AE10300VD3-01

Operation & Maintenance Manual

RUBBER CRAWLER CARRIER

MST-300VD
MST-300VDR

Serial No. 3831 and up

⚠ WARNING

Unsafe use of this machine may cause serious injury or death. Operators and maintenance personnel must read this manual before operating or maintaining this machine. This manual should be kept near the machine for reference and periodically reviewed by all personnel will come into contact with it.

MOROOKA

CONTENTS

FOREWORD

1. FOREWORD

Thank you for purchasing this Morooka Rubber Crawler Carrier.
This manual describes procedures for operation, handling, testing, and maintenance. It will help the operator realize many years of faithful service from the machine.
Please read this manual carefully BEFORE operating the machine. This will enable you to realize the peak performance of the machine.
For details of handling the engine, please see the separate engine operation manual for any item not given 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 should read this manual thoroughly before beginning operation or maintenance.**
  Always keep this manual on the machine and be sure to read and understand it thoroughly before performing operation and maintenance.
- **Some actions involved in operation and maintenance of the machine can cause a serious accident if they are not done in the manner described in this manual.**
- **Keep this manual handy and have all personnel read it periodically.**
- **If this manual has been lost or has become dirty and cannot be read, request a replacement manual from Morooka or your Morooka distributor.**
- **If you lend this machine to another person, always have that person read the operation manual and make sure that they understand the content of the manual before starting operation. Be particularly careful to ensure that they follow the safety regulations when operating.**
- **Continuing improvements in the design of this machine can lead to changes in detail which may not be reflected in this manual. Consult Morooka or your Morooka distributor for the latest available information of your machine or for questions regarding information in this manual.**
- **The description of safety is given in SAFETY INFORMATION on page 0-3 and in SAFETY from page 1-1.**

2. INTRODUCTION

1. FEATURES OF THE MACHINE

- Low-ground-pressure rubber crawler type that can travel easily on uneven ground, soft ground, or snow.
- Long, wide rubber crawler to provide powerful and stable drawbar pull.
- Hydraulic drive (HST) to allow travel operations to be carried out with a single lever to give forward and reverse with stepless gear shifting, as well as turning and stopping.

2. BREAKING IN THE MACHINE

Your Morooka 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 hourmeter). Proper breaking in will allow the machine to give you many years of service.
During breaking in, pay particular attention to the following points.

- After starting the engine, idle it for 5 minutes to carry out the warming-up operation.
- Avoid operation with heavy loads or at high speeds.
- Avoid sudden starts, sudden acceleration, sudden steering and sudden stops except in cases of emergency.

3. WARRANTY

If any failure that is considered to be the responsibility of Morooka should occur within 6 months of delivery of the new machine or within 600 hours on the hourmeter, whichever comes sooner, repairs will be carried out free of charge in accordance with the warranty.

3. SAFETY INFORMATION

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

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

Do not operate or carry out maintenance of this machine unless you are sure that you understand the explanations and procedures completely.

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

⚠ DANGER

This word is used on safety messages and safety labels where there is a high probability of serious injury or death if the hazard is not avoided. These safety messages or labels 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 safety labels where there is a potentially dangerous situation which could result in serious injury or death if the hazard is not avoided. These safety messages or labels 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 safety labels for hazards which could result in minor or moderate injury if the hazard is not avoided. This word might also be word for hazards where the only result could be damage to the machine.

NOTICE

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

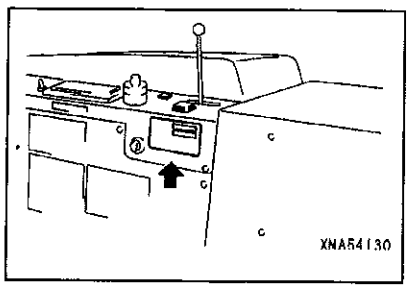
Safety precautions are described in SAFETY from page 1-1.

Morooka cannot predict every circumstance that might involve a potential hazard in operation and maintenance.

Therefore the safety messages 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, it is your responsibility to 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 Morooka distributor.

4. LOCATION OF SERIAL NUMBER

On this machine, a name plate stamped with the serial number is stuck to the side face at the rear of the operator's compartment as shown in the diagram on the right.



For the position of the engine serial number, please see the separate engine operation manual.
When inquiring about service or ordering parts, please quote the machine serial number, engine serial number, and hour-meter reading.

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.

1. GENERAL PRECAUTIONS

SAFETY RULES

- Only trained and qualified personnel, or personnel authorized by the company (or superior) can operate and maintain the machine.
- Follow all safety rules, prohibitions, precautions, procedures, and instructions when operating or performing maintenance on the machine, and pay careful attention to safety.
- Operating the machine when you are not in good physical condition reduces the power of judgment needed to avoid danger and leads to accidents.

  People in the following conditions should not operate the machine.
  - People who cannot operate normally because they are tired, ill, or suffering from the effects of medication.
  - People who have been drinking.
  - Pregnant women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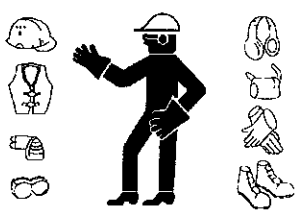
SAFETY FEATURES

- Be sure that all guards and covers are in their proper position. Have guards and covers repaired if damaged.
- Use safety features such as safety lock levers properly.
- Improper use of safety features could result in serious bodily injury or death.

  ★ Parking brake switch : See "OPERATION 3.9 PARKING MACHINE".

WEAR SUITABLE CLOTHING

- Always wear properly fitting clothes which allow ease of movement. If there are buttons, always button the cuffs.
- Avoid loose clothing, towels, jewelry, and loose long hair. They can catch or controls or in moving parts and cause serious injury or death.
- Also, do not wear oily clothes, they can easily catch fire.
- Wear a hard hat, safety glasses, non-slip safety shoes, and gloves when operating or maintaining the machine.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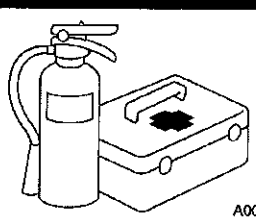
FIRE EXTINGUISHER AND FIRST AID KIT

- Be sure that fire extinguishers have been provided and read the labels to ensure that you know how to use them.
- Provide a first aid kit at the storage point.
- Know what to do in the event of a fire.
- Be sure that you know the phone numbers of persons you should contact in case of an emergency.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UNAUTHORIZED MODIFICATION

- Any modification made without authorization from Morooka can adversely affect the performance of the machine, and may also create hazards.
- Before making a modification, consult your Morooka distributor. Morooka will not be responsible for any injury or damage caused by any unauthorized modification.

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.

- Use well-ventilated areas for adding or storing oil and fuel.
- Keep oil and fuel in the determined place and do not allow un authorized persons to enter.
- Tighten all fuel and oil caps securely.
- Keep any flame away from flammable fluids.
- Do not leave any cloths or rags soaked in oil or fuel lying in the fuel or oil storage area. Clean such materials up immediately.
- Stop the engine and do not bring lighted cigarettes or cigarette lighters close when refueling.

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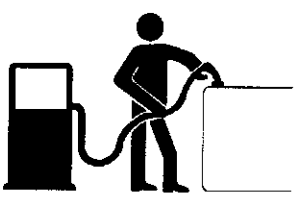

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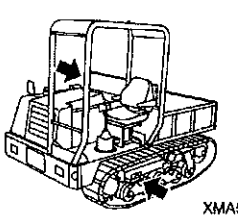
USE HANDRAILS AND STEPS FOR GET ON OR OFF

Get on or off the machine as follows.

- Never jump on or off the machine. Never get on or off a moving machine.
- When getting on or off the machine, always face the machine and use the handrails and steps.
- To ensure safety, always maintain three-point contact with the handrails and steps to ensure that you support yourself.
- If there is any oil, grease, or mud on the handrails or steps, wipe it off immediately. Always keep these parts clean.



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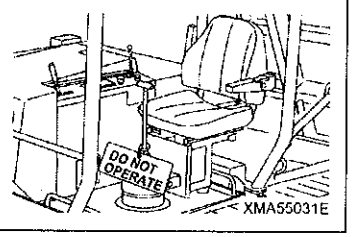
2. PRECAUTIONS DURING INSPECTION AND MAINTENANCE

NO UNAUTHORIZED PERSONS

Never allow unauthorized persons into the area when carrying out inspection and maintenance.
When leaving the operator's seat to carry out operations, hang a "DO NOT OPERATE ! " sign (Part No.: 1-41010-1210) on the control lever to prevent any other person from operating the machine.



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USE SUITABLE TOOLS

Always use tools that are designed for the purpose. Do not use broken or deteriorated tools, or tools that are designed for other purposes.


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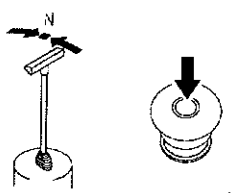
STOP ENGINE WHEN INSPECTION AND MAINTENANCE

When carrying out inspection and maintenance, always follow the precautions below.
- Select firm, level ground to park the machine.
- Lower the dump body, apply the parking brake, then stop the engine.
- Check that the travel lever is at the N position.
- If the engine must be started to carry out inspection or maintenance, take steps to ensure that the engine can be stopped at any moment.
- When carrying out the operation with two or more workers, determine the order of operation and fix signals, and follow the instructions of the person in charge.



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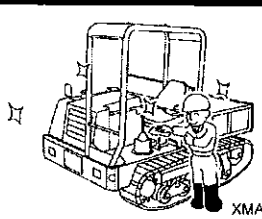
ALWAYS KEEP MACHINE CLEAN

Always do the following to keep the machine clean.
- Always keep the floor, steps, and handrails free of oil, grease, mud, or water. There is danger that you may slip and be injured.
  Always wipe off any oil, grease, mud or water.
- Do not leave tools or parts lying around on the floor or steps. There is danger that you may trip over them. Always clear up tools and parts immediately.
- Dry wood chips, leaves, grass, paper, oil, and other flammable materials around the engine, muffler, battery, or hydraulic tank may cause fire. Always remove any flammable objects and wipe off any oil.
- Always remove any mud accumulated around the undercarriage.
  There is danger that you may slip and fall when stepping on to the rubber crawler.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VENTILATION FOR ENCLOSED AREAS

Exhaust fumes from the engine can kill.
- If it is necessary to start the engine within an enclosed area, open the doors and windows to provide adequate ventilation.

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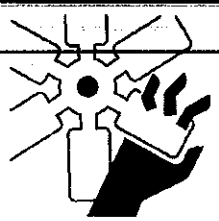
KEEP AWAY FROM ROTATING AND MOVING PARTS

- Do not go close to the fan when it is rotating. Do not bring anything that can be caught up in the fan close to the fan.
- Do not come close to the dump body when it is moving. There is danger of getting caught or crushed.



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KEEP AWAY FROM FLAME WHEN ADDING FUEL

When filling the fuel tank with fuel, or when draining the water, always follow the precautions below.
- Stop the engine.
- Do not bring any lighted cigarette or cigarette lighter close to the fuel tank.
- After adding fuel, tighten the cap securely and wipe up any spilled fuel.
- Do not bend the fuel hose or hit it with any sharp object.
- If any hose is loose or damaged, always repair or replace it.

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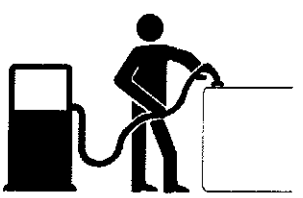

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DO NOT TOUCH HIGH-TEMPERATURE, HIGH-PRESSURE PARTS IMMEDIATELY AFTER STOPPING ENGINE

Immediately after stopping the engine, many parts are at high temperature or under high pressure. If parts are removed or touched carelessly, there is danger of burns or other injury.
For the following parts particularly, always wait for the machine to cool down before inspecting.
- Radiator and radiator cap
- Hydraulic tank and hydraulic hoses
- Muffler and all parts of engine.


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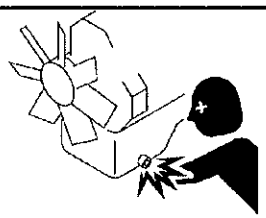
WAIT FOR ENGINE TO COOL BEFORE CHANGING ENGINE OIL

When changing the engine oil, always follow the precautions below.
- Stop the engine and wait for the engine and oil temperature to go down before changing the oil.
- After adding oil, tighten the cap and drain valve securely and wipe up any oil that was spilled.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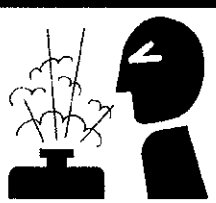
WAIT FOR WATER TEMPERATURE TO GO DOWN BEFORE ADDING COOLANT

Do not add water to the radiator.
Always follow the precautions below.
- Stop the engine and wait for the water temperature to go down.
- Turn the radiator cap slowly to release the internal pressure completely, then remove the cap.
- After adding water, tighten the cap securely and wipe up any water that was spilled.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WAIT FOR PRESSURE TO GO DOWN BEFORE ADDING HYDRAULIC OIL

When adding oil to the hydraulic tank or when changing the oil, always follow the precautions below.
- Lower the dump body and stop the engine.
- Loosen the hydraulic tank cap slowly to release the internal pressure completely, then remove the cap.
- After adding oil, tighten the cap and drain plug securely and wipe up any oil that was spilled.


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TAKE CARE WHEN HANDLING HIGH PRESSURE HOSES

Remember that oil is always flowing under high pressure in the hydraulic hoses. Do not remove the hoses before the internal pressure has been released.
When handling the high-pressure hoses, always follow the precautions below.

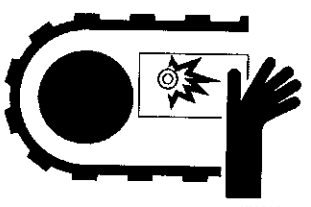
- Do not bend the high-pressure hoses or hit them with any sharp object.
- If any hose is loose or damaged, repair or replace it.
- It is extremely dangerous if oil is leaking from even small holes in the hoses or hydraulic equipment. If such a problem occurs, please contact your Morooka distributor.


A0055180

BE CAREFUL OF HIGH-PRESSURE GREASE WHEN ADJUSTING RUBBER CRAWLER ATTENTION

The rubber crawler tension adjuster is filled with grease. The grease is kept under high pressure by the recoil spring inside the tension adjuster.
Always follow the precautions below when adjusting the tension. If these precautions are not followed, the valve may fly out and cause serious injury.

- Do not loosen the tension adjustment valve more than one turn. There is danger that the valve may fly out.
- When adjusting the tension, do not stand directly in front of the valve; stand to the side to avoid danger.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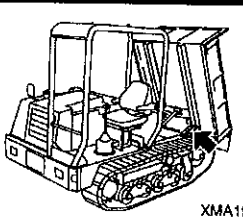
USE SAFETY BAR UNDER DUMP BODY

When going under the dump body to carry out operations, always follow the precautions below.

- Hang a "DO NOT OPERATE !" sign (Part No.: 1-41010-1210) in the operator's compartment to prevent any one else from operating the machine.
- Always use the safety bar when going under the dump body.
  ★ Safety bar: See "OPERATION 4.3 OPERATING SAFETY BAR".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BE CAREFUL WHEN HANDLING BATTERY

- When checking or repairing the electrical system, always remove the negative (-) terminal from the battery to stop the flow of electricity.
  Failure to do this may cause fire or short circuit.
- Be careful not to get battery electrolyte on your skin or clothes. If the battery electrolyte gets on you, wash it off immediately with water.


