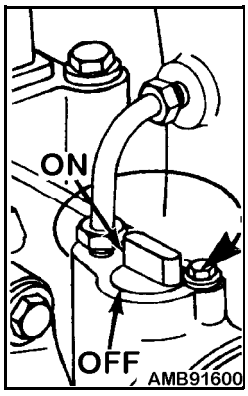


24.7 EVERY 500 HOURS SERVICE

24.7.1 CORROSION RESISTOR

⚠ WARNING

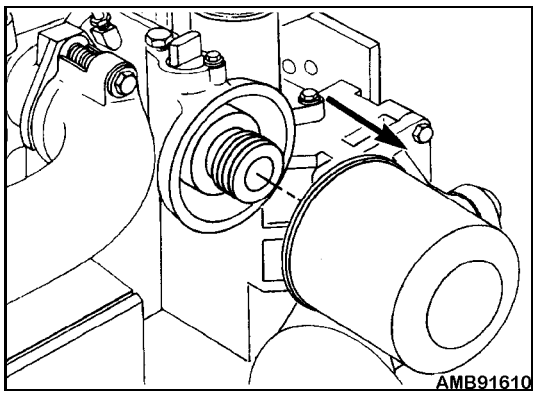
Do not remove the radiator cap from a hot engine. Hot steam will cause serious personal injury. Wait until the coolant temperature is below 50
ing the pressure cap. Remove the coolant system pressure cap and close the shutoff valve before removing the corrosion resistor. Failure to do so can result in personal injury from heated coolant spray.



Maintenance for every 50, 100 and 250 hours service should be carried out at the same time.

Filter wrench 09019-08035

Remove and discard the corrosion resistor. Clean the gasket surface.

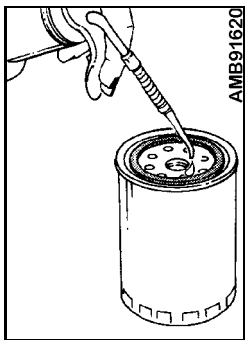


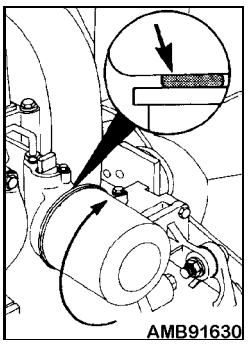
Apply a light film of lubricating oil to the gasket sealing surface before installing the corrosion resistor.

REMARK

Mechanical over tightening may distort the threads or damage the filter head.

Install per the manufacturers recommendation..

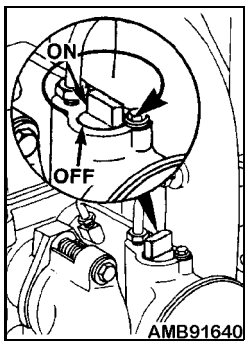




Open the shutoff valve and install the coolant system pressure cap.

NOTE

Failure to open the shutoff valve can result in severe engine damage.



24.7.2 REPLACE FUEL FILTER CARTRIDGE AND IN-LINE FUEL STRAINER

WARNING

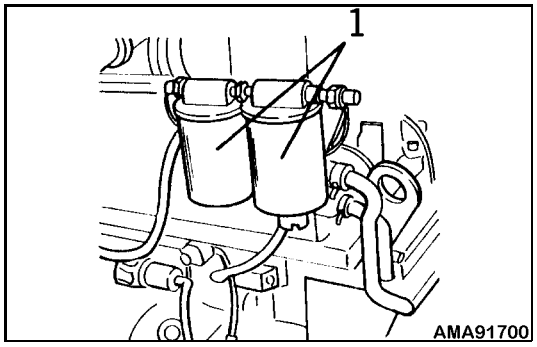
Engine is at high temperature immediately after the machine has been operated. Wait for engine to cool down before replacing the filter.
Do not bring fire or sparks near the fuel.

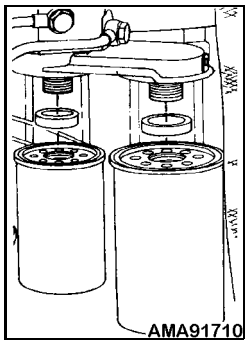
Prepare a filter wrench and a container to catch the fuel.

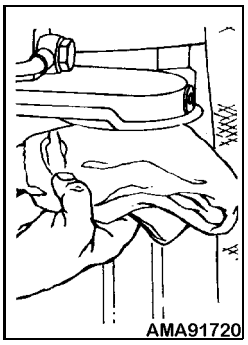
Fuel catch container . . . . . Min 3.8

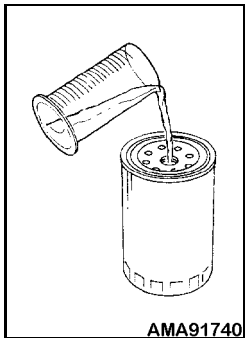
Filter wrench 09019-08035

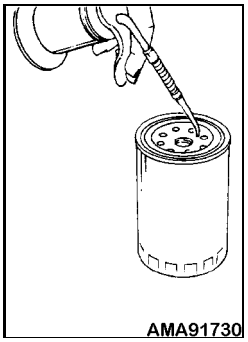
1. Set the container to catch the fuel under the filter cartridges.
2. Using a filter wrench, remove filter cartridges.
3. Clean the filter holder.
4. Fill a new filter cartridge with clean fuel, coat the packing surface with engine oil, then install it to the filter holder.
5. When installing, tighten until the packing surface contacts the seal surface of the filter holder, then tighten it up ½ to ¾ 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.

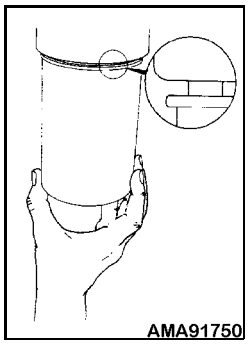


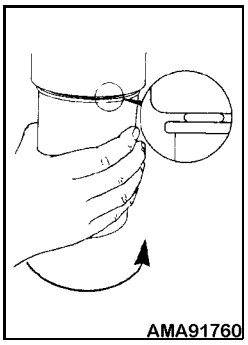








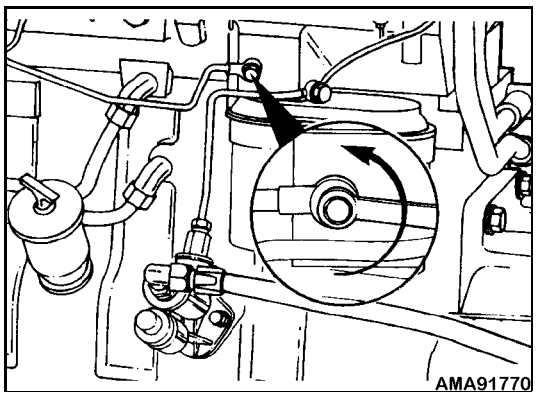




After replacing the fuel filter cartridge, bleed the air from the system as follows.

6. Fill the fuel tank with fuel (to the position where the fuel gauge shows FULL).

7. After replacing filter cartridges, loosen air bleed plug.

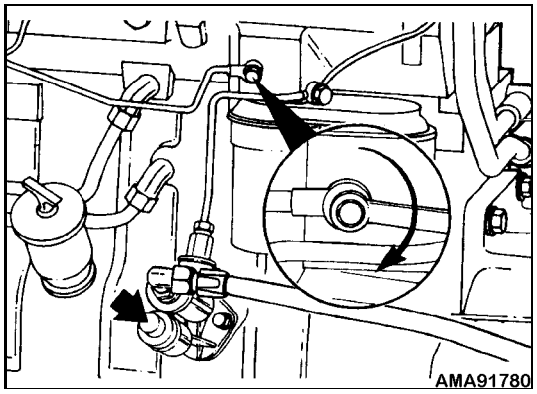


8. Operate the plunger on the fuel transfer pump until the fuel flowing from the fitting is free of air.

9. Tighten air bleed plug (1).

N·m Bleed screw . . . . . 9 N

10. Use a genuine Komatsu filter cartridge. After replacing the filter cartridge, start the engine, and check that there is no leakage of fuel from the filter seal surface.



In-Line Fuel Strainer

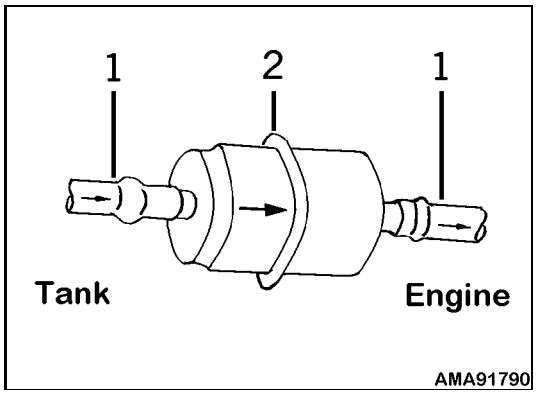
1. Disconnect and plug the fuel hoses (1).

2. Remove and discard the in-line fuel strainer (2).

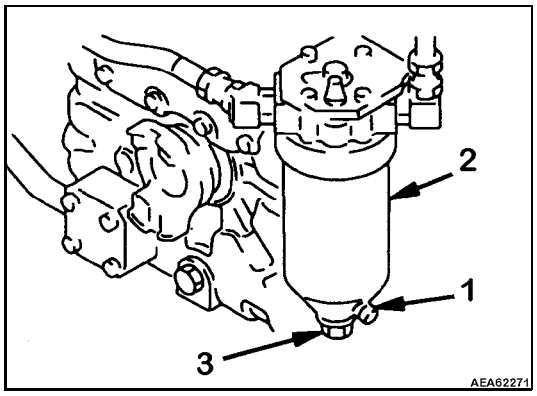
3. Install the new fuel strainer and reverse the process.

REMARK

Refer to the arrow on the fuel strainer for correct fuel flow direction.



24.7.3 REPLACE TRANSMISSION OIL FILTER ELEMENT

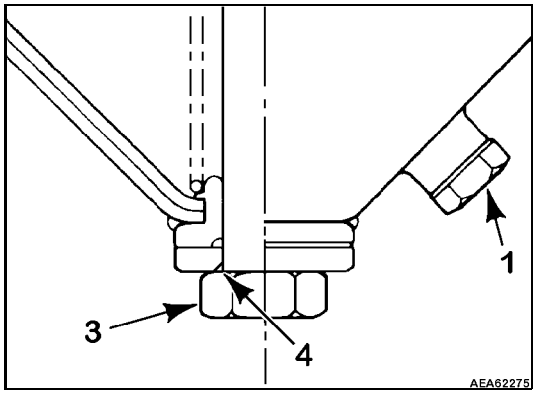


1. Remove the drain plug (1) at the bottom of the filter case, and drain the oil. After draining the oil, tighten the plug.