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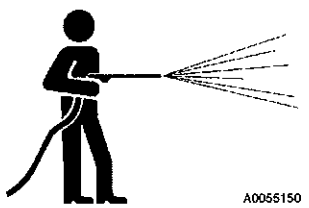
DO NOT SPRAY WATER ON ELECTRICAL COMPONENTS

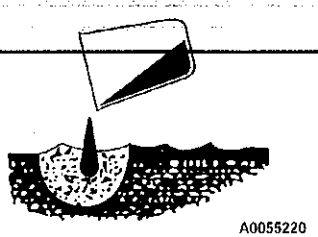
When washing the machine, do not spray water on the electrical components.
If water gets into the electrical system, it will cause defective operations which may lead to malfunctions.
Cover the following parts with a sheet to prevent water from getting on them.

- Instrument panel and control panel, switches, sensors, connectors
- Starting motor, alternator, sensors, connectors around the engine
- Battery, relay, connectors at front right of machine



DISPOSE OF WASTE MATERIAL CORRECTLY

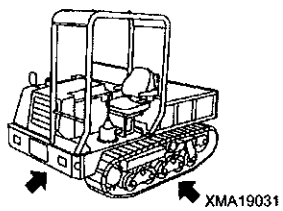
- When draining and changing the oil, always put a container under the engine and tank to catch the oil.
- Do not drain the oil directly into the ground or throw it into rivers or the sewage system.
- When disposing of oil, fuel, coolant, solvent, filters, batteries, and other harmful objects, always use a suitable method or procedure.



3. PRECAUTIONS BEFORE STARTING ENGINE

ALWAYS CARRY OUT CHECKS BEFORE STARTING

Before starting the engine, always carry out the walk-around checks and inspections given in this manual.
- Check the ground under the machine to see if there is any trace of oil or water leakage.
- Be particularly careful to check the undercarriage for loose or missing nuts and bolts.
- If any abnormalities are found during the check, carry out simple repairs. If the repairs are difficult, please contact your Morooka distributor. The machine must not be used before repairs are carried out.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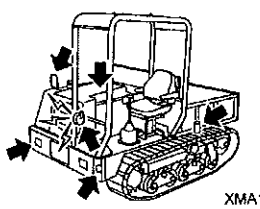
CHECK SAFETY PARTS AND LIGHTING

Check the operation of the following parts and devices needed for operation.
- Check that the horn, buzzer, and turn signal lamps work normally.
- Check that the front lamps light up normally.
- Check that the side mirrors are adjusted so that they give a clear view from the operator's seat.
- Clean the lights to ensure that they give good visibility.
- Adjust the operator's seat to a suitable position for operation. Always adjust the seat if it has been used by another operator.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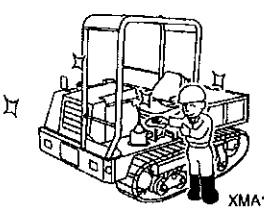
ALWAYS KEEP OPERATOR'S COMPARTMENT CLEAN

Always do the following to keep the operator's compartment clean and tidy.
- Always keep the floor, steps, and handrails free of oil, grease, mud, or water. There is danger that you may slip and be injured. Always wipe off any oil, grease, mud or water.
- Do not leave tools or parts lying around on the floor or steps. Keep these parts in the proper place to prevent them from obstructing operation.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FIRE PREVENTION

- Completely remove all wood chips; leaves, grass, paper and other flammable materials accumulated in the engine compartment. They could cause a fire.
- Check fuel, lubrication, and hydraulic systems for leaks. Have any leaks repaired. Wipe up any excess oil, fuel or other flammable fluids.


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VENTILATION FOR ENCLOSED AREAS

Exhaust fumes from the engine can kill.
- If it is necessary to start the engine within an enclosed area, open the doors and windows to provide adequate ventilation.

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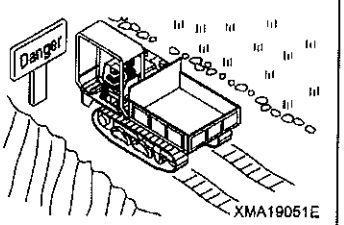
SAFETY AT WORKSITE

Before starting operations, thoroughly check the area for any unusual conditions that could be dangerous.
- Check the terrain and condition of the ground at the worksite, and determine the best and safest method of operation.
- If there are any dangerous places, erect signs and take other steps to ensure safety.
- Check the depth and flow of water and the ground condition before operating in water or crossing a river. NEVER be in water which is in excess of the permissible water depth.
- If there are bridges or any other structure, check that they are of sufficient strength to support the weight of the machine.
- Inside the jobsite, do not allow any person other than the signalman to come close. Restrict the entry even of related workers.



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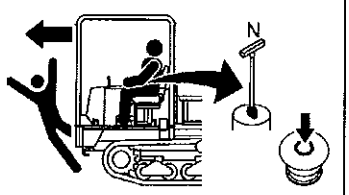
4. PRECAUTIONS WHEN STARTING ENGINE

PLACE LEVERS AT NEUTRAL

Always place the levers at the following positions.
- Place the travel lever at the N position.
- Place the dump control lever at the HOLD position.
- Set the parking brake switch to the STOP position.
- Sit properly in the operator's seat and fit the seat belt.



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CHECK FOR SAFETY IN SURROUNDING AREA

Always check that there are no people in the surrounding area. Be particularly careful to check under the machine.
- Never start the engine if a warning tag has been attached to the controls.
- When starting the engine, sound the horn to warn people in the area.
- Do not allow anyone other than the operator to ride on the machine.

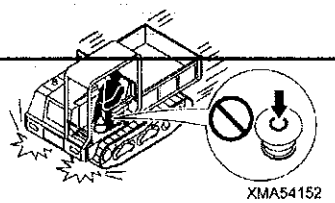
5. PRECAUTIONS WHEN TRAVELING

CHECK FOR SAFETY IN SURROUNDING AREA

Always check that there are no people in the surrounding area. Be particularly careful to check behind the machine.
- If the dump body is raised, always lower it.
- Sound the horn to warn people in the area that you are about to start the machine.

AVOID SUDDEN OPERATIONS EXCEPT IN EMERGENCIES

Do not suddenly start, suddenly stop, or suddenly turn the machine or carry out any other operation suddenly. Such operations may cause the crawler to come off and the machine to tip over.
- When starting or turning the machine, operate the travel lever slowly. Run the engine at low speed.
- Return the travel lever slowly to the N position. Apply the brake to stop the machine.
- If the travel lever is moved too far beyond the N position to the REVERSE (or FORWARD) position, the engine will run in reverse, or other problems will occur.
- Do not use the parking brake to stop the machine.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TRAVEL CAREFULLY ON UNEVEN GROUND OR ON CURVES

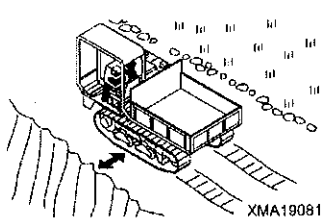
When traveling on uneven ground or in places where there are many curves, reduce the travel speed and travel carefully. If the machine is traveling at high speed it may turn over or crawler may come off.

NO TRAVELING ON PUBLIC ROADS

This machine is not permitted to travel on public roads.
When moving the machine, always transport it by truck or trailer.

BE CAREFUL OF ROAD SHOULDERS

When traveling on narrow agricultural roads, always follow the precautions below.
- Do not travel too close to the road shoulder, and travel at reduced speed.
- Do not travel on any soft road shoulder or place covered with grass.
- During or after rain, the danger of landslides and falling rocks increases. Always travel at low speed and check that the area is safe.

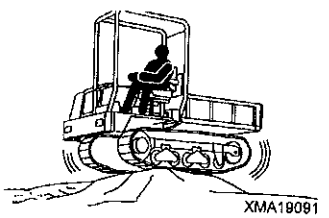

XMA19081

AVOID OBSTACLES

Avoid traveling over obstacles or earth embankments as far as possible. If the machine has to travel over an obstacle, do as follows.
Never travel over large boulders, breakable objects, pieces of concrete, or other sharp objects.

- Reduce the travel speed and travel carefully.
- Steer the machine so that the center of the rubber crawler passes directly over the obstacle. Mount the obstacle slowly, and when the machine goes over the top and starts to tip forward, stop the machine. Then slowly start the machine again. Never change direction when doing this.
- Earth embankments may collapse under the weight or vibration of the machine and cause the machine to slip, so drive the machine slowly and do not change speed or direction.

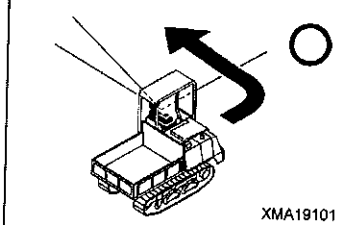
Be particularly careful when traveling over freshly dug ditches. They may collapse.


XMA19091

TRAVELING ON SLOPES

When traveling on hills or slopes, always follow the precautions below.

- Do not travel at an angle on a hill or slope, or parallel to the slope. Such action could result in the machine tipping over or slipping.
- When traveling up hills or slopes, always travel directly up the slope. Set the travel speed to a low range and keep the travel lever close to the N position (low speed).
- Do not suddenly change speed on the slope. There is danger that the direction of the machine may suddenly change and the machine may slip.
- When traveling down slopes, set the travel speed to a low range, run the engine at low idling, and operate the travel lever to a position less than 1/2 of the full stroke from the N position.
  If the machine travels too fast, there is danger that the engine will overrun and the machine may slip.
- Do not travel on grass, fallen leaves, wet steel plates, or other slippery objects.
- If a dangerous state occurs by any possibility, and when it becomes necessary to stop the machine urgently, press the parking brake switch to set it to the STOP position or turn the engine starting switch to the OFF position to stop the engine.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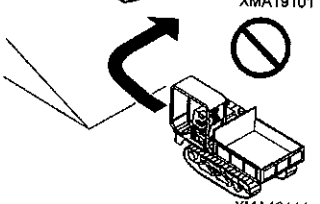
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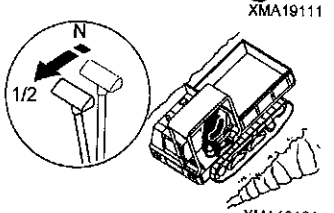


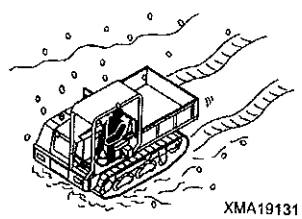
XMA19121

ENSURE GOOD VISIBILITY

When working in dark places or at night, turn on the head lamps.
Turn on the lights in mist, snow, or rain.

OPERATE CAREFULLY ON SNOW

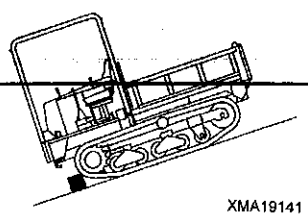
- When working on snow or icy roads, even a slight slope may cause the machine to slip to the side, so always travel at low speed and avoid sudden starting, stopping, or turning.
- When there has been heavy snow, the road shoulder and objects placed beside the road are buried in the snow and cannot be seen, so always carry out operations carefully.


XMA19131

PARKING MACHINE

Park the machine on firm, level ground.
Select a place where there is no problem of falling rocks, landslides, or floods.
If the machine has to be parked on a slope, do as follows.

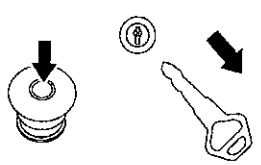
- Stop the machine facing directly up or down the slope.
- Always put blocks under the tracks to prevent the machine from moving.
- Lower the dump body fully.


XMA19141

REMOVE KEY WHEN LEAVING MACHINE

When leaving the machine, always do as follows.

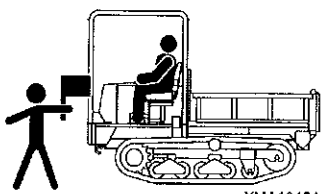
- Lower the dump body fully.
- Apply the parking brake, then stop the engine.
- Remove the starting key and always take it with you.


XMA54161

6. PRECAUTIONS FOR OPERATION

USE SIGNALS

When carrying out work with one or more workers, or when using a signalman, determine the signals and the person in charge before starting work, and always follow the agreed procedure.
Even when using a signalman, always pay careful attention to the following.
- When working in confined spaces or indoors, be careful not to hit the surroundings or the ceiling.
- When operating in urban areas or on roads, put up fences around the jobsite and take steps to ensure the safety of passing traffic and pedestrians.

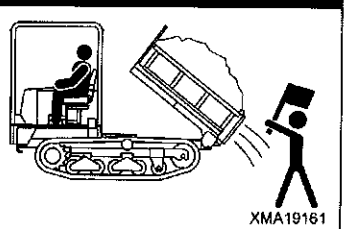

XMA19151

MAKE JOBSITE FLAT

Make the jobsite flat. This will not only increase the efficiency but will also ensure safety.
If the jobsite is dusty, spray water to ensure the visibility.

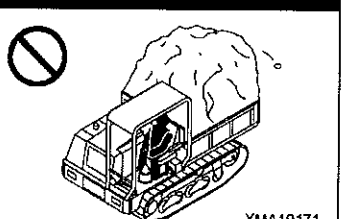
OPERATE DUMP BODY CAREFULLY

When carrying out dumping operations, be careful of the following.
- Check that there is no person or obstacle near the dump body.
- Stop the machine at the determined point and operate the dump in accordance with signals from the signalman.
- Block the tracks to prevent the machine from moving in reverse.
- When dumping on slopes, there is danger of the machine tipping over. If it is felt that there is danger to the machine, stop the operation immediately.


XMA19161

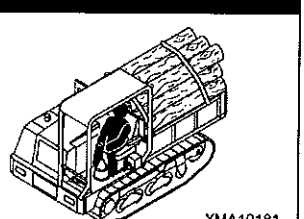
NO OVERLOADING

Never load the machine above its capacity.
Overloading will not only cause failures, but will also cause overrunning and tipping over on slopes.


XMA19171

LOAD DUMP BODY EVENLY

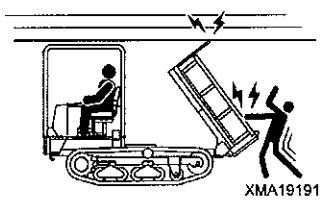
- Do not load the dump body on one side. Always spread the load to maintain the balance in the dump body.
- When carrying long objects, such as timber or steel beams, give careful consideration to the position of the center of gravity of the load, and secure with ropes.
- When stacking U-shaped ditch liners or concrete blocks, lay a plate down first and secure with ropes to prevent the load from slipping.


XMA19181

DO NOT GO CLOSE TO HIGH-VOLTAGE CABLE

When carrying out operations on jobsites where there are power cables, use a signalman and take steps to protect the electric cables. Check with the electricity company before starting operations.

- Going close to high-voltage cables can cause electric shock, even if the machine does not touch the cables. Always maintain the safe distance given below between the machine and the electric cable.



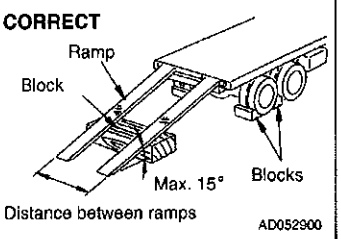
	Voltage of Electrical Cable	Minimum Safe Distance
Low voltage (Distribution line)	100 • 200V	2m
	6,600V	2m
	22,000V	3m
Special (Transmission line)	66,000V	4m
	154,000V	5m
	187,000V	6m
	275,000V	7m
	500,000V	11m

- If the dump body should touch the electric cable, the operator should not leave the operator's compartment. He should call another worker to report the situation.
  The following actions are effective in preventing accidents.
  (1) Wear shoes with rubber soles.
  (2) Use a signalman to give warning if the machine approaches too close to the electric cables.
- When carrying out operations near high-voltage cables, do not let anyone come close to the machine.

7. PRECAUTIONS FOR TRANSPORTATION

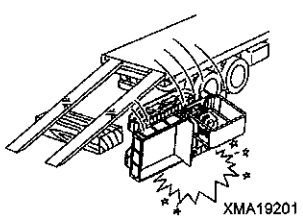
USE SAFE RAMPS

Always use ramps which fulfill the following conditions.
- Strong ramps which can fully support the weight of the machine.
- Ramps with a width greater than the width of the crawlers.
- Ramps of a length which will not form a steep angle when placed against the platform of the truck or trailer to be used for transportation.
  If the ramps are too long and they bend excessively, use blocks to support the ramps as necessary.
- Ramps with hooks and non-slip surface.
- Be sure that the ramp surface is clean and free of grease, oil, ice and loose materials. Remove dirt from the machine tracks.



LOADING AND UNLOADING

Loading and unloading the machine always involves potential hazards. EXTREME CAUTION SHOULD BE USED.
Always do as follows
- Perform loading and unloading on firm level ground only.
- Stop the engine of the haulage truck, apply the parking brake securely, then block the tires.
- Set the ramps parallel and in line with the width of the crawlers.
- Fix the hooks of the ramps securely to the truck platform.
- Set the machine to be loaded in line with the ramps, then approach the ramps at low speed.
- Do not correct the direction of travel when on the ramps.
  If it is necessary to change the direction, drive the machine off the ramps, and set the machine to the correct direction.
- After loading, put blocks under the front and rear of the crawlers to prevent the machine from moving, then tie the machine down with chains or wire rope.



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.

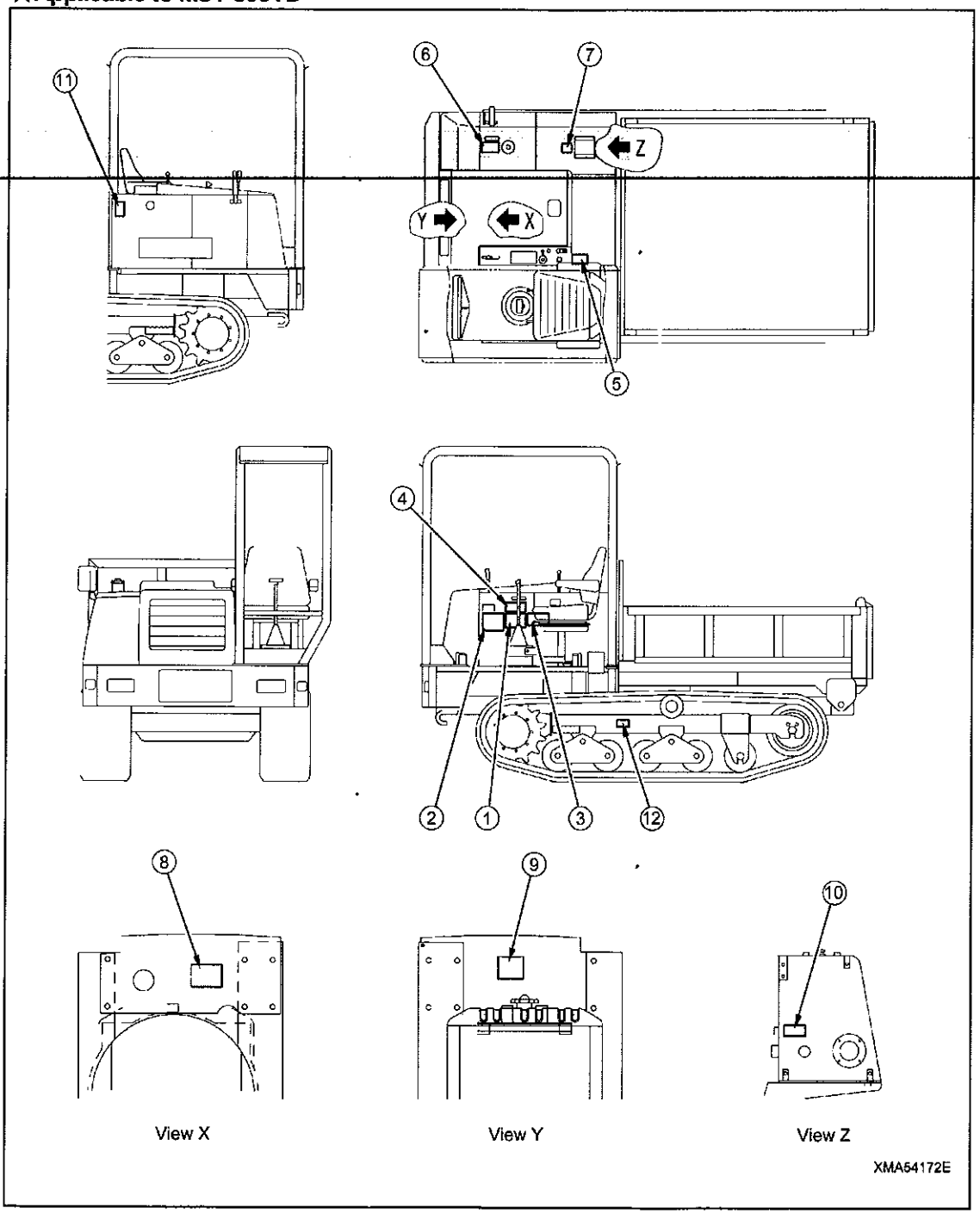
8. POSITION FOR ATTACHING SAFETY LABELS

Always keep these labels clean.

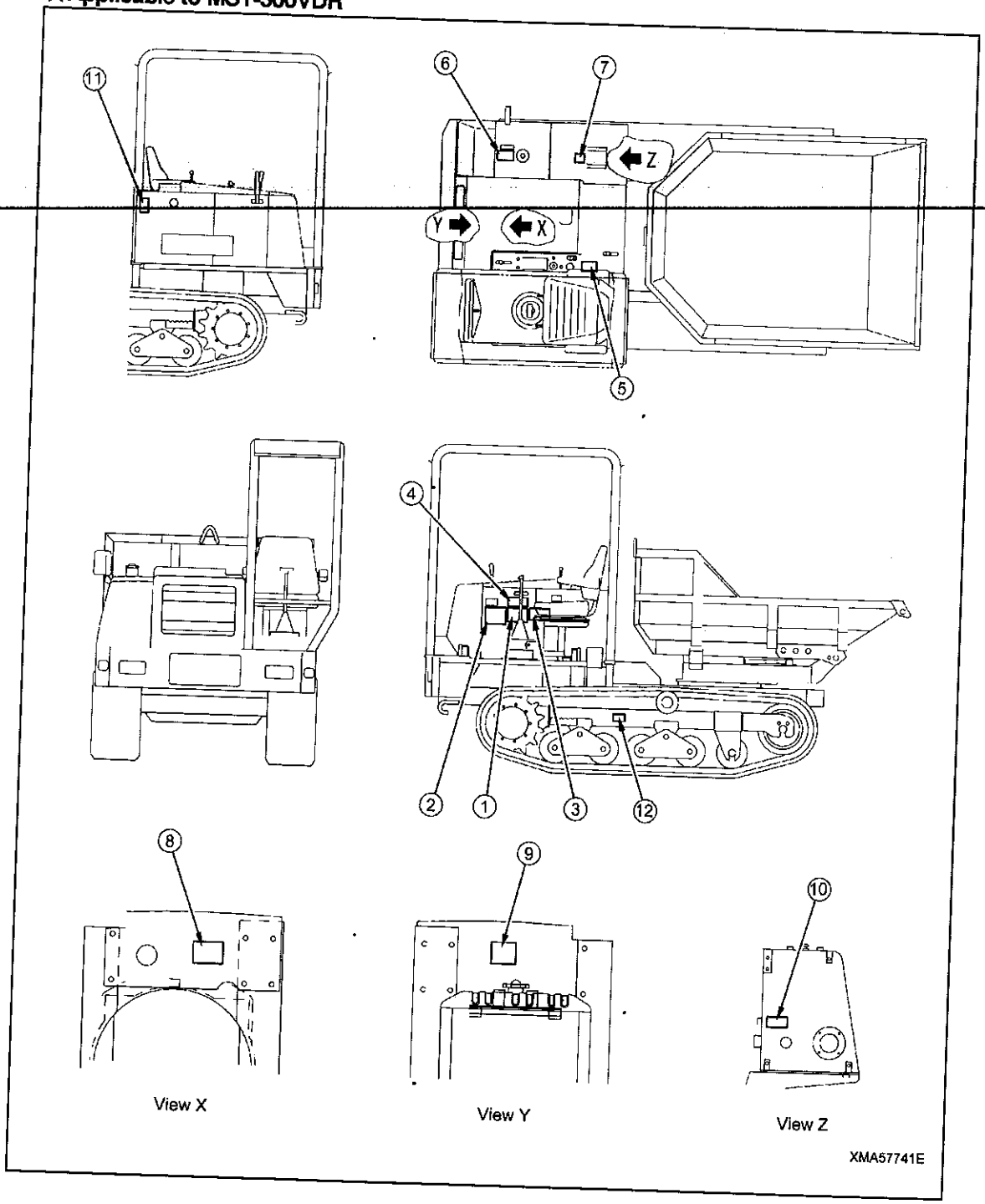
If they are lost or damaged, always attach them again or replace them with a new label.

There are other labels in addition to the safety labels listed as follows, so handle them in the same way.

★Applicable to MST-300VD



★Applicable to MST-300VDR



(1) Precautions when operation (1-41010-1330)

⚠WARNING

- Before operating the machine read the Operation & Maintenance Manual carefully.
- Take extra care when traveling on uneven ground or oval-shaped ground. Depending on the track tension,this may cause the track to disengage or the machine to damage.
- Always check if there are stones clogged around the inks before starting.
- When entering under the dump body for checking, always use the safety bar to prevent the dump body lowering.
- Always dump the load on the level, hard ground.
- When leaving the operators seat, put the travel lever in the N position, and put the parking brake or the switch in the STOP position.
- DO NOT use the parking brake as the service brake except in an emergency.
- When leaving the machine, always take the key.

1-41010-1330

(2) machine Precautions when travelling downhill (1-41010-1290)

⚠WARNING

WHEN TRAVELLING DOWN SLOPES

- When traveling down slopes, reduce the engine speed before traveling on slopes, adjust the travel level throttle, and travel down the slope at low speed.
- DO NOT travel across or parallel slopes. The machine may overturn sideslips.
- NEVER travel down slopes at engine speed more then the rated engine speed. This may overturn and dangerous slipping.

1-41010-1290

(3) Precaution for starting engine and leaving (1-41010-1320)

⚠WARNING

STARTING ENGINE AND MACHINE

- When starting engine, put the travel lever in the N position, and put parking brake lever or the switch in the STOP position.
- When traveling the machine, always put the parking brake lever or the switch in the RUN position.
- Ensure safety around the machine, sound the horn and start.
- DO NOT operate abruptly: this means no startingabruptly, stopping abruptly or turning abruptly. Operating abruptly may cause the track to disengage or cause the machine to fall over.

1-41010-1320

(4) Caution for periodic replacement parts (1-12020-1210)

⚠ CAUTION

Replace the following parts periodically.

Periodic replacement parts	Replacement Interval
Fuel hose (from fuel tank to fuel injection pump)	Every 2 years
Fuel hose (from fuel injection pump to fuel tank)	
Hydraulic hose (from main pump to travel motor)	
Hydraulic hose (from gear pump to main control valve)	
Hydraulic hose (from dump control valve to dump cylinder)	
Hydraulic hose (between left and right dump cylinder)	
Seat belt	Every 3 years

1-12020-1210

(5) Precautions for warming-up operation (1-41010-1230)

⚠CAUTION

WARMING-UP

- This machine must be properly warmed up, or the equipment will operate abnormally or unexpectedly, and may by damaged.

1-41010-1230

(6) Precautions when adding fuel (1-41010-1280)

⚠DANGER

DIESEL FUEL

- Stop the engine when adding fuel.
- Keep away from fire.

1-41010-1280

(7) Precautions for oil inside hydraulic tank (1-41010-1250)

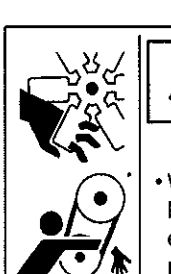
⚠CAUTION

HYDRAULIC OIL

- Use the specified hydraulic oil shown the Operation & Maintenance Manual.

1-41010-1250

(8) Beware of rotating fan and pulley (1-41010-1260)



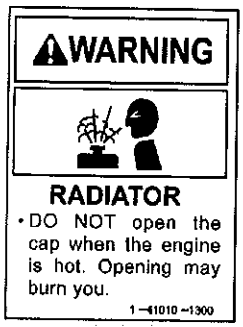
⚠WARNING

FAN, PULLEY

- When engine is rotating, keep hands, feel clothes, etc. away from fan and pulley.