N•m Drain plug . . . . . 108 ± 15 N

2. Hold the case (2) and loosen the center bolt (3). Remove the 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 the center bolt (3), install the bolt washer (4) so that its chamfered surfaces faces the hexagonal head of the center bolt. Be careful not to apply excessive torque to the center bolt (3).

N•m Center bolt . . . . . 76 ± 12 N

4. Run the engine for a short period oftime 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 3-28.**

24.8 EVERY 1,000 HOURS SERVICE

Maintenance for every 50, 100, 250 and 500 hours should be carried out at the same time.

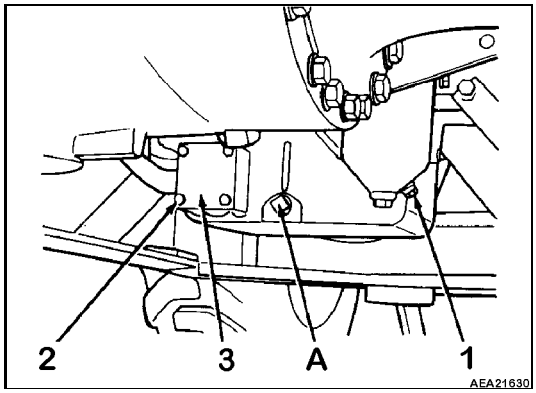
24.8.1 CHANGE OIL IN TRANSMISSION, CLEAN STRAINER

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 . . . . . 69 ± 10 N

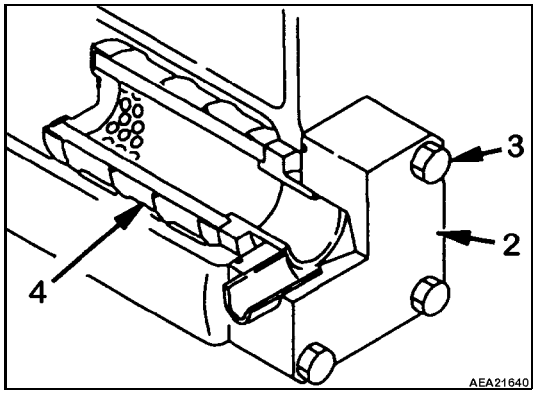
2. Loosen drain plug (1) of transmission oil filter to drain oil. After draining out the oil, tighten up drain plug.

Drain plug . . . . . 108 ± 15 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.

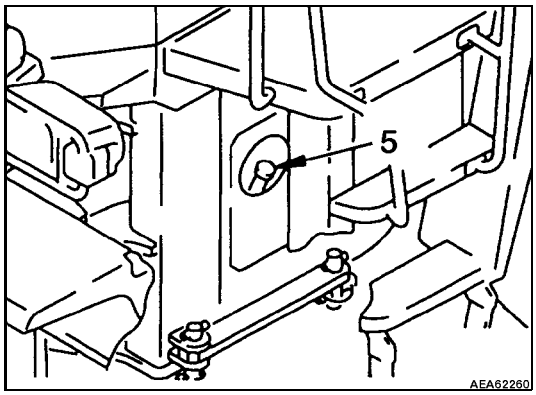
5. Install strainer (4) to cover (3).



Strainer torque . . . . . 108 ± 15 N

Replace the o-ring of the cover with a new part, then install the cover.

6. Pour in the specified amount of oil at oil filler (5).



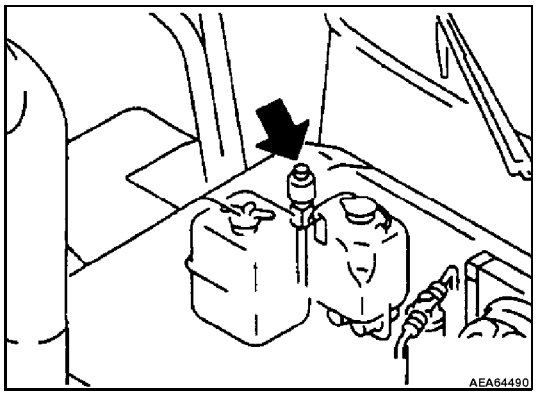
For details of the oil to use and refill capacity, **see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**

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 3-28.**

8. Check for oil leaks at the transmission case and the filter.

24.8.2 CLEAN TRANSMISSION CASE BREATHER



Remove all mud and dirt from around the breather. Remove the breather and put it into a cleaning fluid to clean.

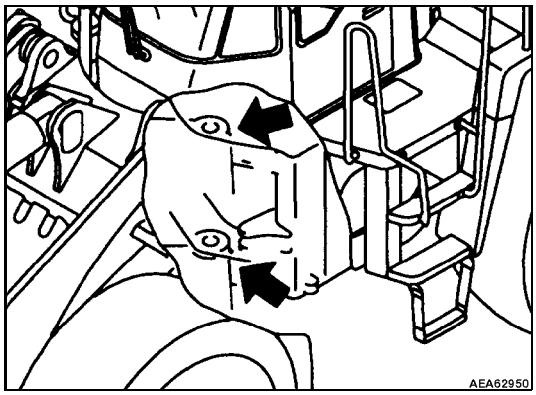
Take care, so as not to let any dust ordirt get into the transmission case through the port while the breather is removed.

24.8.3 LUBRICATE

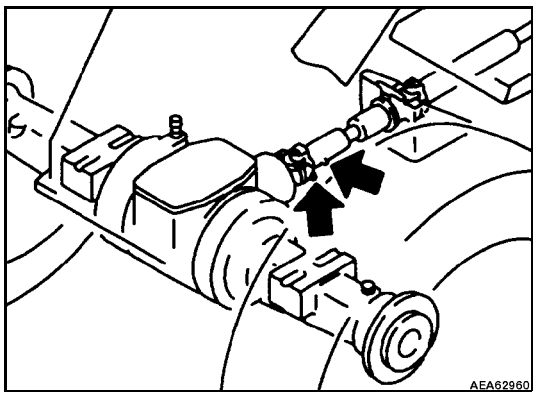
Set the work equipment in a stable condition, then turn OFF the machine and apply the lock for the work equipment control levers. Apply the parking brake, and lock the front and rear frames with the safety bar and pin.

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.

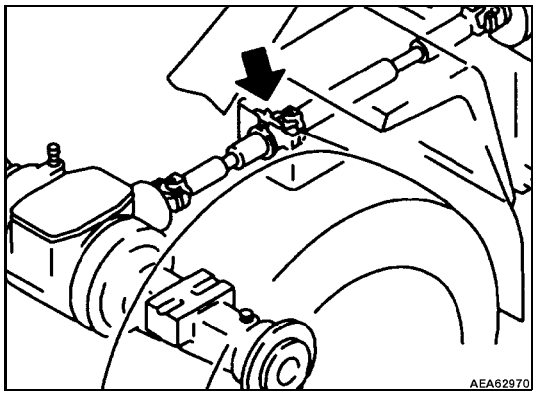
1. Center hinge pin (2 places)



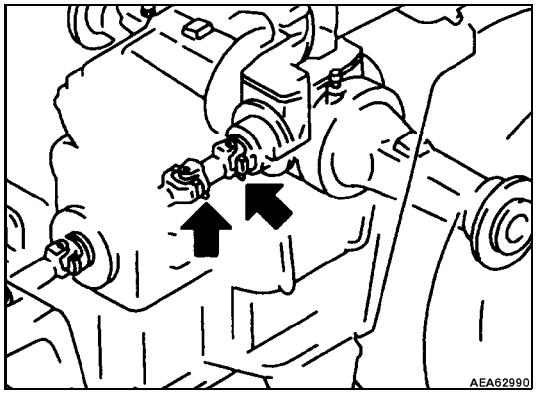
2. Front drive shaft (2 places)



3. Drive shaft center support (1 place)

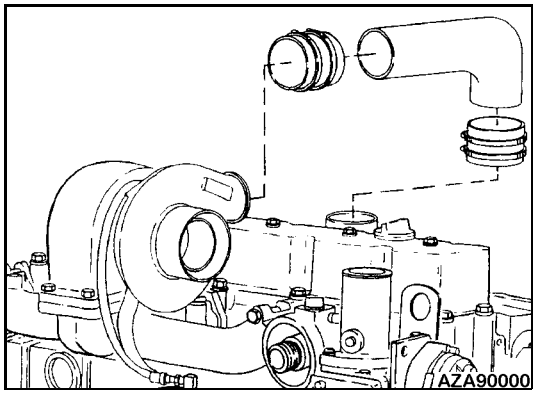


4. Rear drive shaft (2 places)

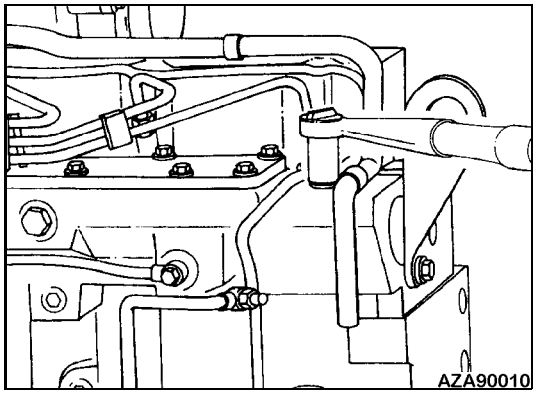


24.8.4 CHECK ENGINE VALVE CLEARANCE, ADJUST

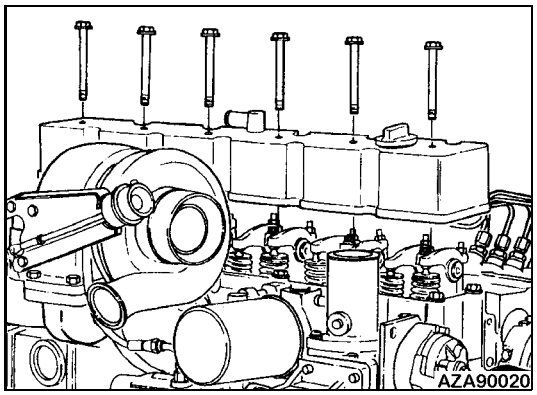
1. Remove the air crossover tube.



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.