1-141010-1260

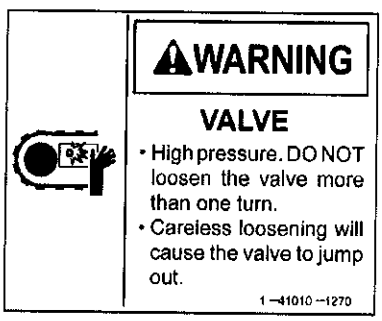
(9) Beware of high-temperature coolant (1-41010-1300)



(10) Muffler is at high temperature (1-41020-1220)

(11) Beware of rotating crawler (1-41010-1240)

(12) Precautions for crawler adjustment valve (1-41010-1270)

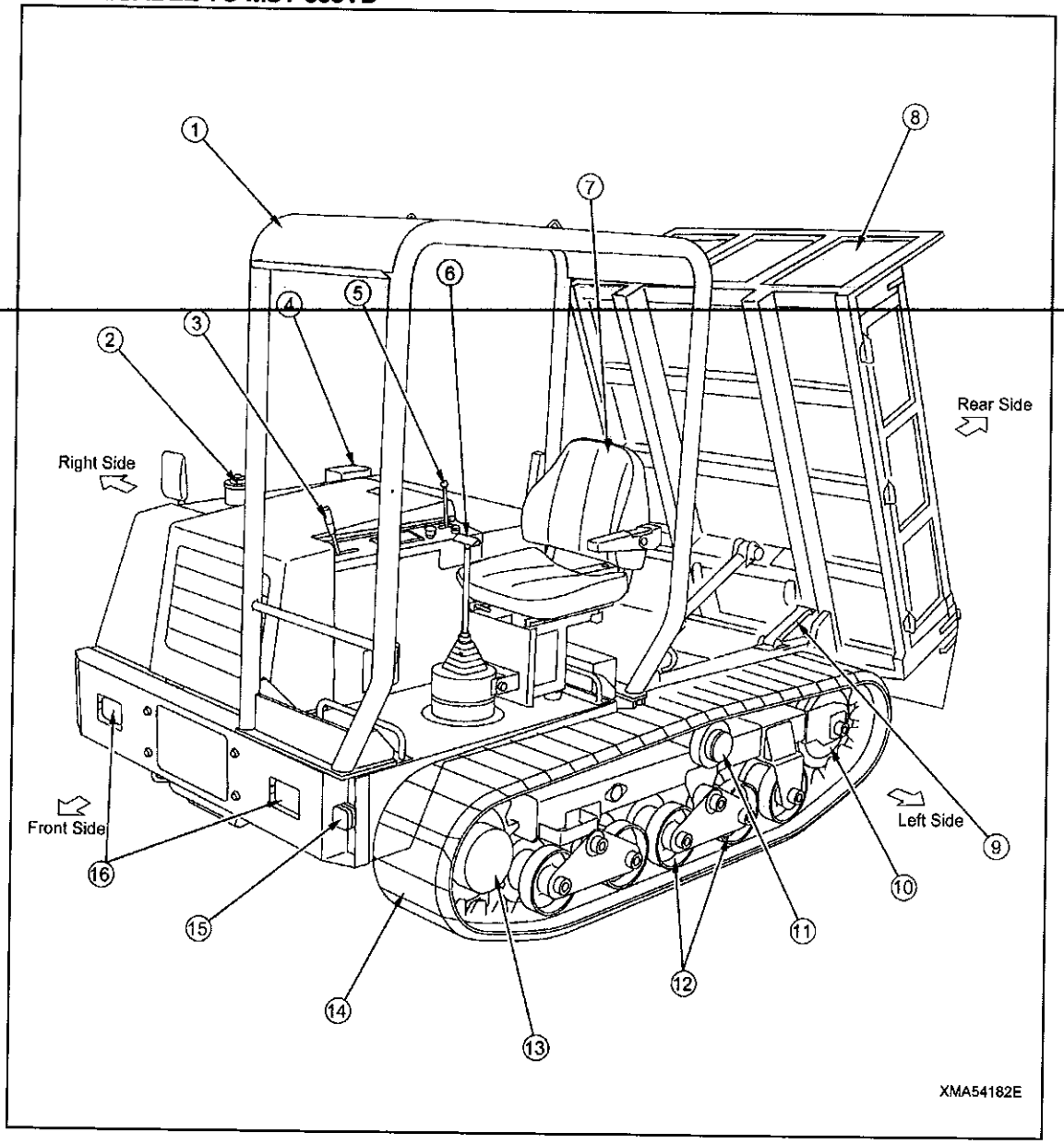


OPERATION

1. GENERAL VIEW

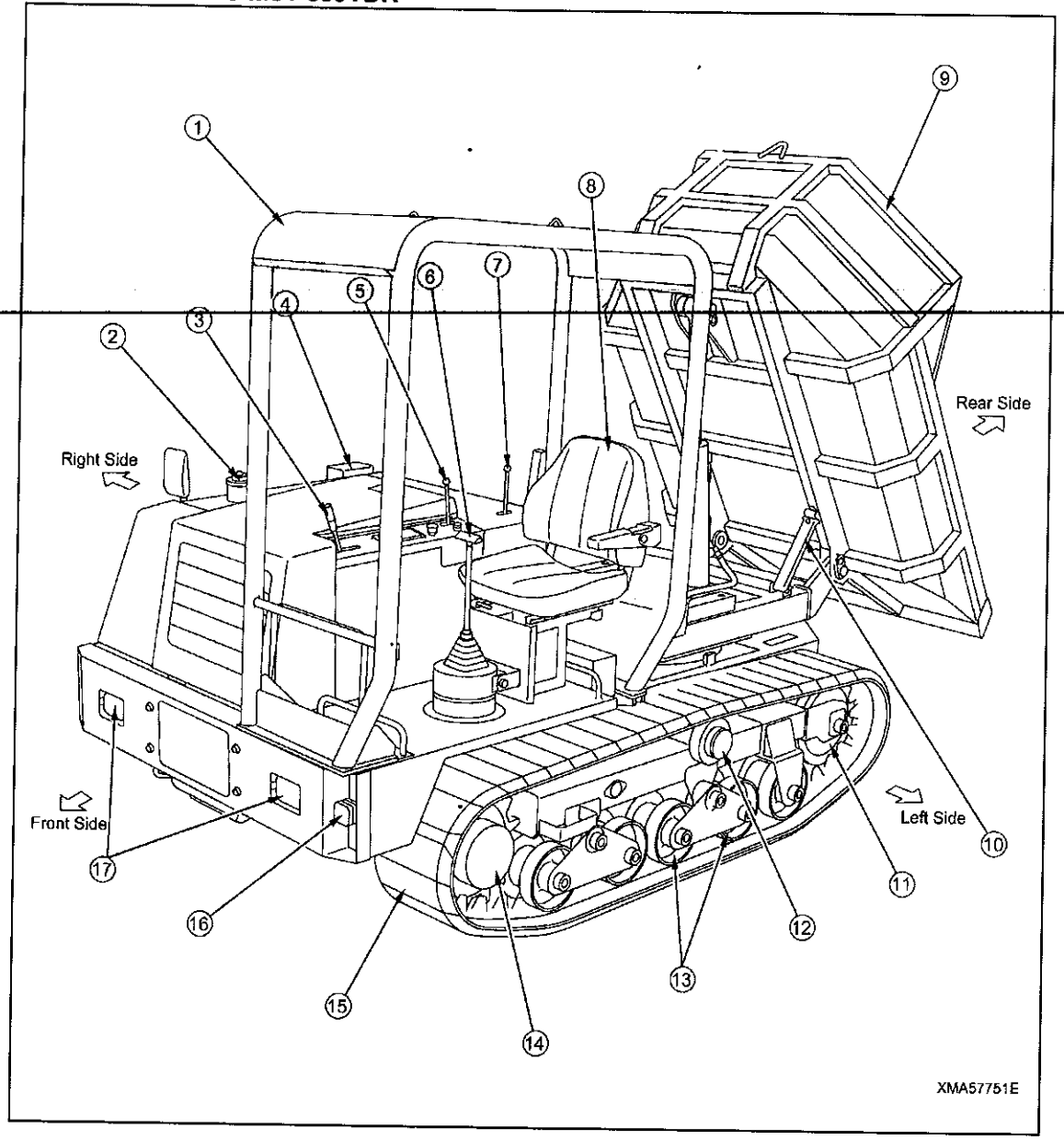
1.1 GENERAL VIEW OF MACHINE

★APPLICABLE TO MST-300VD



(1) ROPS canopy
(2) Fuel tank
(3) Engine throttle lever
(4) Hydraulic tank
(5) Dump control lever
(6) Travel lever
(7) Operator's seat
(8) Dump body
(9) Safety bar
(10) Rear idler
(11) Carrier roller
(12) Track roller
(13) Travel motor, sprocket
(14) Rubber crawler
(15) Turn signal lamp
(16) Head lamp

★APPLICABLE TO MST-300VDR



(1) ROPS canopy
(2) Fuel tank
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(7) Dump body turn control lever
(8) Operator's seat
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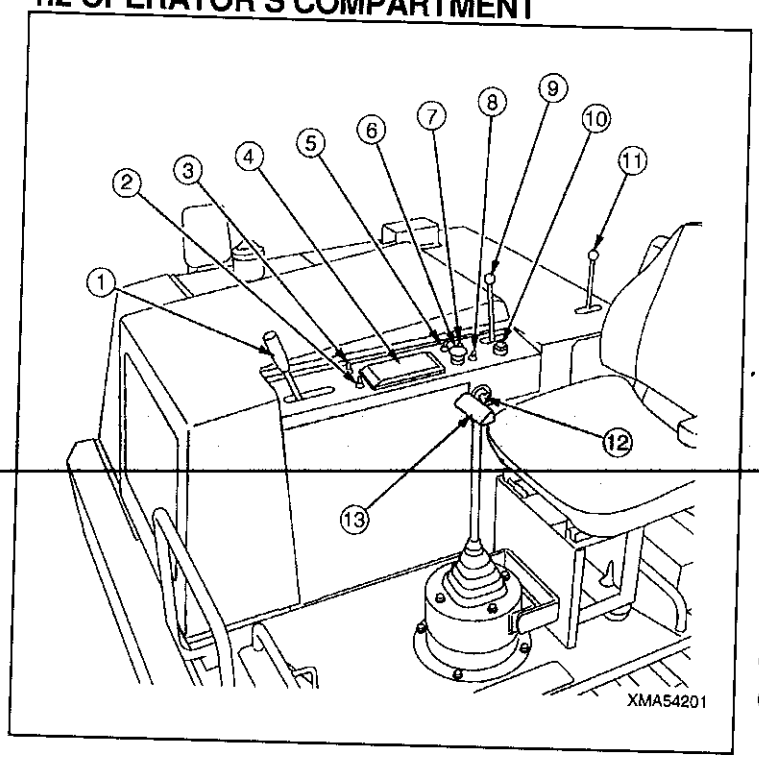
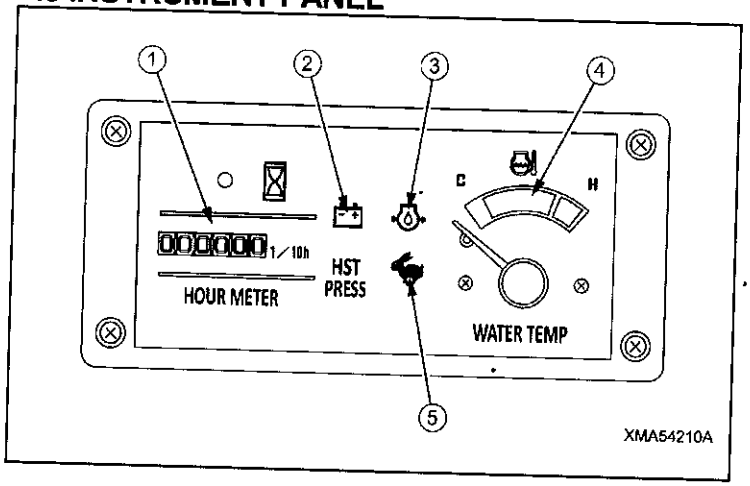
(10) Safety bar
(11) Rear idler
(12) Carrier roller
(13) Track roller
(14) Travel motor, sprocket
(15) Rubber crawler
(16) Turn signal lamp
(17) Head lamp

1.2 OPERATOR'S COMPARTMENT



(1) Engine throttle lever
(2) Hi-Lo speed range selector switch
(3) Turn signal lamp switch
(4) Instrument panel
(5) Head lamp switch
(6) Parking brake switch
(7) Preheating indicator lamp
(8) Light switch
(9) Dump control lever
(10) Horn switch
(11) Dump body turn control lever
(Applicable to MST-300VDR)
(12) Starting switch
(13) Travel lever

1.3 INSTRUMENT PANEL



(1) Hourmeter
(2) Battery charge lamp
(3) Engine oil pressure lamp
(4) Engine water temperature gauge
(5) High-speed travel lamp

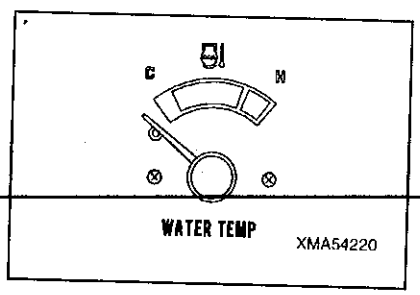
2. EXPLANATION OF COMPONENTS

The following is an explanation of devices needed for operating the machine.
To carry out suitable operations correctly and safely, it is important to understand fully the methods of operating the equipment and the meanings of the displays.

2.1 CONTROL PANEL AND INSTRUMENT PANEL METERS AND LAMPS

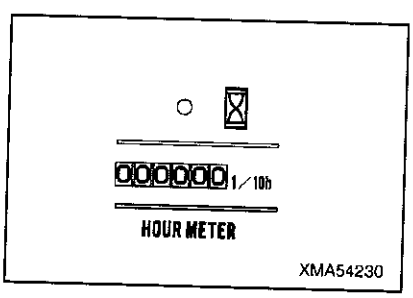
[1] ENGINE WATER TEMPERATURE GAUGE

This indicates the temperature of the engine cooling water.
During normal operations, the center of the indicator should be in the green range.
If the indicator is in the red range, run the engine at low speed and wait until the indicator enters the green range.
★After stopping the engine, check for leakage of water from the radiator, clogging of the radiator core, and damage to the fan belt.
Check also that the fan belt tension is correct.



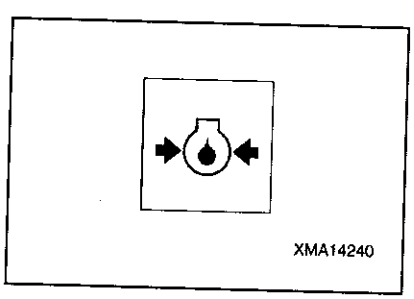
[2] HOURMETER

This shows the total number of hours that the machine has been operated.
If the starting switch is at the ON position, the hourmeter will advance even if the machine is not moving.
Use the time on the hourmeter as the standard for periodic inspection and maintenance.
★The digit on the right indicates 0.1 hours (6 minutes).
★After stopping the engine, always turn the starting switch to the OFF position.



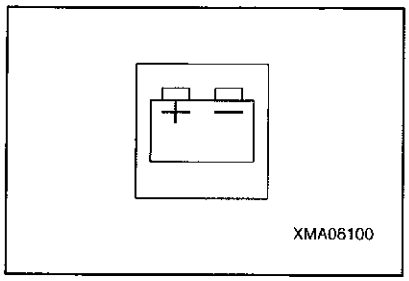
[3] ENGINE OIL PRESSURE LAMP

This warns the operator that the engine lubricating oil pressure has dropped.
This lamp should stay out during operations.
If it lights up during operations, the engine oil pressure has dropped.
Stop operations immediately and carry out inspection.
★Check the engine oil level and check for clogging of the engine oil filter.
★If the result of the inspection shows that there is no abnormality, please contact your distributor.



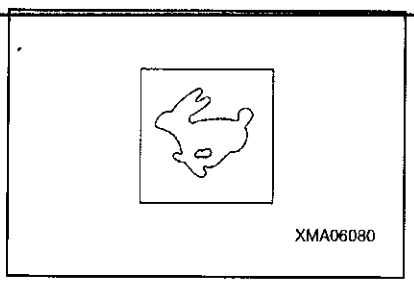
[4] BATTERY CHARGE LAMP

This indicates the condition of the charging system.
When the starting switch is turned ON, it lights up, and after the engine is started and the engine speed rises, it should go out.
If it lights up during operations, there is an abnormality in the charging system.
Stop operations immediately and carry out inspection.
★Check the tension of the fan belt and the alternator.
★If the result of the inspection shows that there is no abnormality, please contact your distributor.



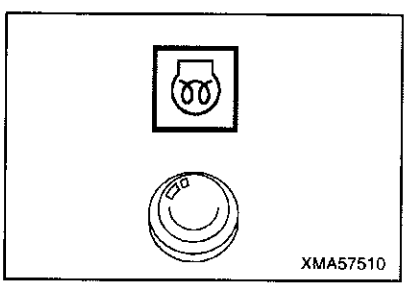
[5] HIGH-SPEED TRAVEL PILOT LAMP

This informs the operator of the travel speed range.
If the Hi-Lo speed range selector switch is set to the HIGH (front) position, the machine will enter the high speed range and the lamp will light up.
If the Hi-Lo speed range selector switch is set to the LOW (rear) position, the machine will enter the low speed range and the lamp will go out.



[6] PREHEATING INDICATOR LAMP

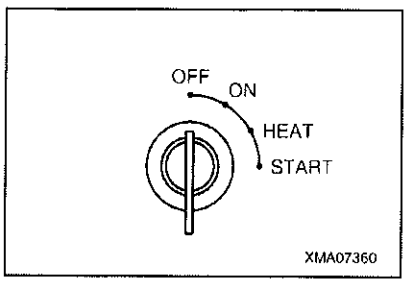
This informs the operator of the actuation condition of the preheating.
When the starting switch is turned to HEAT, it lights up and then goes out to inform the operator that the preheating of the engine is completed.
★Use the HEAT position of the starting switch when starting in cold weather on when it is difficult to start the engine.



2.2 CONTROL PANEL SWITCHES

[1] STARTING SWITCH

This switch is used to start and stop the engine.



- OFF: The starting key can be inserted and removed at this position. When the key is turned to this position, all the switches for the electric circuits are turned off, and the engine stops.
- ON : Electricity flows to the charging circuit and lamp circuit.
- HEAT: Turn the key to this position in cold weather to warm up the engine intake air and make it easier to start the engine. When the preheating indicator lamp goes out and the preheating is completed, turn the key immediately to the START position to start the engine.
- START: This is the position for starting the engine (the starting motor turns). When the engine starts, release the key. The key will return automatically to the ON position.

★After the engine is started, do not turn the key to the OFF position except when stopping the engine.

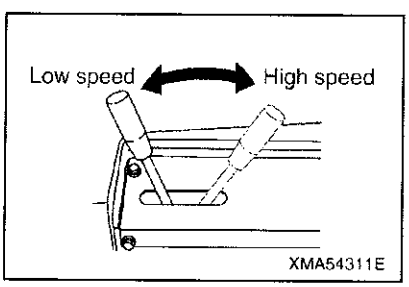
[2] ENGINE THROTTLE LEVER

NOTICE

- **If the engine is stopped before it has cooled down properly, there is danger that the service life of the engine parts will be reduced. Never stop the engine suddenly except in cases of emergency.**
- **If the engine has overheated, do not suddenly stop it. Run the engine at a midrange speed and gradually cool it down before stopping it.**

This lever is used to control the engine speed and output.

- Pulled back: Engine runs at high speed
- Pushed forward: Engine runs at low speed



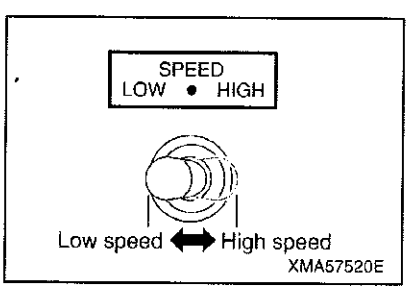
[3] HI-LO SPEED RANGE SELECTOR SWITCH

⚠ WARNING

- **When traveling on slopes, always set the travel speed range to low speed. If the machine is driven in the high speed range, it will cause the engine to overrun.**
- **When traveling with a load, always set the travel speed range to low speed. If the machine is driven in the high speed range, it will cause the engine to overheat.**

This switch is used to select the travel speed range.

When the switch is operated, the speed selection mechanism inside the travel motor is actuated and the machine enters the high speed range or low speed range. In the high speed range and low speed range, if the engine speed and the amount the travel lever is operated are the same, the travel speed changes.



- High speed (rear): The travel motor enters the high speed range and the high-speed travel lamp lights up.
- Low speed (front): The travel motor enters the low speed range and the high-speed travel lamp goes out

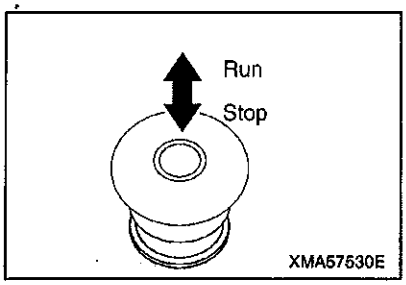
[4] PARKING BRAKE SWITCH

NOTICE

When starting the engine, be sure to press the parking brake switch to set it to the STOP position. The engine cannot be started without setting the parking brake switch to this STOP position.

This switch is used to apply the parking brake.

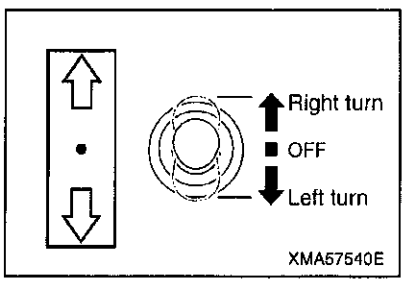
- STOP (PARKING): Push the switch to apply the parking brake.
- RUN (TRAVELING): Pull the switch to release the parking brake.



[5] TURN SIGNAL LAMP SWITCH

This switch is used to flash the turn signal lamps.

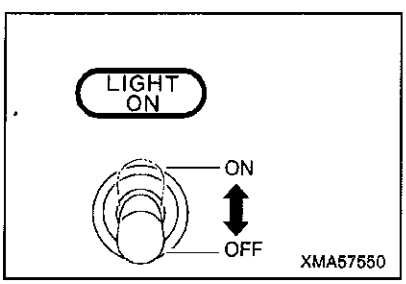
- Right turn: Push the switch to make the right turn signal lamps flash.
- OFF: The turn signal lamps go out.
- Left turn: Pull the switch to make the left turn signal lamps flash.



[6] LIGHT SWITCH

This switch is used to right up the head lamps and lighting.

- ON: Push the switch to light up the head lamps and the panel lighting.
- OFF: Pull the switch to go out the head lamps and the panel lighting.

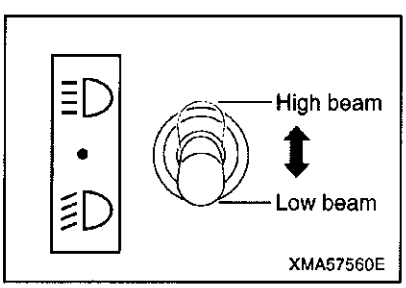


[7] HEAD LAMP SWITCH

This switch is used when changing the direction of the light beam of the head lamp.

Operate this switch after turning ON the light switch.

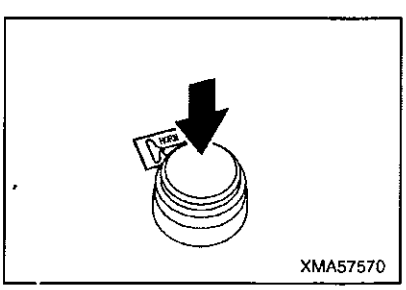
- HIGH BEAM (Upward): Push the switch to turn the head lamp to upward (HIGH BEAM).
- LOW BEAM (Downward): Pull the switch to turn the head lamp to downward (LOW BEAM).



[8] HORN SWITCH

This switch is used to operate the horn.

- Push the switch to sound the horn.



2.3 TRAVEL LEVER

⚠ WARNING

- **Always stop the machine before operating the travel lever from FORWARD to REVERSE. If the lever is suddenly placed in reverse, this will cause failures such as the engine rotating in reverse.**
- **Do not operate the travel lever suddenly; always operate it slowly. If it is operated suddenly, there will be shock to the machine and operator.**
- **When returning the travel lever to the N position to stop the machine, be careful not to move it too far past the N position. If it goes too far past the N position, this will cause failures such as the engine rotating in reverse.**
- **Do not turn the machine at high speed; do not carry spin turns unless necessary. This will damage the crawler and hydraulic equipment, and there is also danger that the machine may hit other objects.**

The travel lever is used to travel the machine in forward or reverse, to stop and turn the machine, and to control the travel speed.

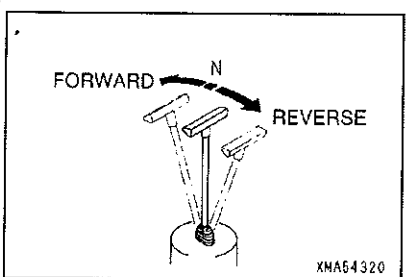
★The travel lever becomes heavier when operated to the front or rear, and becomes lighter when it is returned to the N position.

★The direction of operation of the travel lever is the always the direction seen when sitting in the operator's seat, regardless of whether the seat is facing the front or rear of the machine.

[1] TRAVELING IN STRAIGHT LINE, STOPPING

Operate the travel lever to the front or rear.

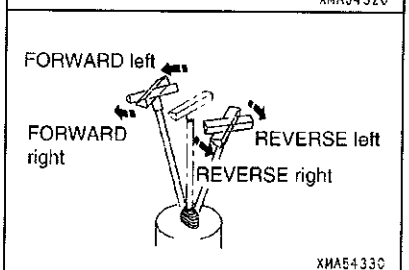
- FORWARD: Push the lever forward.
- REVERSE: Pull the lever back.
- STOP: Return the lever to the N position.



[2] TURNING (STEERING)

Keep the travel lever pushed to the front or rear and rotate the lever in the desired direction.

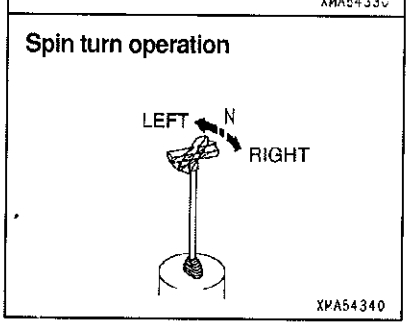
- Forward left: Push travel lever forward and rotate to left.
- Forward right: Push travel lever forward and rotate to right.
- Reverse left: Pull travel lever back and rotate to right.
- Reverse right: Pull travel lever back and rotate to left.



[3] GRADUAL TURNING

Adjust the amount that the lever is rotated to adjust the angle when turning.

Rotate the lever slightly to make a gradual turn, and rotate it further to turn at a sharper angle.



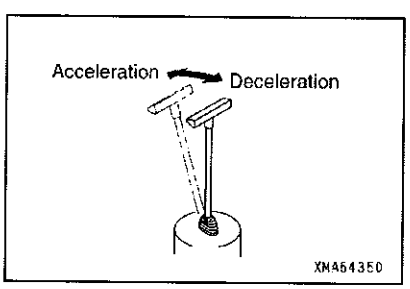
[4] SPIN TURN

Place the travel lever at the N position and rotate the lever.

[5] CHANGING SPEED

Adjust the amount that the lever is operated to the front or rear.

Operate the lever slightly from the N position to travel at low speed, and operate it further to increase the speed.



2.4 DUMP CONTROL LEVER

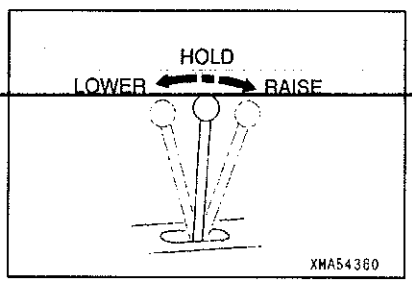
⚠ WARNING

- **Always stop the machine before operating the dump body to the dump position.**
- **Position a signalman to ensure safety in the surrounding area, and follow his signals when carrying out the dumping operation.**
- **Always operate the dump control lever slowly. If the dump body is suddenly stopped or it is allowed to hit the frame when it is lowered, it will cause failures and will also cause problems of safety in the surrounding area.**
- **When leaving the operator's compartment with the dump body raised, always use the safety bar to prevent the dump body from coming down.**
  Even when the engine is stopped, it is possible to lower the dump body.

Dump control lever is used to raise and lower the dump body.
There are three operating positions: RAISE, HOLD, and LOWER.

- RAISE: Pull the lever to back to raise the dump body.
- HOLD: Return the lever to the this position to stop the dump body and hold in position.
- LOWER: Push the lever to front to lower the dump body.

★When the control lever is released, it automatically returns to the HOLD position.



2.5 DUMP BODY TURN CONTROL LEVER

★Applicable to MST-300VDR

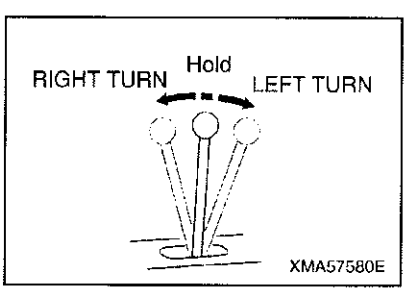
⚠ WARNING

- **Be sure to stop the machine in advance when making turning operations of the dump body.**
- **When operating the dump body turn control lever, be sure to lower the dump body in advance. If the dump body is turned while the dump body is in raised position, collapsing accident may occur or safety of the surroundings may be endangered.**
- **When operating the dump body turn control lever, shift the engine speed down to low speed and operate it slowly. When the dump body is turned at a higher speed or when it is stopped abruptly, not only failures may occur but also the safety of the surroundings may be endangered.**

Dump body turn control lever is used to make turning operations of the dump body.
There are three operating positions: LEFT TURN, HOLD, and RIGHT TURN.

- LEFT TURN: Push the lever away. The dump body will turn toward the left side (counterclockwise)
- HOLD: Return the lever to the this position to stop the dump body and hold in position.
- RIGHT TURN: Pull the lever toward this side. The dump body will turn toward the right side (clockwise)

★When the control lever is released, it automatically returns to the HOLD position.

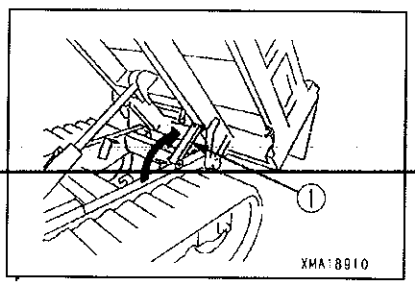


2.6 DUMP BODY SAFETY BAR

⚠ WARNING

- **If it is necessary to go under the dump body to carry out inspection and maintenance, always use the safety bar to prevent the dump body from coming down.**
- **When using the safety bar, check that the bar is fitted securely to the dump body holder.**
- **The safety bar is a safety device used during inspection and maintenance. Do not use the safety bar to support the dump body when replacing the dump cylinder, valve, hydraulic hoses, or other equipment. In such cases always support the dump body with a crane.**

Safety bar (1) is a device to ensure safety during operations, and is used when going under the dump body to carry out inspection and maintenance.



2.7 FUSE BOX AT RADIATOR UPWARD PORTION

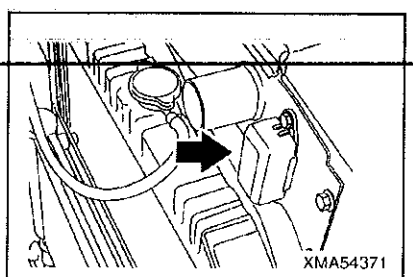
⚠ CAUTION

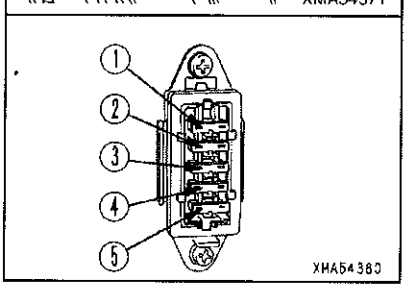
- **Always turn the starting switch to the OFF position before replacing the fuse.**
- **If the fuse is blown, always check for the cause in that circuit and carry out repairs before replacing the fuse.**
- **When replacing the fuse, always replace it with a fuse of the same capacity.**

NOTICE

- **Fuses are used to protect the electrical equipment and wiring from burning out.**
- **If the fuse is corroded and there is white powder on it, replace it immediately.**

1. Open the engine bonnet.
2. Remove the cover of the fuse box being installed to the upper section of the radiator.
3. Inspect and replace the fuses.