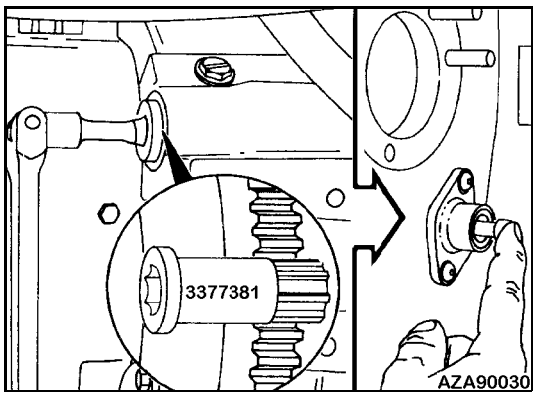


3. Remove the valve cover.

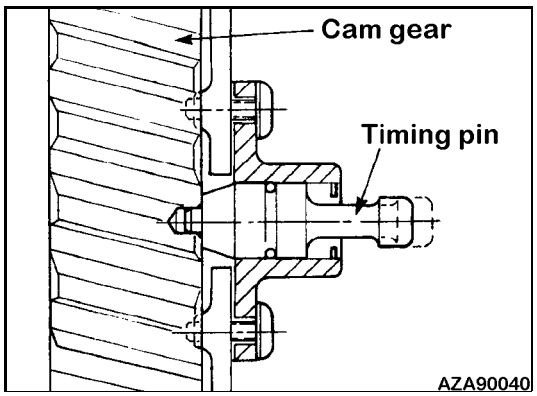


4. Locate top dead center (TDC) for cylinder number 1 by rotating the crankshaft slowly while pressing on the engine timing pin

Barring Gear 3377381

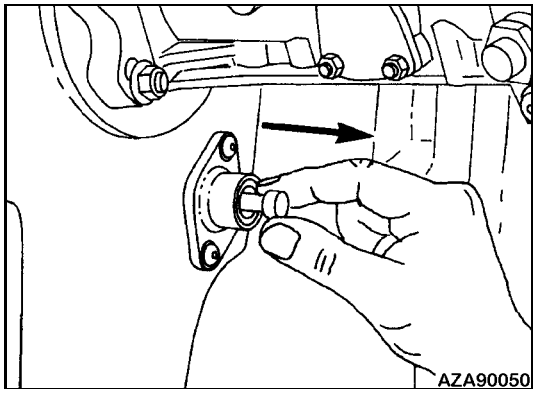


5. When the engine timing pin engages the hole in the camshaft gear, Cylinder Number 1 is at TDC on the compression stroke.



⚠ WARNING

Be sure to disengage the engine timing pin after locating TDC to prevent damage to the engine timing pin.

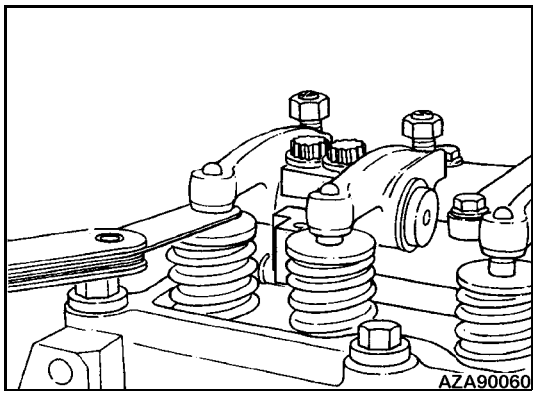


6. Intake Clearance: . . . . . 0.30 mm (0.012 in)
   Exhaust Clearance: . . . . . 0.61 mm (0.024 in)

Check or set valves with engine cold - below 60

REMARK

The clearance is correct when some resistance is felt when the feeler gauge is slipped between the valve stem and the rocker lever.



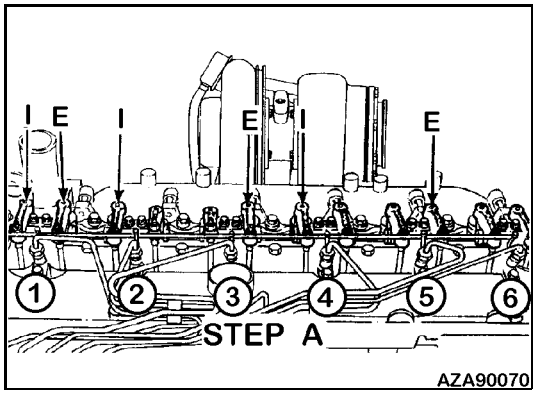
Step A

Locate top dead center (TDC) for cylinder number 1.

Check/Adjust the valves . . . . . I = Intake; E = Exhaust

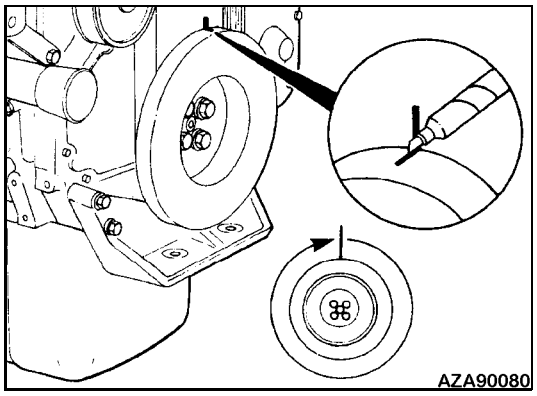
N·m Locknut . . . . . .24 N

After tightening the rocker lever lock nut, check the valve clearance to make sure it has not changed.



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).

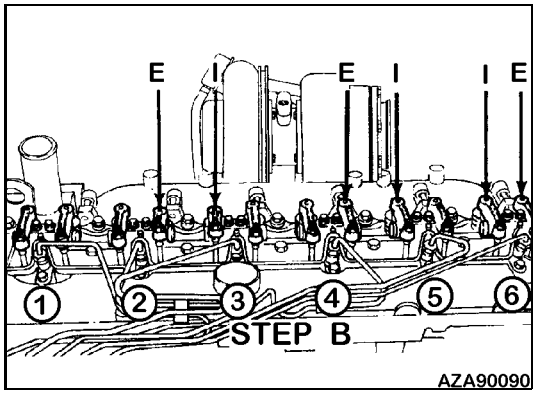


Step B

Check/Adjust the valves . . . . . I = Intake; E = Exhaust

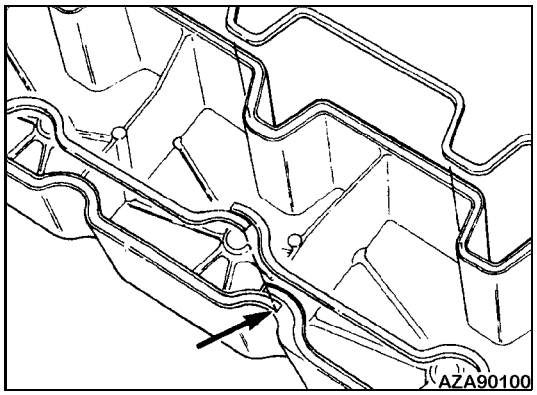
N·m Locknut . . . . . .24 N

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.

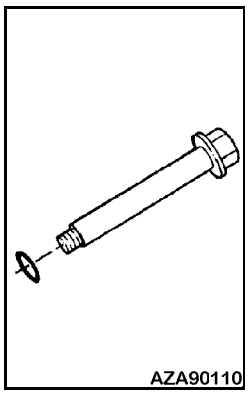
REMARK
Do not stretch the rubber seal.

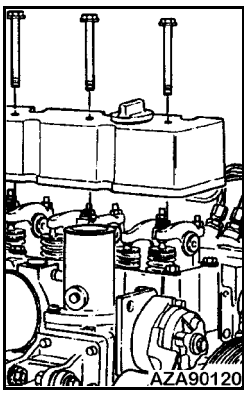


9. Install new sealing o-rings on the bolt.

10. Install the valve cover and wastegate sensing tube.

N·m Bolt . . . . . .24 N

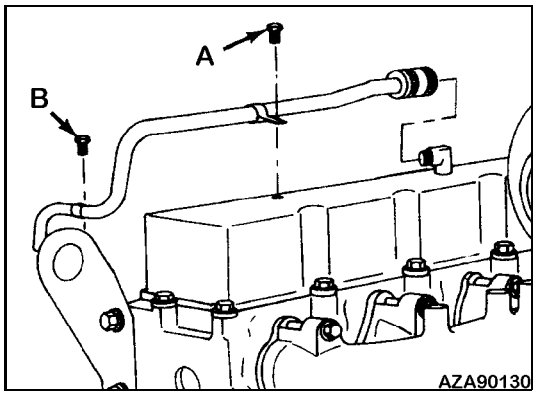




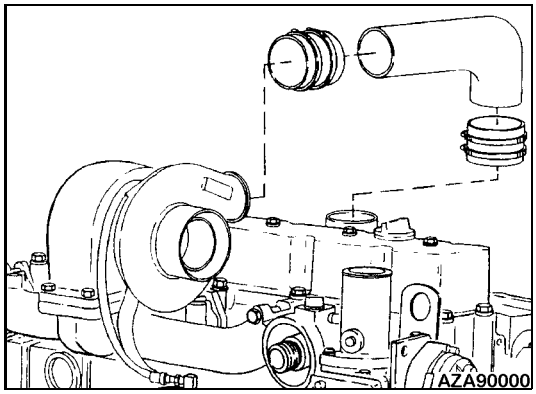
11. Install the crankcase vent tube and secure with the support clamps and hose clamp.

Bolt A . . . . . .24 N

Bolt B . . . . . .43 N



12. Install the air crossover tube and any other parts previously removed to gain access to the valve cover.

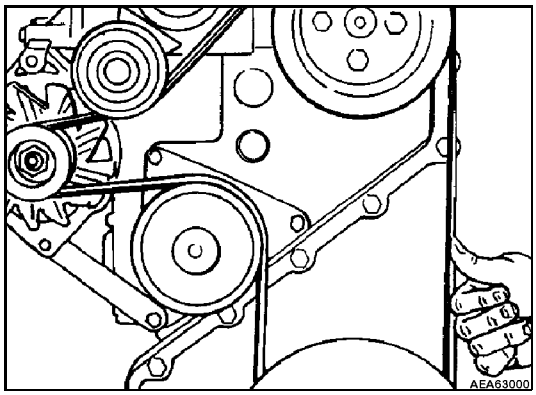


24.8.5 CHECK TENSION OF DRIVE BELT

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 (

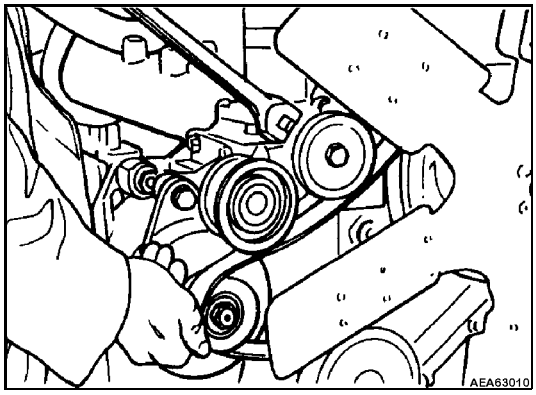
NOTE: Belt tension gauge ST-1293 may be used. The required gauge value is 356 to 489 N (80 to 110 lbs).