4. The circuit for the fuses inside the fuse box are as shown in the table below.

No.	Capacity	Name of circuit
1	15A	Parking brake relay
2	15A	Preheating lamp, hourmeter relay, fuel pump, engine water temperature gauge, engine oil pressure lamp, timer unit
3	15A	Hi-Lo speed range selector relay
4	20A	Turn signal flasher relay
5	20A	Lighting, lamps, horn

2.8 FUSIBLE LINK AT BATTERY PORTION

⚠ CAUTION

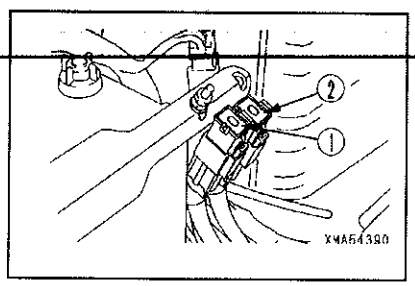
- **Always turn the starting switch to the OFF position before replacing the fuse.**
- **If the fuse is blown, always check for the cause in that circuit and carry out repairs before replacing the fuse.**
- **When replacing the fuse, always replace it with a fuse of the same capacity.**

[1] FUSE FOR CHARGING SYSTEM

Check and replace this fusible link (1) if the battery charge lamp stays lighted up when the engine is running.

★ Fuse capacity: 45 A

1. Open the engine hood.
2. Release the lock and take out fusible link (1).
3. Remove the transparent cover and check the fuses inside.
4. If the result of the inspection shows that there is any abnormality in the fuses, replace the whole case.



[2] FUSE FOR ENGINE STARTING SYSTEM

Check and replace this fusible link (2) if the engine does not start (the starting motor is not actuated).

★ Fuse capacity: 45 A

1. Open the engine hood.
2. Release the lock and take out fusible link (2).
3. Remove the transparent cover and check the fuses inside.
4. If the result of the inspection shows that there is any abnormality in the fuses, replace the whole case.

2.9 OPERATOR'S SEAT

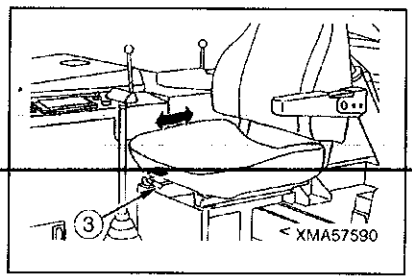
⚠ CAUTION

- **Adjust the operator's seat before operations. Always adjust the operator's seat after it has been used by another operator.**
- **Adjust the operator's seat so that you can operate the travel lever easily with your back against the seat backrest.**
- **Never adjust the seat when traveling.**

[1] SLIDING (forward-backward) ADJUSTMENT OF OPERATOR'S SEAT

When carrying out this adjustment, be sure to sit on the seat and use the lever (3) being positioned on the right side at the lower section in the front side of the seat.

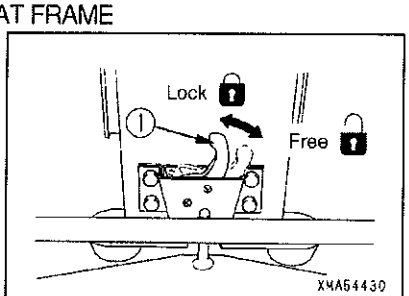
1. Keeping the lever (3) pulled toward the right side, adjust the position of the seat forward and backward to set it to the optional position.
2. After releasing the lever (3) push the seat slightly to lock the position of the seat.

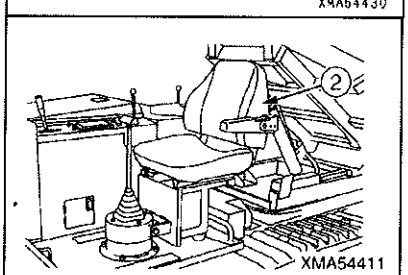


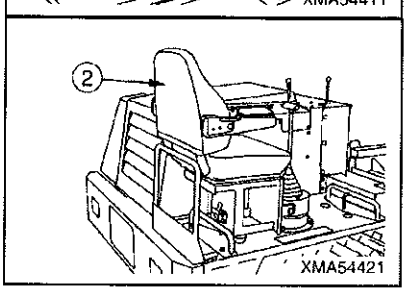
[2] TURNING (direction of seat) OPERATION OF OPERATOR'S SEAT FRAME

The operator's seat can be rotated to face directly to the front or directly to the rear.

1. Release lock (1) and pull up operator's seat (2) towards the travel lever.
2. Rotate operator's seat (2) 180° to face the opposite direction.
3. Lower operator's seat (2) and apply lock (1).



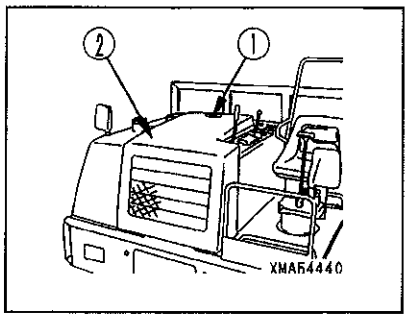




2.10 ENGINE HOOD

When carrying out inspection and maintenance of the engine or when cleaning the radiator fins or oil cooler fins, or when carrying out inspection and maintenance around the battery and fuse box, do as follows to open the engine hood.

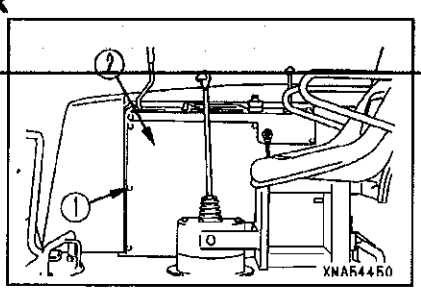
1. Release lock (1) with key and pull up hood (2) towards the front of the machine.
2. After completing inspection and maintenance, lower hood (2) to the rear of the engine and lock up lock (1) with key securely.



2.11 OPERATOR'S COMPARTMENT SIDE COVER

When carrying out inspection and maintenance of the fan belt, do as follows to remove the operator's compartment side cover.

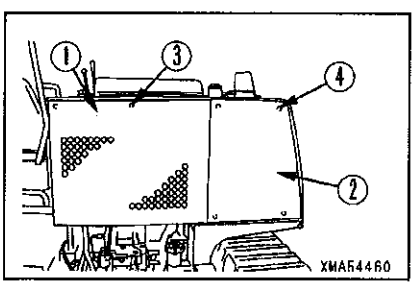
1. Remove 7 mounting bolts (1), then remove side cover (2).
2. After completing inspection and maintenance, set side cover (2) in position and tighten with mounting bolts (1).



2.12 ENGINE REAR SIDE COVER

When replacing the fuel filter and air cleaner element, remove two covers (1), (2) as follows.

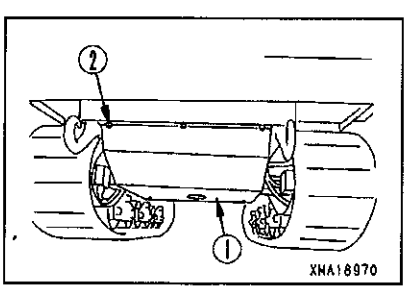
1. Remove 5 mounting bolts (4), then remove cover (2).
   ★ When removing cover (1), remove cover (2) first.
2. Remove 6 mounting bolts (3), then remove cover (1).
3. After completing inspection and maintenance, set cover (1) and cover (2) in position, then tighten each with their mounting bolts.



2.13 UNDERCOVER

When changing the engine oil or when replacing the engine oil filter, remove the undercover as follows.

1. Set a garage jack under the center of undercover (1).
   ★ Put wooden blocks on the supporting portion of the jack to prevent damage to undercover (1).
2. Remove 6 mounting bolts (2), lower the jack, remove undercover (1), then pull it out from under the machine.
3. After completing inspection and maintenance, set undercover (1) on top of the jack, push it under the machine to the mounting position, then tighten with mounting bolts (2).



3. OPERATION

3.1 CHECK BEFORE STARTING ENGINE

[1] WALK-AROUND CHECK

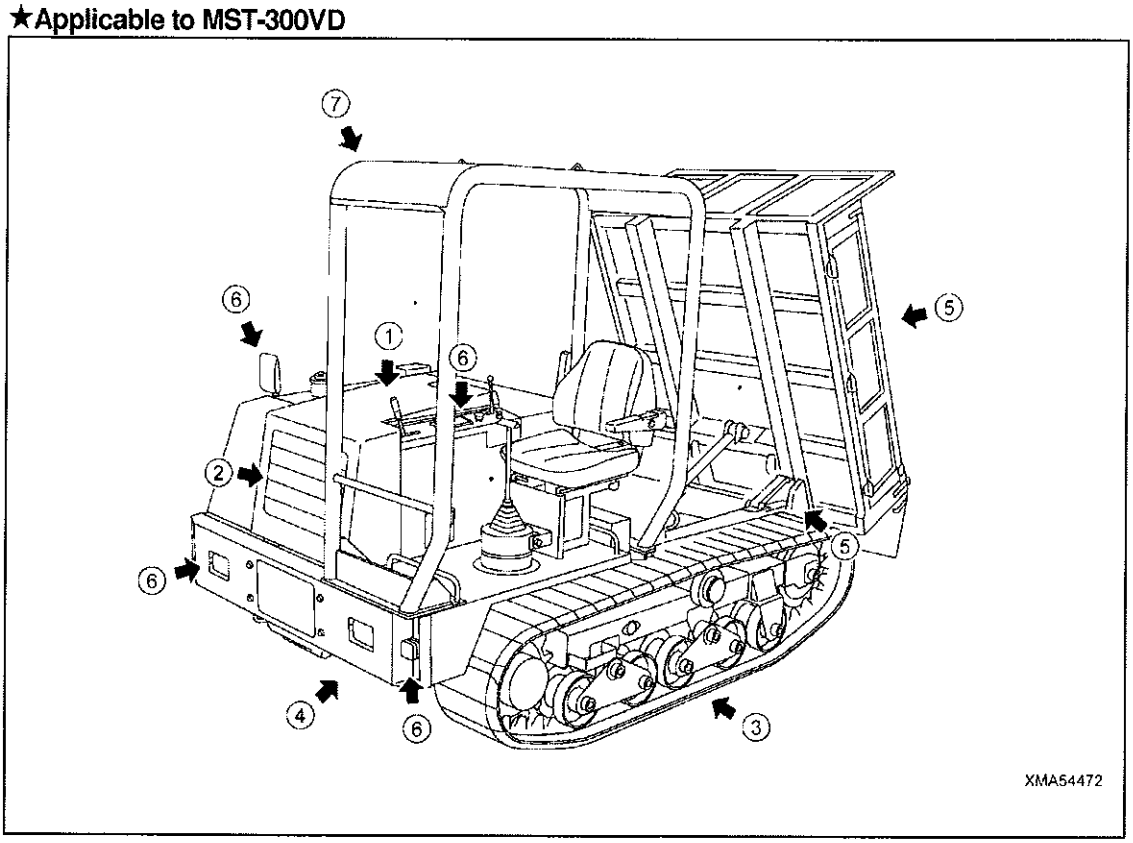
⚠ WARNING

- **Check carefully that there are no dead leaves, waste paper, oil, grease, or other flammable materials around the battery or the muffler, or other parts of the engine which reach high temperatures. These flammable materials can cause fire.**
- **Check carefully that there is no leakage of oil or fuel from the hydraulic hoses or fuel hoses. If any cracks, deformation, or other abnormalities are found, repair them immediately. These problems will cause fire, abnormalities in travel, or problems with raising or lowering the dump body.**
- **Always use the handrails and steps when getting on or off the machine.**

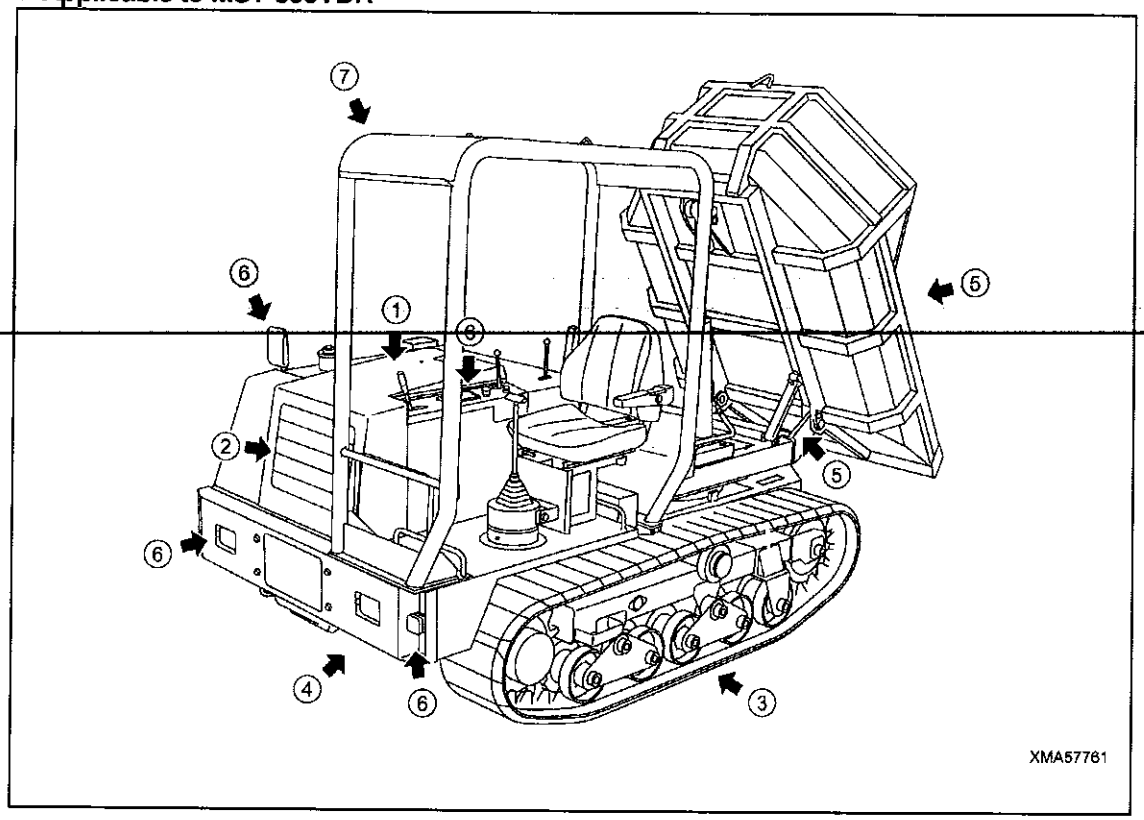
Before starting the engine at the beginning of the day's work, look under and around the machine and check the following points.

- Check for dead leaves, waste paper, dust, oil, or grease at places which reach high temperatures.
- Check for loose or missing bolts, nuts, or connecting pins.
- Check for leakage of oil, fuel, or coolant.
- Check for hanging electrical wires or loose connections.

★Applicable to MST-300VD



★Applicable to MST-300VDR



(1) Check in engine bonnet

Check for dead leaves, waste paper, dust, oil, grease, or other flammable materials, and check for leakage of fuel, oil, or coolant from the engine. Remove any flammable materials, and repair any abnormalities.