24.8.6 CHECK DRIVE BELT TENSIONER BEARING AND FAN HUB BEARING

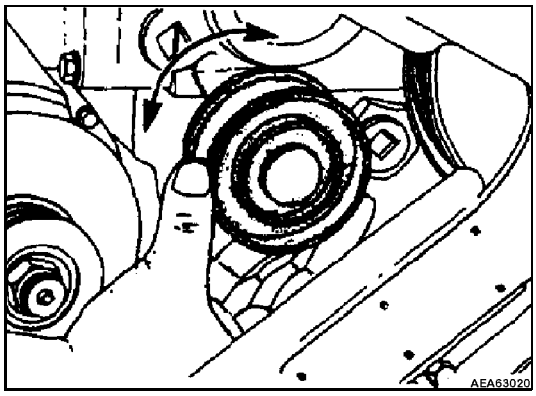
1. Remove drive belt and complete the following steps:

2. Inspect the belt for damage.



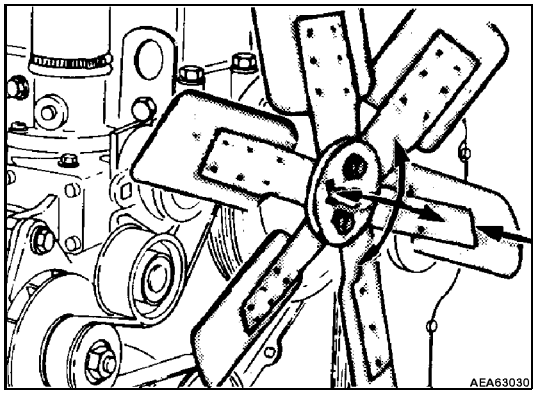
3. Check the tensioner bearing.

NOTE: The tensioner pulley should spin freely with no rough spots detected under hand pressure.

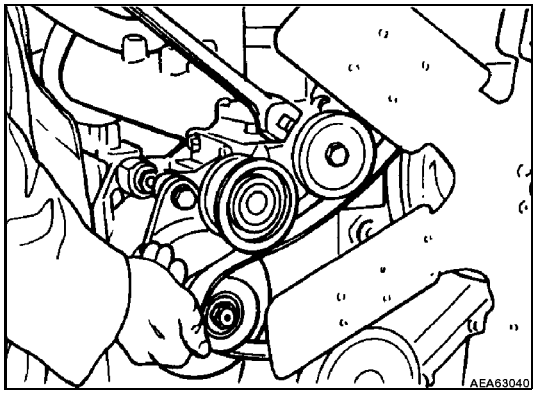


4. Check the fan hub bearing.

   The fan hub should spin freely without excessive end play.



5. Install the drive belt.



24.9 EVERY 2,000 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 coolant through the engine block, cylinder heads, radiator and engine oil cooler. Circulation is controlled by the thermostat which by-passes 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 is free of coolant and air flow restrictions and is filled to the proper level.

Selection and maintenance of 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 alone allows rust, scale deposits, and corrosion to occur within the system.

After 2,000 hours or 1 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 20.6 COOLANT SPECIFICATIONS on page 3-12.**

REMARKS

Always replace the coolant corrosion resistor cartridge after cleaning and flushing the cooling system and installing new coolant, **see 24.6 EVERY 250 HOURS SERVICE on page 3-43.**

Radiator Cap General Information

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 0.35 to 0.65 kg/cm² (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

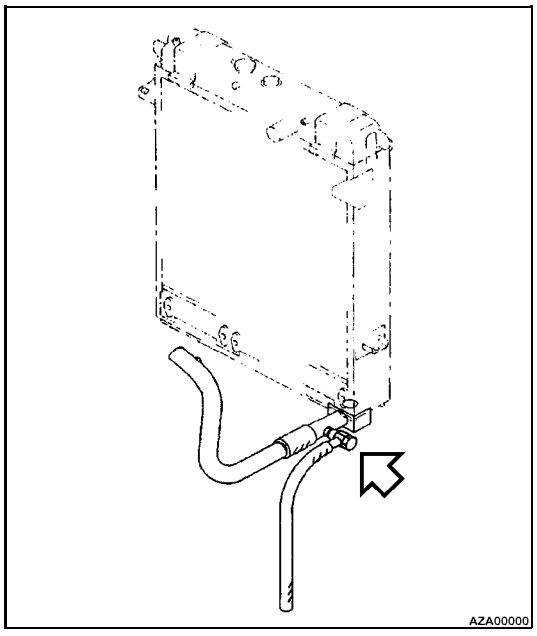
Coolant catch container . . . . . Min. 53

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 as necessary. 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.) Close the drain valve.

REMARKS

Always replace the coolant corrosion resistor cartridge after cleaning and flushing the cooling system and installing new coolant, **see 24.6 EVERY 250 HOURS SERVICE on page 3-43.**

Flushing the Cooling System

1. Refill the system with water only. Then run the engine at low idle and open the drain valve.

2. While the engine is running continue adding water in the top of the radiator, so that you are passing water through the cooling system for about 10 minutes. After flushing the system with water then close the drain valve.

3. 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. Do not use a caustic cleaners in the cooling system. Aluminum components will be damaged.

4. After cleaning with the flushing agent, refill the system with fresh water and repeat step 2 and 3 and run until clean water comes out the drain valve.

5. Now turn the engine OFF, drain all the water out, then close the drain valve.

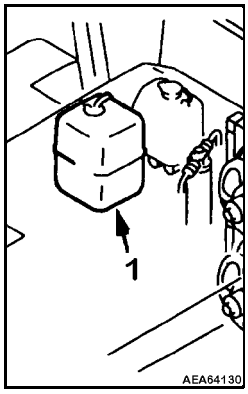
Filling the Cooling System

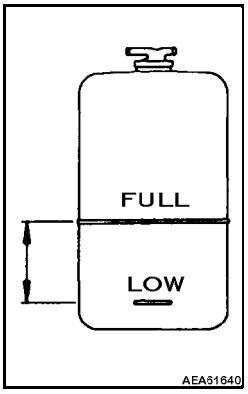
1. Prepare the proper coolant for your environment as specified, **see 20.6 COOLANT SPECIFICATIONS on page 3-12.**

2. 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

3. Turn the engine OFF and wait 3 minutes and then add more coolant until the radiator is full. Repeat steps 2 and 3 until all trapped air has been eliminated.

4. Drain and clean the inside of the radiator overflow tank (1). Then add coolant up to the FULL mark. Install the radiator cap as outlined in this section.





REMARKS

Always replace the coolant corrosion resistor cartridge after cleaning and flushing the cooling system and installing new coolant, **see 24.6 EVERY 250 HOURS SERVICE on page 3-43.**

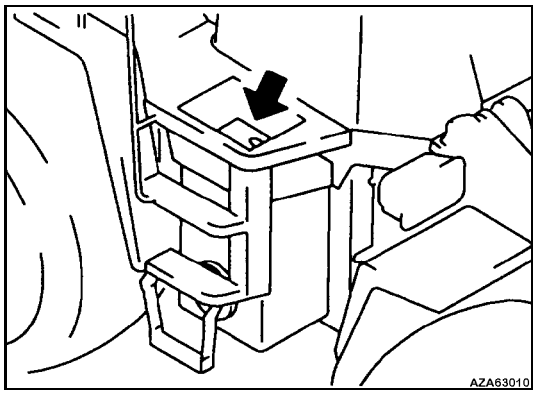
24.9.2 CHANGE OIL IN HYDRAULIC TANK, REPLACE HYDRAULIC FILTER ELEMENT

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.

Oil catch container . . . . . Min. 190

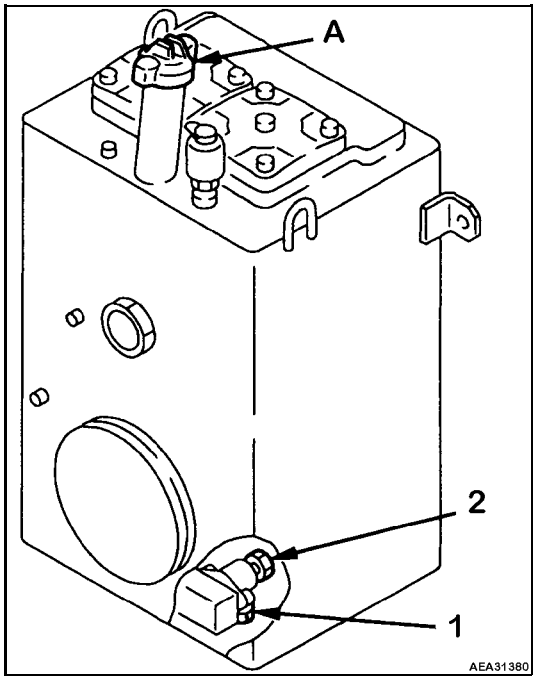
1. Lower the bucket to the ground and apply the parking brake, then turn OFF the engine.
2. Remove bolt, then remove cover. Cover design varies depending on machine.



3. Remove the cap of the oil filler **A**.
4. Set a container to catch the oil under drain plug (1).
5. Remove drain plug (1).
6. Open drain valve (2) gradually to drain the oil.
7. After draining the oil. close drain valve (2), then tighten drain plug (1).

Drain plug (1) . . . . . 69 ± 10 N

Drain valve (2) . . . . . 64 ± 15 N



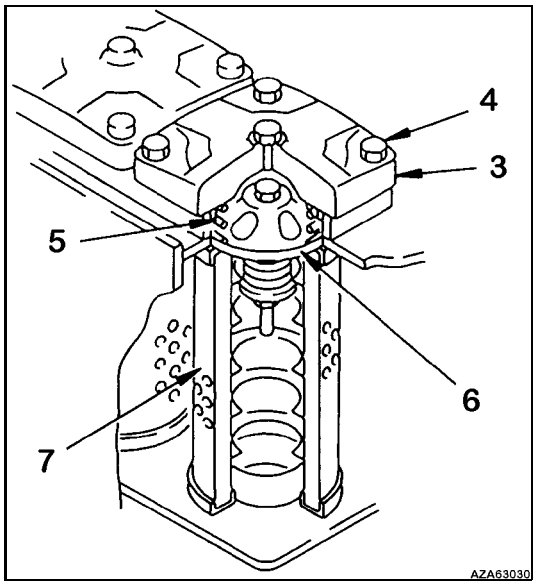
8. Remove the mounting bolts (4) of the two filter covers (3) at the top of the tank. Remove the covers. When doing this step, the cover could fly off because of the force of spring (5), so keep the cover pushed down while removing the bolts.

9. Remove the spring (5) and the by pass valve (6). Remove the element (7).

10. Check to be sure there is no foreign matter inside the tank before cleaning it.

11. After installing a new element, install the bypass valve (6), spring (5), and cover (3). If the O-ring of the cover is damaged or deteriorated, replace the O-ring.

12. When installing the cover bolts, push down on the cover and tighten the bolts evenly.



13. Add hydraulic oil through oil filler port **A** to the specified level, then install cap.

For details of the oil to use and refill capacity, **see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**

14. Check that the hydraulic oil is at a standardlevel, **see 24.5 EVERY 100 HOUR SERVICE on page 3-41.**

15. Run the engine at LOW idle and extend and retract the steering, bucket, and lift arm cylinders 4 to 5. times. Be careful not to operate the cylinder to the end its stroke (stop approximately 100 mm (4 in) before the end of the stroke)

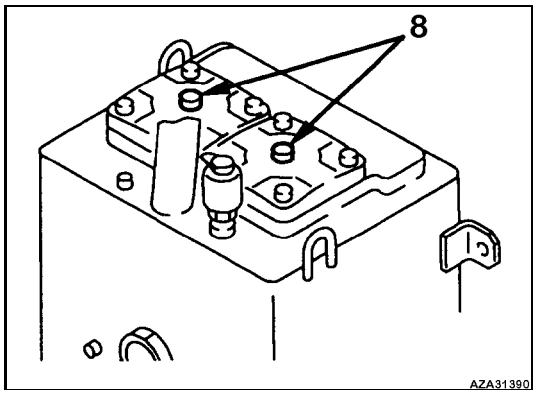
⚠ WARNING

If 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.

16. Next, operate the steering, bucket, and lift arm cylinders to end their stroke 3 to 4 times, then turn OFF the engine and loosen bleed plug (8). Then 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 (8) again.

17. Check the hydraulic oil level and add oil to the specified level. For details, **see 24.5 EVERY 100 HOURS SERVICE on page 3-41.**

18. Next, increase the engine speed and repeat the procedure in Step 16 to bleed air. Continue this procedure until no more air comes out from the plug (8).



N·m Bleed plug . . . . . 11 ± 2 N

19. Check that the hydraulic oil is at the standard level. For details, **see 24.5 EVERY 100 HOURS SERVICE on page 3-41.**

21. Check to be sure that there are no leaks of oil from the filter cover mount.

24.9.3 REPLACE HYDRAULIC TANK BREATHER ELEMENT

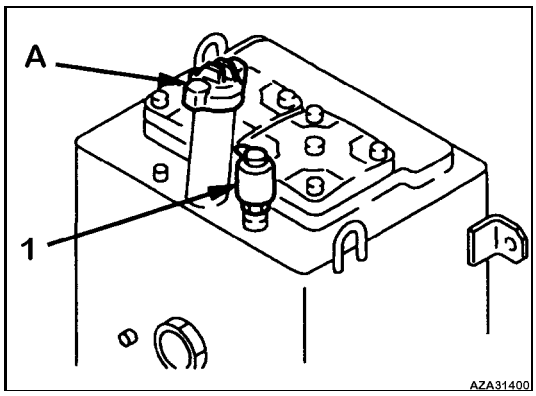
⚠ WARNING

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 the cap of the oil filler **A**.

2. Remove the snap ring on the breather (1). Remove the breather cap. Replace the filter element with a new part. Install the cap and snap ring.

3. Tighten the cap of oil filler **A**.



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 assembling again, and be careful not to over tighten.

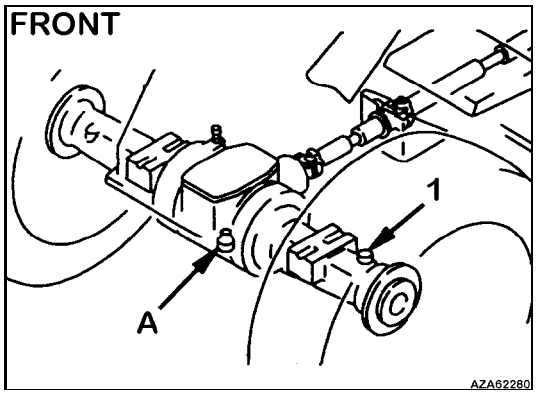
24.9.4 CHANGE AXLE OIL

⚠ WARNING

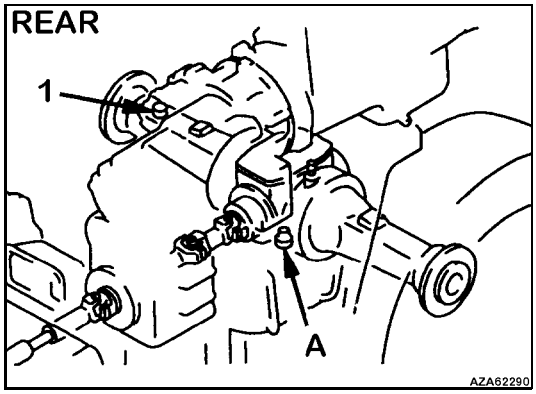
The oil is hot if the machine has just been operated. Wait for the oil to cool down before changing it.

Oil catch container . . . . . Min. 190

1. Set a container to catch the oil under drain plug **A**. Remove front and rear oil filler plugs (1), then remove drain plug **A** to drain the oil.



2. After draining the oil, clean all the plugs. Add axle oil through the plug hole (1) to the specified level.



For details of the oil to use and refill capacity, **see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.**

To be sure that the oil is at the specified level, **see 24.2 WHEN REQUIRED on page 3-26.**

REMARKS

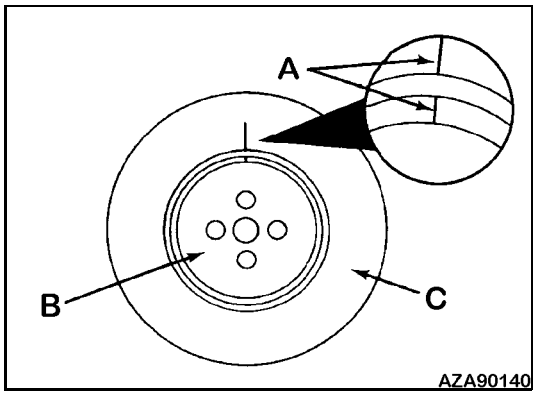
For operations where the brake is used frequently, change the axle oil at shorter intervals.

24.9.5 CHECK BRAKE DISC WEAR

Have your distributor check and repair brake discs.

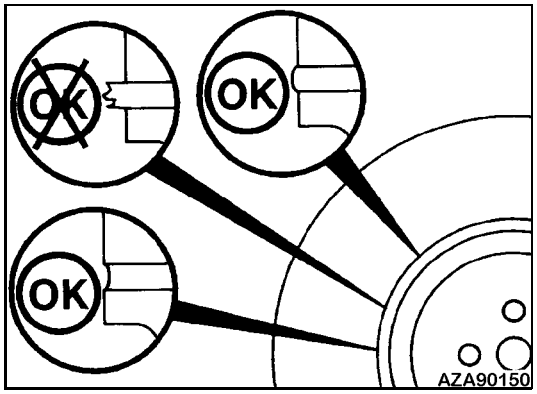
24.9.6 CHECK VIBRATION DAMPER

1. Check the index lines **A** on the damper hub **B** and the inertia member **C**. If the lines are more than 1.59 mm (1/16 inch) 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 inch) 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

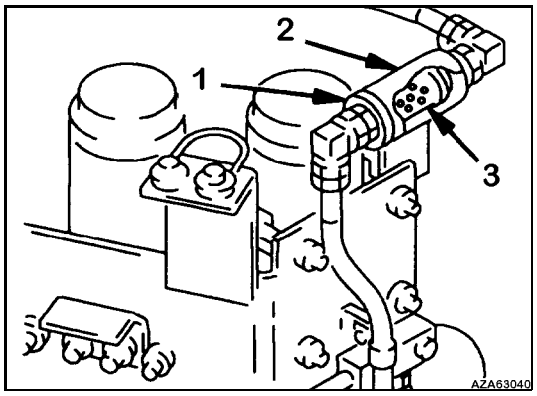
Remove both the recirculation filter and the fresh air filter in the same way as when cleaning, and replace them with new parts.

For details of cleaning the recirculation air filter, **see 24.6 EVERY 250 HOURS SERVICE on page 3-43.** For details of cleaning the fresh air filter, **see 24.5 EVERY 100 HOURS SERVICE on page 3-41.**

24.9.8 CLEAN PPC CIRCUIT STRAINER

1. Remove the flange (1). Remove the strainer case (2). Remove the strainer (3) and wash it in clean diesel oil.

2. Assemble the strainer (3) to the strainer case (2). Install it with the flange (1).



24.9.9 CHECK ACCUMULATOR GAS PRESSURE

When performing the EVERY 2,000 HOURS SERVICE or EVERY YEAR SERVICE or when making periodic replacement of critical parts, have your distributor check the accumulator gas pressure.