Check for hanging electrical wires, loose connections, or signs of burns around the starting motor, alternator, battery, or battery relay. Repair any abnormality.

(2) Check inside front grill

Check the front surface of the radiator and oil cooler for dead leaves, waste paper, dust, or other flammable materials or materials which cause clogging. Remove any such materials.

(3) Check undercarriage (rubber crawler, track roller, carrier roller, sprocket, idler)

Check for any wear, breaks, or cracks. Check for any loose or missing nuts or bolts. Tighten if necessary and repair any abnormalities.

(4) Check under machine

Check the hydraulic tank and fuel tank for leakage, and check the ground under the machine for traces of oil, fuel, or coolant. If any signs of leakage are found, check for the source of the leakage and repair any abnormality.

Check for loose or missing nuts and bolts from the undercover and other parts, and tighten if necessary.

(5) Check dump body, safety bar

Check for any wear, breaks, or cracks. Check for any loose or missing nuts, bolts, or connecting pins. Tighten if necessary and repair any abnormalities.

Check for any leakage of oil from the hydraulic hoses or hydraulic cylinders, and repair any abnormality.

(6) Check mirrors, lamps, instrument panel

Check for any damage to the mirrors, lamps, or meters, and repair or replace if there is any abnormality.

(7) Check ROPS canopy

Check for any breaks, or cracks. Check for any loose or missing nuts, bolts. Tighten if necessary and repair any abnormalities.

[2] CHECKS BEFORE STARTING

Before starting the engine at the beginning of the day's work, carry out the following checks before starting and checks when required.

For details of the checks before starting, checks when required, and other maintenance, see "MAINTENANCE".

1. Checks when required

(1) Check, adjust rubber crawler tension
(2) Check rubber crawler for damage, wear
(3) Clean, replace air cleaner
(4) Clean inside of cooling system (change coolant)
(5) Check, clean radiator fins, oil cooler fins

2. Checks before starting

(1) Check, add coolant
(2) Check, add fuel
(3) Check, add engine lubricating oil
(4) Check, add oil to hydraulic tank
(5) Check and adjust fan belt tension
(6) Check electrical wiring
(7) Check operation of switches, lamps, gauges
(8) Check operation of horn

[3] ADJUST OPERATOR'S SEAT

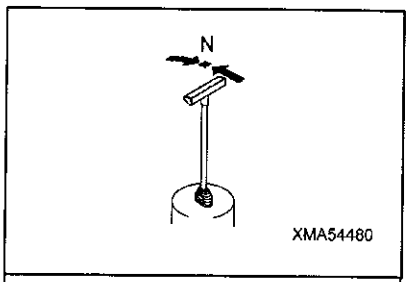
⚠ WARNING

- **Adjust the operator's seat before operations. Always adjust the operator's seat after it has been used by another operator.**
- **Adjust the operator's seat so that you can operate the travel lever easily with your back against the seat backrest.**
- **Never adjust the seat when traveling.**
- **Always lower the armrest and fasten the seat belt before starting operation.**
  The armrest and seat belt are installed to prevent the danger of the operator falling from the operator's seat if the machine tips at an angle when traveling.

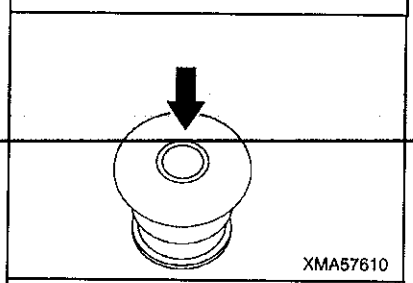
For details of adjusting the operator's seat, see "2.9 OPERATOR'S SEAT".

3.2 OPERATIONS AND CHECKS BEFORE STARTING ENGINE

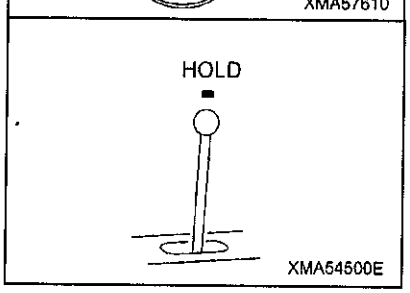
1. Check that the travel lever is at the N position.



2. Check that the parking brake switch is pushed in.

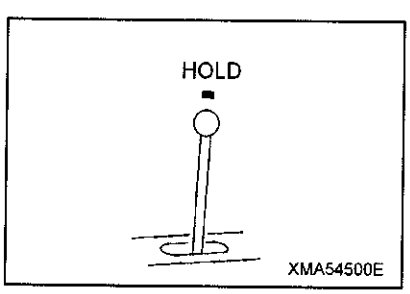


3. Check that the dump body is completely lowered and that the dump control lever is at the HOLD position.



★Applicable to MST-300VDR

4. Check that the dump body is being positioned straight forward to the machine and that the dump body turn control lever is at the HOLD position.



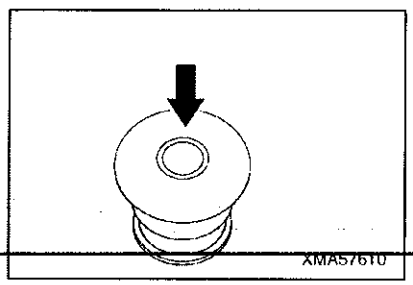
3.3 STARTING ENGINE

⚠ WARNING

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

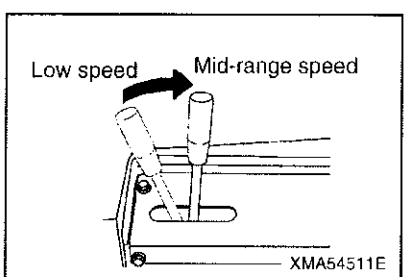
NOTICE

- **When starting the engine, be sure to press the parking brake switch to set it to the STOP position. The engine cannot be started without setting the parking brake switch to this STOP position.**
- **Do not crank the starting motor continuously for more than 10 seconds.**
  If the engine does not start, wait for at least 30 seconds before trying to start again.

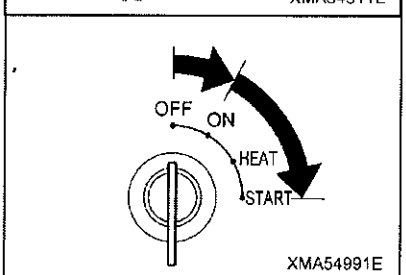


[1] NORMAL STARTING

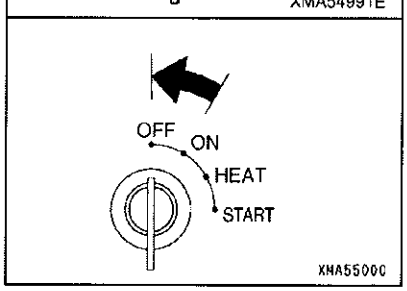
1. Pull the engine throttle lever back and set to the mid-range speed position.



2. Insert the key in the starting switch, and turn it to the START position.



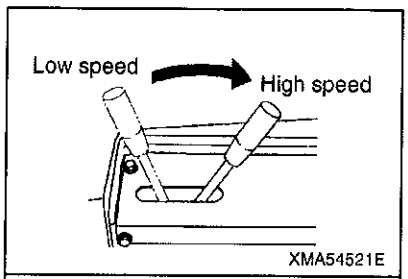
3. After the engine starts, release the key.
   ★The key will return automatically to the ON position.



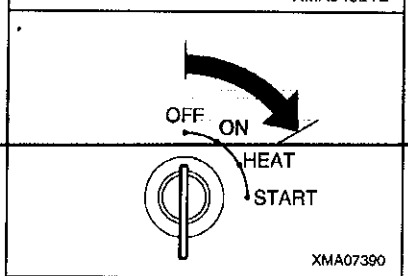
[2] STARTING ENGINE IN COLD WEATHER

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

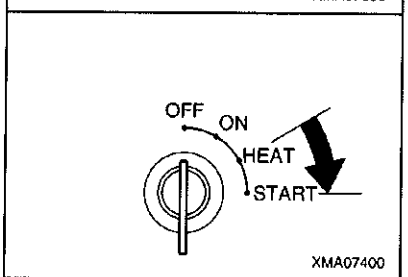
1. Pull the engine throttle lever back fully and set to the high speed position.



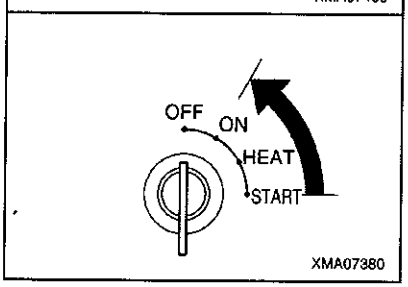
2. Insert the key in the starting switch, turn it to the HEAT position, check that the preheating indicator lamp on the operating panel lights up, and wait until it goes out.
   ★If the outside air temperature is -5 degrees C or less, continue the preheating for another five seconds after the preheating indicator lamp goes out.



3. When the preheating indicator goes out, turn the key to the START position and start the engine.



4. After the engine starts, release the key.
   ★The key will return automatically to the ON position.



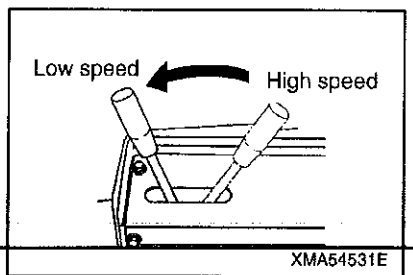
[3] AFTER STARTING (warming-up operation)

NOTICE

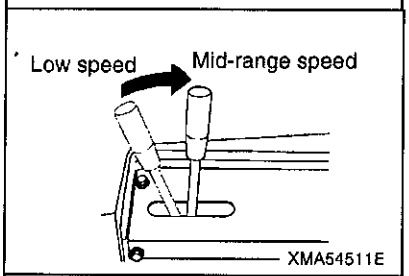
Carry out warming-up operation at a light load level until the pointer of the engine water temperature gauge goes into the green range and do not make sudden acceleration of the engine.

After the engine starts, carry out the warming-up operation as follows.

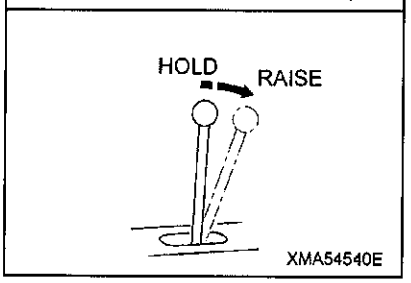
1. Push the engine throttle lever forward, set the engine to low speed, and run for approx. 5 minutes under no load.



2. Pull the engine throttle lever back, raise the engine to a mid-range speed, and run for approx. 5 minutes under no load.



3. Operate dump control lever to the RAISE position, raise the dump body to the maximum height, and run the engine in this condition for approx. 5 minutes.
   ★Keep dump control lever at the RAISE position.
4. Keep dump control lever at the RAISE position, push the engine throttle lever down further to run the engine at high speed, and run the engine in this condition for 2 - 5 minutes.
   This operation warms up the hydraulic oil and makes the operation of the travel and dump body smooth.
5. Check that the instrument panel gauges, monitor and charge lamps work normally.
6. Check that there is no abnormality in the exhaust gas color, engine noise, or vibration.

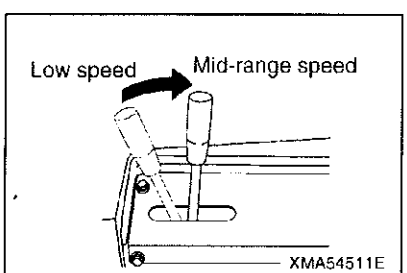


3.4 MOVING MACHINE OFF

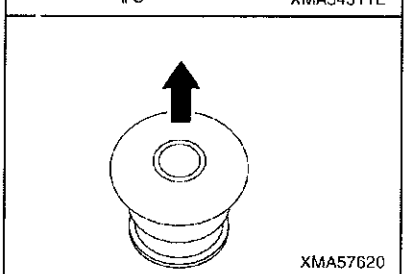
⚠ WARNING

- **Check that there is no one in the area around the machine before starting. Check particularly carefully around the dump body at the rear of the machine.**
- **When starting the machine off, check that the surrounding area is safe, and sound the horn to inform people that you are starting.**
- **When starting the machine off, operate the travel lever gradually. The more the travel lever is operated, the faster the machine will travel. Do not start the machine off suddenly.**
- **When starting uphill on slopes, always start in the low speed range and run the engine at high speed. Keep the travel lever as close as possible to the N position.**
- **When traveling forward downhill, if the angle of the slope goes above a certain range, the SLOPE CAUTION lamp on the instrument panel lights up and the slope alarm buzzer at the rear of the operator's compartment sounds to warn the operator.**
  It is dangerous to start the machine off with the dump body loaded if the slope alarm buzzer sounds. Reduce the engine to low speed, set the travel lever close to the N position, and start the machine off carefully.

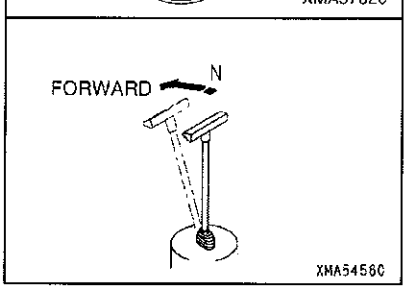
1. Pull the engine throttle lever back and run the engine at a mid-range speed.



2. Pull the parking brake switch to release the parking brake.



3. Operate the travel lever gradually and start the machine off slowly.



3.5 SHIFTING SPEED RANGE, CHANGING BETWEEN FORWARD AND REVERSE

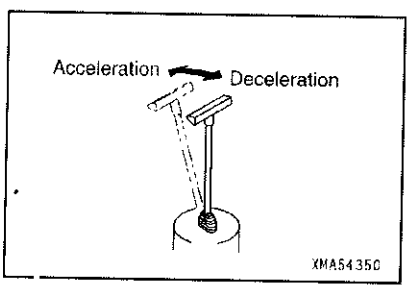
⚠ WARNING

- When traveling, select a travel speed to match the travel surface and ground condition.
- When traveling on a slope, be sure to set the travel speed range to the low speed range. Also, when traveling on a slope, travel straight forward.
- When going down a slope, always travel in the low speed range. Run the engine at low speed and operate the travel lever to a position less than 1/2 of the full stroke from the N position. Traveling at excessive speed is dangerous and will cause overrunning.
- When traveling up a slope, always travel in the low speed range. Run the engine at the rated speed and keep the travel lever close to the N position. Always travel directly up the slope.
- If a dangerous state occurs by any possibility, and when it becomes necessary to stop the machine urgently, press the parking brake switch to set it to the STOP position or turn the engine starting switch to the OFF position to stop the engine.
- When switching between FORWARD and REVERSE, always stop the machine before shifting direction.
  If the direction of travel is shifted suddenly between FORWARD and REVERSE, it will cause failures such as reverse rotation of the engine.
- When switching the travel speed range, always stop the machine first before operating the switch.

[1] CHANGING SPEED

The travel speed can be changed by changing the amount that the travel lever is operated.

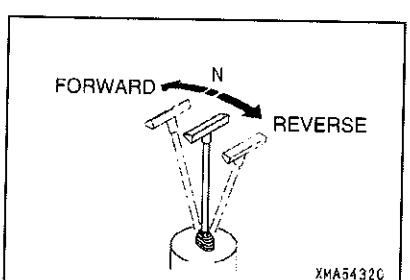
- The closer the travel lever is to the N position, the lower the travel speed.
- The further the travel lever is from the N position, the higher the travel speed.