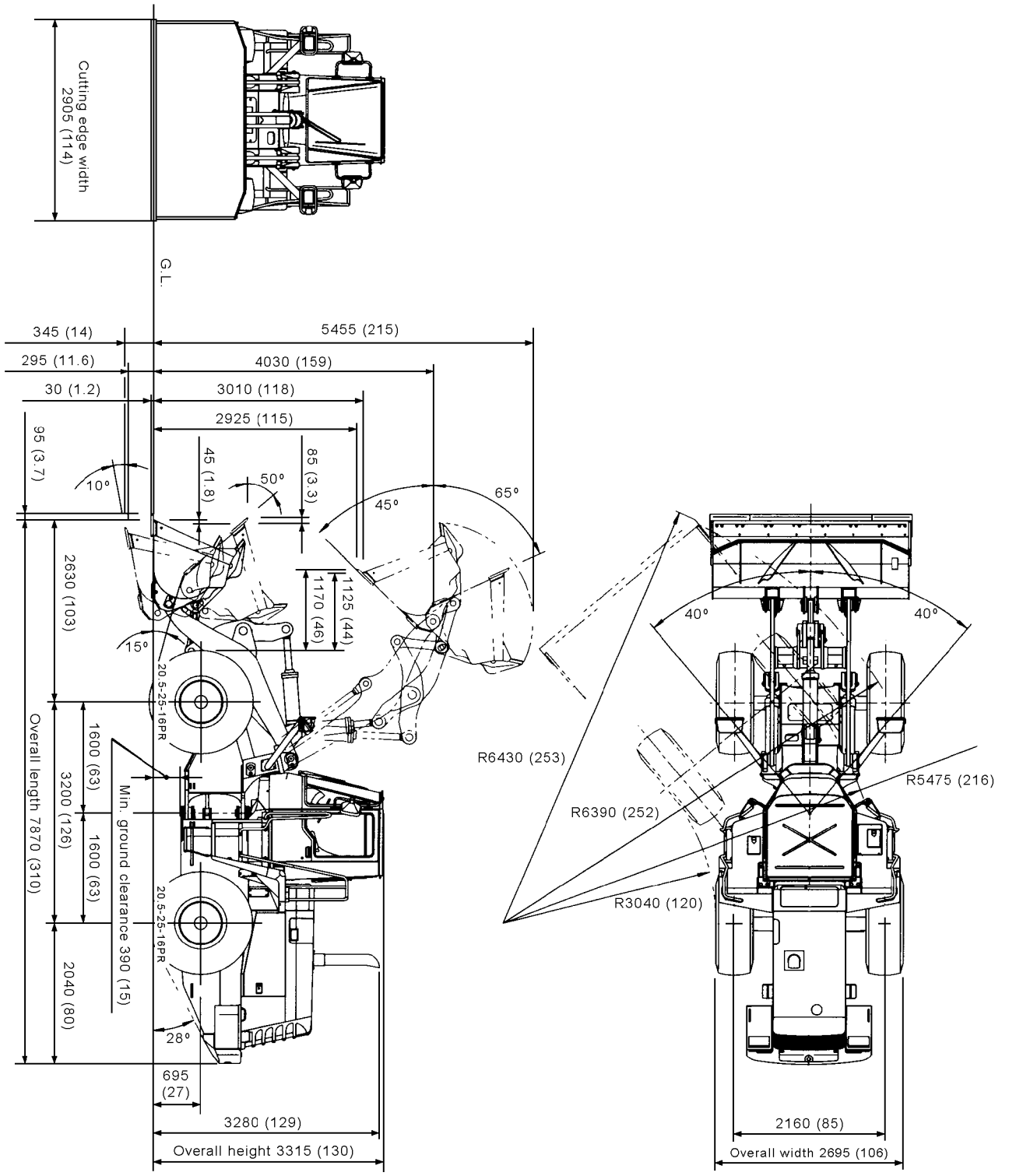
SPECIFICATIONS

25. SPECIFICATIONS

25.1 GENERAL

				Optional tire	Standard size tire
				20.5-25 L3	23.5-25 L3
PERFORMANCE	Bucket capacity			3.2 m³ (4.25 yd³)	
	Normal load			4960 kg (10940 lb)	
	Travel speed	Forward	1st	7.1 km/h (4.4 mph)	7.7 km/h (4.8 mph)
			2nd	11.4 km/h (7.1 mph)	12.3 km/h (7.6 mph)
			3rd	20.2 km/h (12.5 mph)	21.4 km/h (13.3 mph)
			4th	31.0 km/h (19.3 mph)	34.0 km/h (21.1 mph)
		Reverse	1st	7.4 km/h (4.6 mph)	8.0 km/h (5.0 mph)
			2nd	11.8 km/h (7.3 mph)	12.8 km/h (7.9 mph)
			3rd	21.0 km/h (13.0 mph)	22.6 km/h (14.0 mph)
			4th	32.5 km/h (20.0 mph)	35.0 km/h (21.7 mph)
	Maximum rimpull			159850 N (35935 lbf)	147100 N (33069 lbf)
	Minimum turning radius	Outside of chassis		6,430 mm (253 in)	
		Center of outside tire		5475 mm (216 in)	
WEIGHT	Operating weight Includes: 1 operator 80 kg (176 lbs), full fuel and oil, ROPS cab, front fenders and additional counterweight.			16730 kg (36890 lbs)	17830 kg (39315 lbs.)
ENGINE	Model			Komatsu S6D114E-1	
	Flywheel horsepower			141 kW (189 hp) @ 2200 RPM	
	Maiximum torque - gross			862 N	
	Starting motor			24 Volt 7.5 kW	
	Alternator			24 Volt 50 Amp	
	Battery			12 Volt 150 Amp hours x 2 pieces	

25.2 MACHINE SPECIFICATIONS



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OPTIONS, ATTACHMENTS

26. OPTIONAL PARTS AND ATTACHMENTS

NAME	SPECIFICATION, USE
Excavating bucket	Capacity 2.6 m^3 (3.4 yd^3) Capacity (with BOC) 2.8 m^3 (3.6 yd^3)
Light material bucket	Capacity (for light duty work) 3.8 m^3 (4.9 yd^3) Capacity (for light duty work, with BOC) 4.0 m^3 (5.2 yd^3)
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 fender

Seat belt

Tires

27. SELECTING BUCKETS AND TIRES

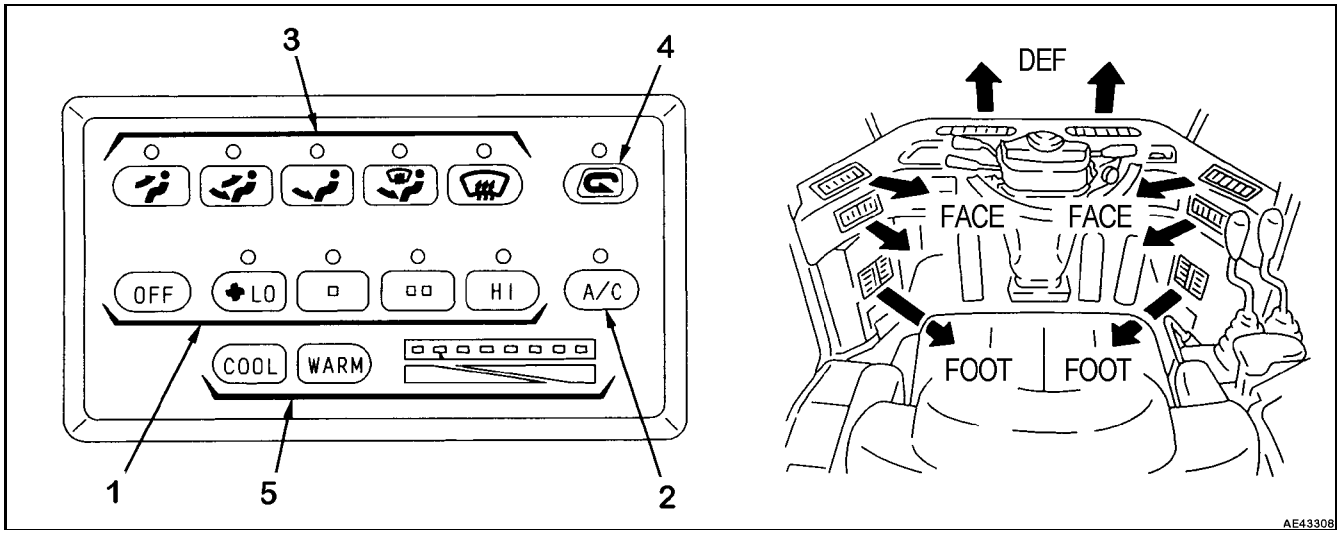
Select the most suitable bucket and tires for the type of work and job site conditions.

TYPE OF WORK	BUCKET	GROUND CONDITIONS	TIRE	
Loading products Loading and carrying products	Stockpile bucket with bolt on edge 3.2 m³ (4.25 yd³)	General ground condition	20.5-25-12PR Rock	23.5-25-16PR Rock
		Leveled ground condition	20.5-25-12PR Traction	23.5-25-12PR Traction
		Soft ground	20.5-25-12pr Traction	23.5-25-12pr Traction
Loading products and crushed rock	Stockpile bucket with teeth 2.9 m³ (3.8 yd³)	General ground condition	20.5-25-16PR Rock	23.5-25-16PR Rock
		Hard ground	20.5-25-20PR Rock	23.5-25-20PR Rock
Loading crushed rock	Excavating bucket with teeth 2.6 m³ (3.4 yd³)	General ground condition	20.5-25-20PR Rock	23.5-25-20PR Rock
		Soft ground	20.5-25-16PR Rock	23.5-25-16PR Rock

The speed display differs according to tire size, so when using optional tires, please contact your distributor.

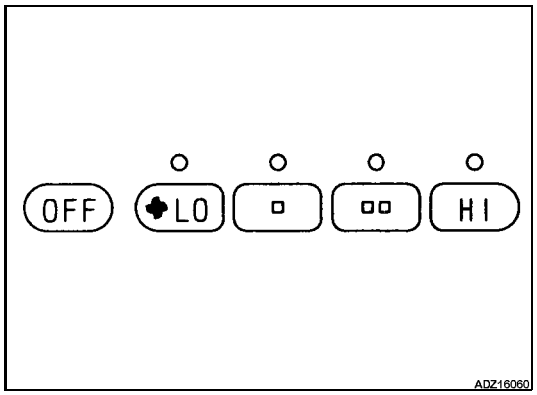
28. AIR CONDITIONING

28.1 GENERAL LOCATIONS AND FUNCTION OF CONTROL PANEL



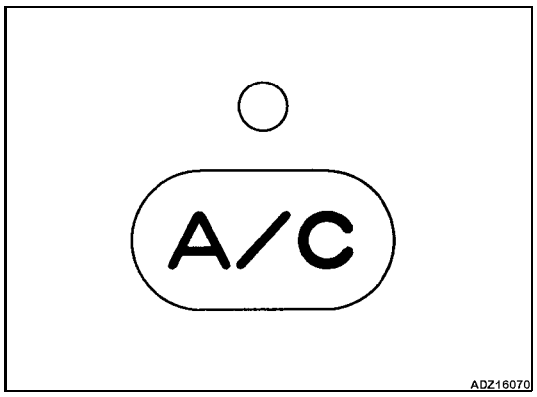
28.1.1 FAN SWITCH

This can be used to adjust the air flow to4 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.

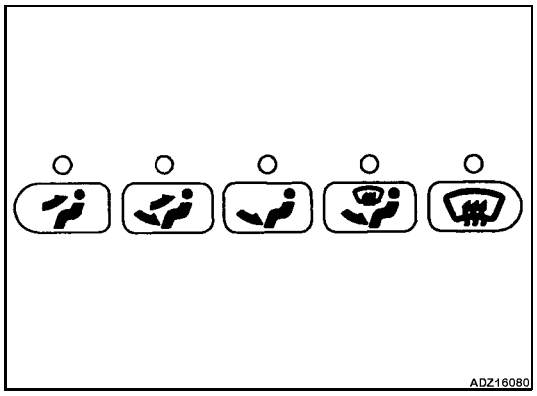


28.1.2 AIR CONDITIONER SWITCH

This is used to start or stop the cooling or dehumidifying function. When the fan switch isturned 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

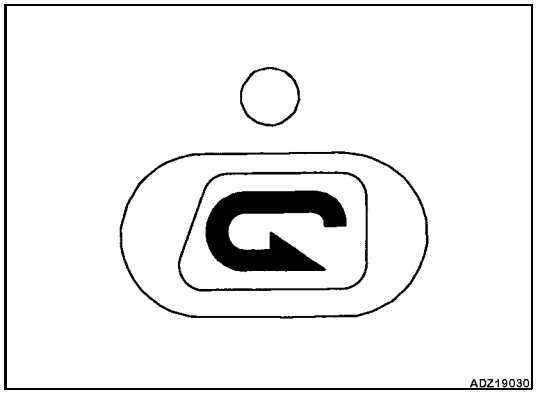


This is used to select the vents. The following five vent modes are available:

FACE
FACE/FOOT
FOOT
FOOT/DEF
DEF

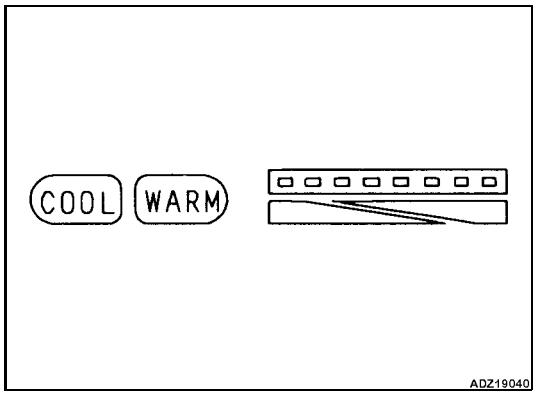
When the switch is pressed, the indicator lamp above that switch lights up to display the vent mode.

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.

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 is. 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 7 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)

If the air conditioner is used at the FRESH position, the inside of the cab will be pressurized and this will prevent the entry of dust. The higher the position of the fan switch, the more effective the pressurizing becomes.

28.2 METHOD OF OPERATION

Switch / Condition of use		Fan switch	Air conditioner switch	Temperature control switch	FRESH/RECIR switch	Vent mode selector switch
Cooling	Rapid	HI	ON	All blue	RECIR	FACE
	Normal	HI-LO	ON	More than half are blue	FRESH	FACE
Dehumidifying, heating		HI-LO	ON	More than half are red	FRESH	FOOT
Heating	Rapid	HI	OFF	All red	RECIR	FOOT
	Normal	HI-LO	OFF	More than half are red	FRESH	FOOT
Defroster		HI	ON	More than half are red	FRESH	DEF
Ventilation or pressurizing		HI-LO	OFF	All blue	FRESH	FACE

When carrying out the defrosting,if the temperature control switch is set so that 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 is 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

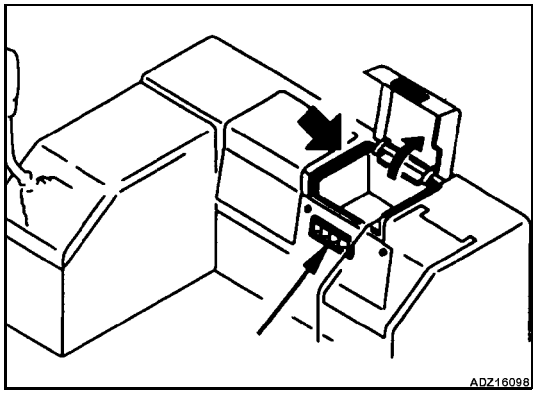
To lubricate each part of the compressor, occasionally operate cooling, dehumidifying and heating for a few minutes.

REMARK

When temperature in the cab 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

When the cooling is being used, this can be used for keeping drinks and other things cool. When the heating is being used, it can be used to keep things warm. When using the box, open the vent grill. When not using the box, close the grill. Do not use the cool box for things which smell or leak water or break easily. Do not use it as a holder for tools or other small objects.

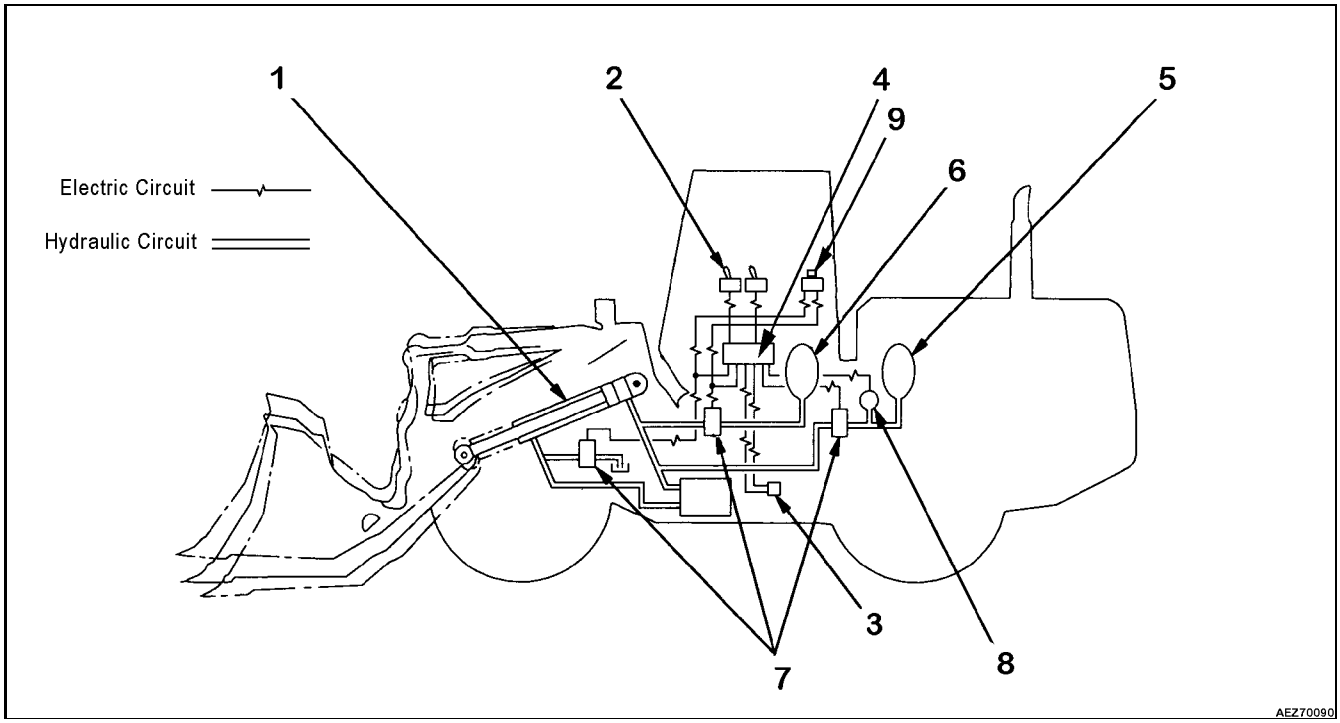


29. HANDLING ECSS

(Electronic Controlled Suspension System)

Always read this section before using the ECSS in order to enable you to use it safely and effectively.

29.1 STRUCTURE AND FUNCTION OF ECSS

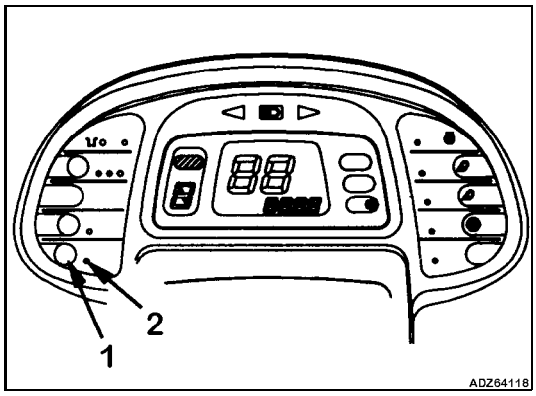


The ECSS uses the hydraulic spring effect of the hydraulic accumulator installed to the circuit at the lift cylinder (1) bottom to absorb the vibration of the chassis when the machine is traveling. This enables the machine to travel smoothly at high speed.

The ECSS consist 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 (3.1mph) or higher, the solenoid valves open, the circuit atthe 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 shutoff from the hydraulic accumulator, and the ECSS is not actuated.

When the ECSS is actuated, the pressure switches automatically open and the 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 press again, it is turned off, the pilot lamp goes out, and the ECSS is canceled.

It is possible to carryout 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/cm² (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 performed with the ECSS switch 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 PRECAUTIONS WHEN HANDLING ACCUMULATOR

⚠ 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.

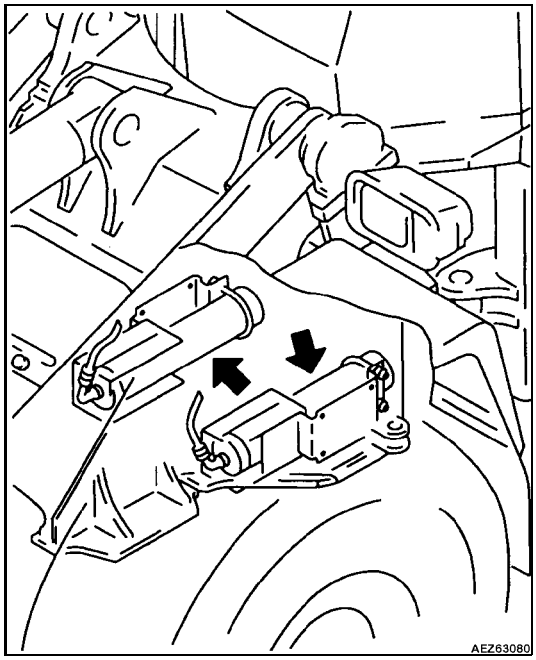
The gas must be charged into the accumulator only by a qualified person from your distributor or by a person licensed to handle high pressure gas.

Do not bring any flame or heat close to the accumulator when it is charged with gas.

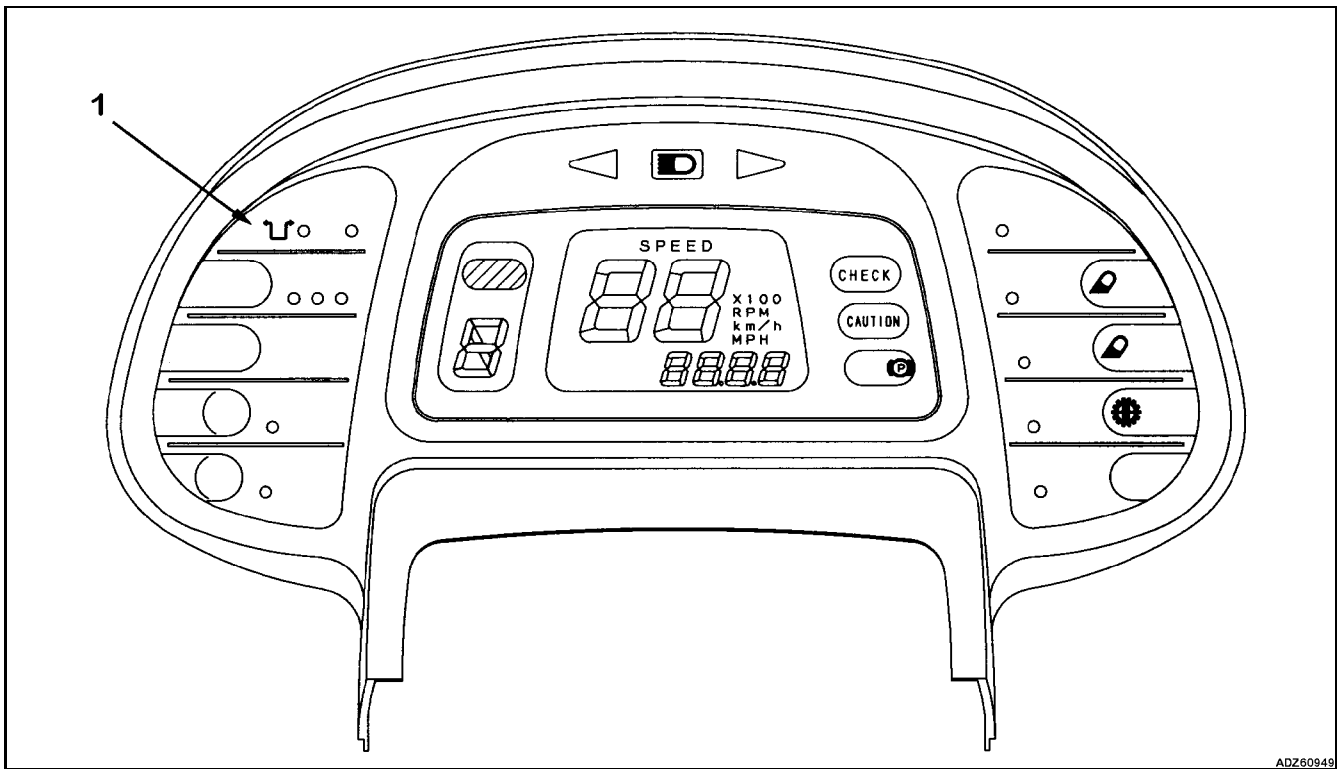
Do not make any hole in; or weld anything to, the accumulator.

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

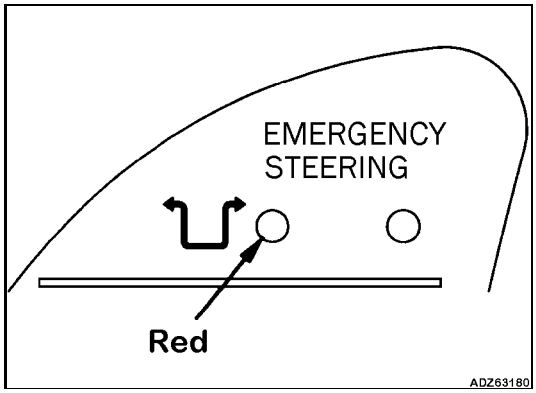


This is on the left side of the main panel and indicates the condition of actuation of the options.

30.1 EMERGENCY STEERING PILOT LAMP

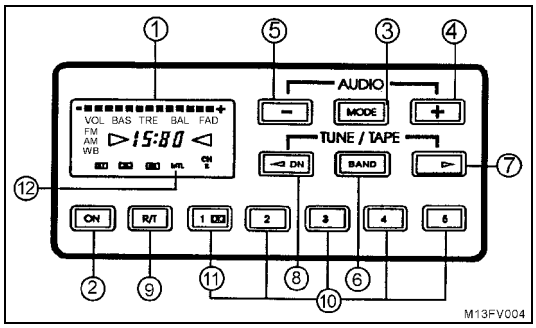
This indicates that the main pump is operating normally When the machine is traveling.

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 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 (LCD) PANEL
   This panel graphically represents all selected functions: radio frequencies, time and cassette functions.

2. ON-OFF POWER BUTTON
   This button is the primary control for turning the system on and off.

3. AUDIO MODE SELECTOR BUTTON
   This button allows the selection of the: volume, bass, treble, balance and fader control.

4 and 5. AUDIO LEVEL BUTTONS (+) (-)
   After selecting the audio mode (3) to be adjusted, use either the (+) button to increase or the (-) button to decrease the desired mode.

6. RADIO BAND/TAPE PROGRAM BUTTON
   In the radio mode, this control selects the broadcast band (FM1, FM2, AM, WB). In the cassette mode, this button allows the selection of Side 1or Side 2 of the cassette being played.

7 and 8. UP, DOWN TUNING/FAST FORWARD, REWIND
   In the radio mode, these buttons allow the operator to search for the radio frequency. In the cassette mode, these buttons select the Fast Forward or Rewind operation.

9. RADIO TIME/RADIO, TAPE SELECTOR
   In the radio mode, this button allows the operator to display either the time or radio frequency. Pushing a cassette tape into the cassette player automatically selects the tape mode. However, pressing this button while the tape is playing reverts to the radio mode and the tape continues to spool.

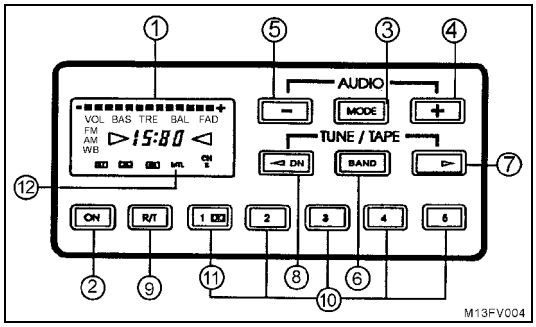
10. RADIO PRESET MEMORIES
    These five buttons allow the operator to store up to 20 radio stations (10 FM, five AM, and five weather bands) into memory.

11. DOLBY® NOISE REDUCTION
    In the tape mode, this button engages the Dolby® Noise Reduction. In the radio mode, this button is memory 1.

12. AUTO METAL TAPE SENSOR (MTL)
    The equipment automatically senses a cassette that requires metal or CrO_2 equalization and adjusts the reproduction accordingly. When activated, the MTL symbol appears on the display.

NOTE: The control panel operates all radio and cassette functions, except the eject function, which is actuated from the cassette player. The remote portion of the unit includes the controls only. The remote will not operate outside of its cradle holder. **See 30.2.4 REMOTE CONTROL UNIT on page 5-15.**

30.2.2 OPERATION



1. LIQUID CRYSTAL DISPLAY (LCD) PANEL
   The LCD panel is the primary information display: radio frequency, time, audio settings, and cassette operation (if used).

2. ON-OFF POWER BUTTON
   Press this button to turn off the power for the radio and cassette player. Press thisbutton again to turn on the power.

3. AUDIO MODE SELECTOR BUTTON
   After selecting the desired audio function, the LCD wil display the selected function: VOL (volume), BAS (bass), TRE (treble), FAD (fader). FAD will be displayed only if the four speakers connect to the system. Once the audio mode is selected, use the (+) button (4) or the (-) button (5) to adjust the level.

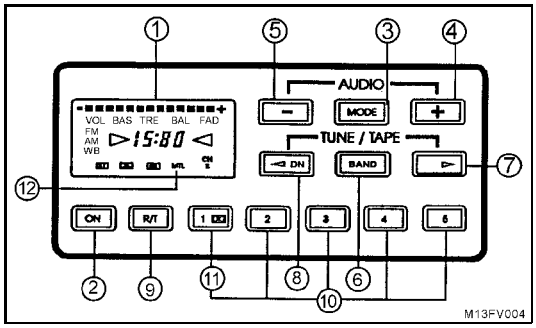
   Volume
   After VOL appears on the LCD, hold the (+) to increase the volume or the (-) button decrease the volume. A bar graph on the LCD indicates the progress. The bar graph has a maximum of 13 squares:

   Bass
   After BAS appears on the LCD, press the (+) or (-) button within five seconds to obtain the desired emphasis of the low range tones. A triangle (on the display panel to indicate the level. The unit will retain this setting when turned off.

   Treble
   After TRE appears on the LCD, press the (+) or (-) button within five seconds to obtain the desired emphasis of the high range tones. A triangle (
   indicate the level. The unit will retain this setting when turned off.

   Balance
   After BAL appears on the LCD, press the (+) button within five seconds to emphasize the the right speaker volume and the (-) button to emphasize the left speaker volume. The center illuminated arrow indicates mid-balance position.

4, 5. AUDIO LEVEL BUTTONS (+) (-)
   After obtaining the desired mode (3) to adjust, use these buttons to make the adjustments.



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 manually change from Side one to Side two of the cassette being played.

7, 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 the one being received, 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 the 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.

Pushing a cassette tape into the player automatically engages the tape mode.

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 the button until a "beep" is heard and then release to resume cassette play.

Operation (radio playing): The time is displayed until the radio frequency is changed or this buton is pressed, causing 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. PRESET RADIO STATION MEMORIES
To set any of the five memories in each band:
A. Turn on the system and select the band.
B. Select the first station to be preset with the UP and DN tuning controls (7) and (8).
C. Press the desired preset 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. Press the desired preset button to tune to the station in the memory.

E. Repeat the procedure for each button and four bands. You can change any preset memory 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 the 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.

30.2.3 SETTING THE CLOCK

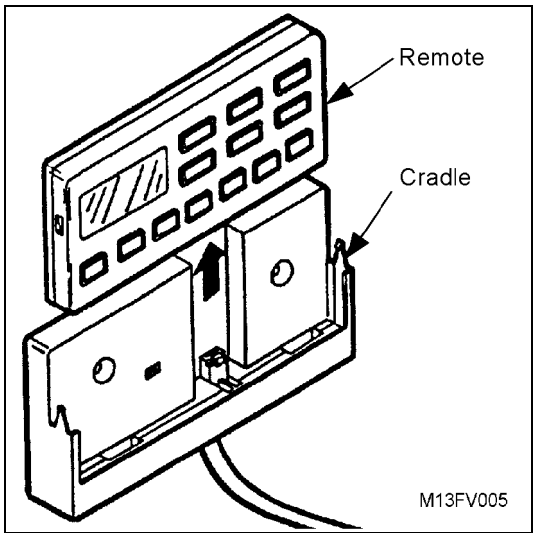
1. Turn on the radio power. Remove the cassette from the player.

2. Press and hold R/T button (9) until the time display begins to flash. Release the R/T button.

3. Within 10 seconds after releasing the R/T button, press the down tuning (DN) (8) to advance the hours. Press the UP button (7) to advance the 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 the radio power.

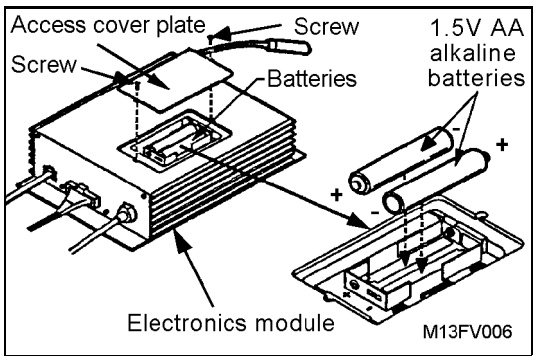
2. Grasp the sides of the remote at the top serrated edges and pull upward.

NOTE:

When removed from its cradle, the remote is inoperable.
Do not expose the remote or cradle to extreme heat, direct sunlight, solvents, or water.
Use a slightly damp, soft cloth to clean the remote. Never immerse the remote 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. Battery replacement is required when the clock fails to keep time or the memory presets fail.

NOTE:
Turn off the radio's power before replacing the batteries.

1. After removing the two screws that secure the access cover plate atop the module, remove the access cover plate.

2. Remove the two batteries.

3. Install two new 1.5 volt AA-type alkaline batteries.

NOTE:
Observe the proper polarity when installing the batteries. The correct battery polarity is illustrated 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 overhead clearance.

For safety reasons, when operating, keep the radio volume at a level that permits hearing sounds 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 use a soft, dry cloth (in extreme cases, alcohol may be applied sparingly to the cleaning cloth).