[2] SHIFTING BETWEEN FORWARD AND REVERSE

The direction of travel can be changed by changing the direction of operation of the travel lever.

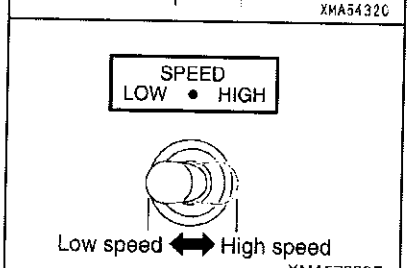
- When the travel lever is pushed forward, the machine will travel forward.
- When the travel lever is pulled back, the machine will travel in reverse.

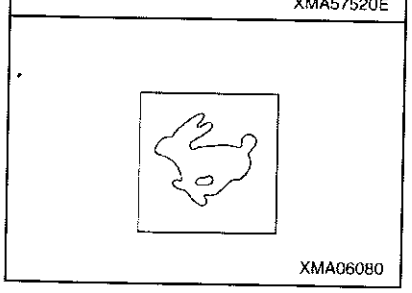


[3] SWITCHING BETWEEN HIGH AND LOW SPEED RANGES

The travel speed range is changed by operating the Hi-Lo speed range selector switch.

- When the switch is pushed to the rear, the mechanism inside the travel motor is switched, the machine enters the high speed range, and the machine travels at high speed.
  At the same time, the high-speed travel lamp on the instrument panel lights up to show that the machine is traveling in the high speed range.
- When the switch is pushed to the front, the mechanism inside the travel motor is switched, and the machine enters the low speed range.
  At the same time, the high-speed travel lamp on the instrument panel goes out to show that the machine is traveling in the low speed range.





3.6 STEERING MACHINE

⚠ WARNING

- **Do not turn the machine sharply at high speed; do not carry spin turns unless necessary. This will damage the crawler and hydraulic equipment, and there is also danger that the machine may hit other objects.**
- **The machine may slip to the side if it is turned on a slope, so avoid turning on slopes as far as possible. Be particularly careful about turning on soft ground of clay ground.**
- **When traveling forward downhill, if the angle of the slope goes above a certain range, the SLOPE CAUTION lamp on the instrument panel lights up and the slope alarm buzzer at the rear of the operator's compartment sounds to warn the operator. It is dangerous to turn with the dump body loaded if the slope alarm buzzer sounds. Dump the load immediately to empty the dump body, then turn slowly.**
- **If a dangerous state occurs by any possibility, and when it becomes necessary to stop the machine urgently, press the parking brake switch to set it to the ON (STOP) position or turn the engine starting switch to the OFF position to stop the engine.**

[1] TURNING ANGLE

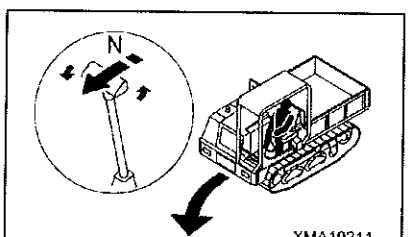
The turning angle is determined by the amount that the travel lever is rotated.

The more the travel lever is rotated, the sharper the turning angle becomes.

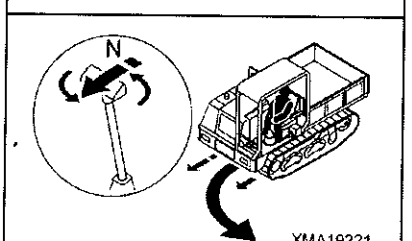
- When carrying out a gradual turn, push the travel lever to the front and rotate it slightly in the direction of the turn.
- To make a sharp turn, push the travel lever to the front and rotate the travel lever fully in the direction of the turn.

★To turn to the left when traveling forward, rotate the travel lever to the left. To turn to the right when traveling forward, rotate the travel lever to the right.

★To turn to the left when traveling in reverse, rotate the travel lever to the right. To turn to the right when traveling in reverse, rotate the travel lever to the left.



XMA19211



XMA19221

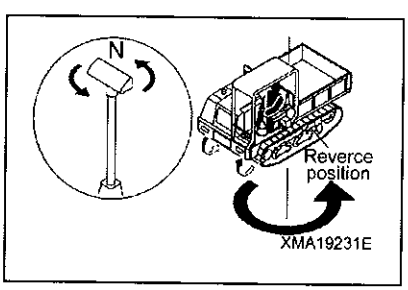
[2] SPIN TURN

Keep the travel lever at the N position and rotate the travel lever. The left and right rubber crawlers will rotate in opposite directions and the machine will carry out a spin turn.

The further the travel lever is rotated, the faster the speed of turning will be.

★To carry out a spin turn to the left, rotate the travel lever to the left.

★To carry out a spin turn to the right, rotate the travel lever to the right.



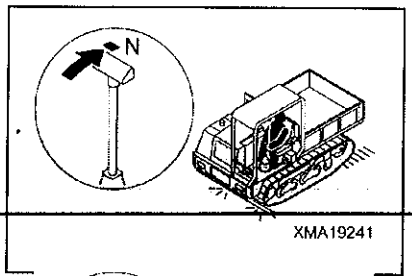
XMA19231E

3.7 STOPPING MACHINE

⚠ WARNING

- **Avoid stopping suddenly. Always leave room to spare when stopping.**
- **Never use the parking brake to stop the machine. Using the parking brake will cause the machine to stop suddenly and will also damage the machine.**
- **When stopping, do not return the travel lever past the N position. If the travel lever is moved past the N position, it will cause failures such as reverse rotation of the engine.**

Return the travel lever to the N position.
The hydraulic brake is automatically applied and the machine will stop.

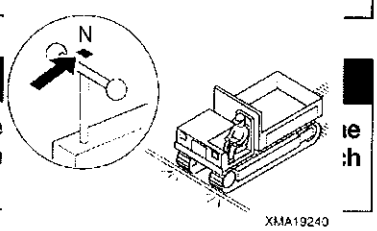


XMA19241

3.8 EMERGENCY STOPPING MACHINE

⚠ WARNING

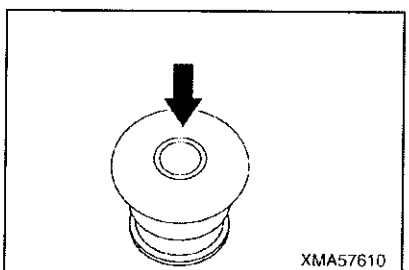
If a dangerous state occurs by any possibility, and when it become urgently, press the parking brake switch to set it to the STOP position to the OFF position to stop the engine.



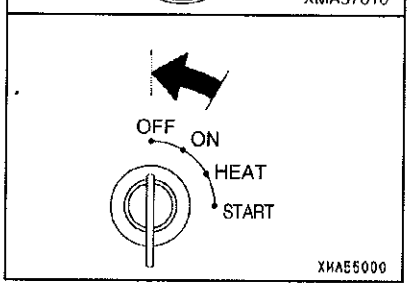
XMA19240

There are following 2 methods when making an emergency stop of the machine.

- Push in the parking brake switch to apply the parking brake.


XMA57610

- Turn back the starting switch key to the OFF position to stop the engine.



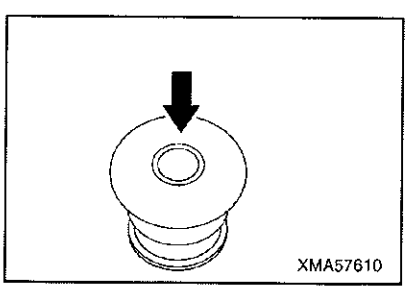
XMA55000

3.9 PARKING MACHINE

⚠ WARNING

Choose firm, level ground to park the machine.
If the machine must be parked on the slope, apply the parking brake and block the tracks to prevent the machine from moving.

Press the parking brake switch in to apply the parking brake.

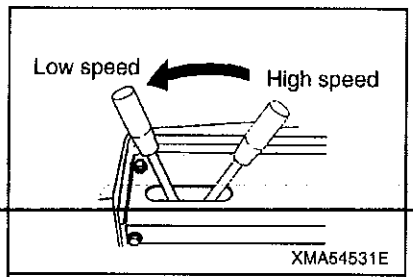

XMA57610

3.10 STOPPING ENGINE

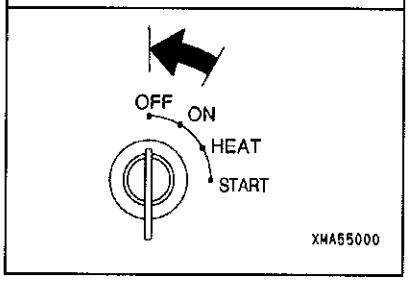
NOTICE

- **Do not stop the engine before it has properly cooled down. Stopping the machine before it cools down will shorten the service life of the engine.**
  Never stop the engine suddenly except in emergency.
- **If the engine has overheated, do not stop it suddenly. Run the engine at a mid-range speed and gradually cool it down before stopping the engine.**

1. Push the engine throttle lever to the front to reduce the engine speed and run the engine at idling for 5 minutes to cool the engine down.



2. Return the key in the starting switch to the OFF position.



3.11 CHECKS AFTER STOPPING ENGINE

- Carry out a walk-around check and check the undercarriage, dump body, and bodywork; check also for leakage of oil and water. If any abnormality is found, repair it.
- Fill the fuel tank with fuel.
- Remove any dead leaves, waste paper, or other flammable materials from around the engine that may cause fire.
- Remove any mud or snow stuck to the undercarriage or dump body.

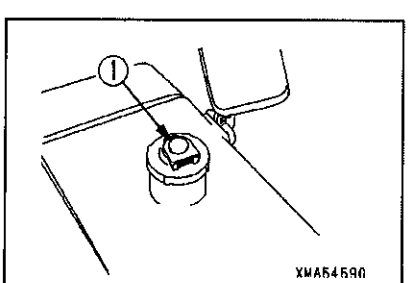
3.12 LOCKING

To prevent vandalism, the following locations can be locked.

To prevent vandalism, the following locations can be locked.

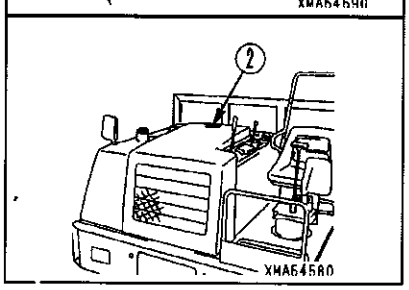
(1) Fuel tank filler cap

★ The key is different from the starting key.



(2) Engine hood

★ The key is different from the starting key.



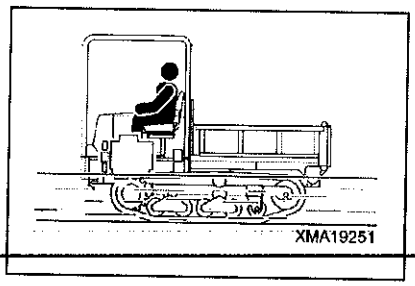
3.13 PRECAUTIONS WHEN TRAVELING

⚠ WARNING

Always follow these precautions when traveling. Failure to follow these precautions may lead to a serious injury or accident.

[1] PERMISSIBLE WATER DEPTH

When operating in water, do not let the bottom surface of the engine oil pan go below the water surface.



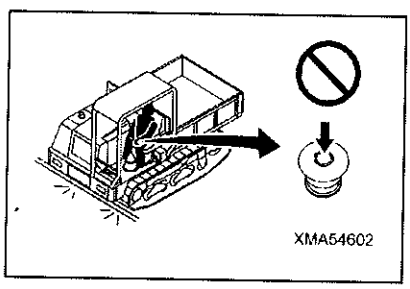
[2] USE OF PARKING BRAKE

When stopping the machine, return the travel lever to the N position. The hydraulic brake inside the HST is automatically applied to stop the machine.

Never use the parking brake to stop the machine.

Using the parking brake will not only stop the machine suddenly, but will also cause failure of the travel motor.

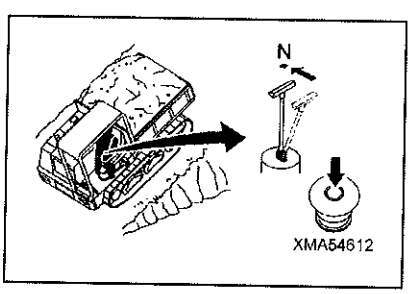
Do not use the parking brake to stop the machine except when it is necessary to stop the machine suddenly in emergencies.



[3] PRECAUTIONS WHEN ENGINE STOPS ON SLOPES

If the engine stops on a slope, do as follows.

1. Return the travel lever to the N position.
2. Press the parking brake switch to the ON (STOP) position.
   ★Check that the parking brake lamp lights up.
3. Start the engine again.



[4] PRECAUTIONS WITH FUEL LEVEL ON SLOPES

If the fuel level in the fuel tank is low and the machine is on a slope or there is swaying, the engine may suck in air, which may cause the engine to stop.

Always maintain a sufficient level of fuel in the fuel tank.

[5] PRECAUTIONS FOR OIL LEVELS ON SLOPES

When traveling or carrying out operations on steep slopes, check the oil level in the hydraulic tank and engine, and add oil to the high level.

This will prevent failure caused by lack of oil.

4. HANDLING DUMP BODY

4.1 OPERATING DUMP BODY

⚠ WARNING

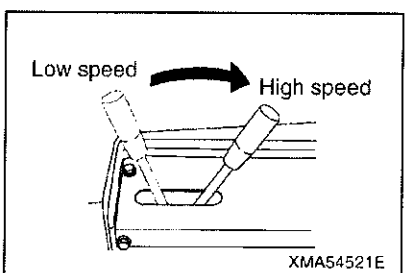
- **Always stop the machine before operating the dump body to the dump position.**
- **Position a signalman to ensure safety in the surrounding area, and follow his signals when carrying out the dumping operation.**
- **Always operate the dump control lever slowly. If the dump body is suddenly stopped or it is allowed to hit the frame when it is lowered, it will cause failures and will also cause problems of safety in the surrounding area.**
- **When leaving the operator's compartment with the dump body raised, always lock the dump control lever.**
  In addition, use the safety bar to prevent the dump body from coming down.
  Even when the engine is stopped, it is possible to lower the dump body.

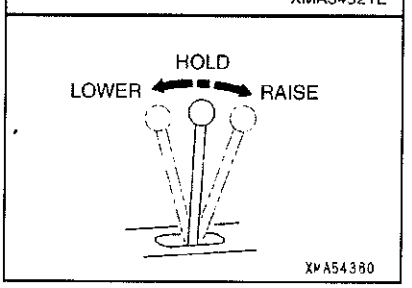
Operate the dump body as follows.

★The further the dump control lever is operated, the faster the dump body will move.

★When the dump control lever is released, it automatically returns to the HOLD position.

1. Stop the machine completely. For details, see "3.7 STOPPING MACHINE".
2. Pull the throttle lever back and raise the engine speed sufficiently.
3. Pull the dump control lever up. The dump body will rise.
   ★When the dump body comes near to the max. height, push the dump control lever down to reduce the speed of the dump body.
4. Push the dump control lever (1) down. The dump body will go down.
   ★When the dump body comes near to the frame, pull the dump control lever up to reduce the speed of the dump body.





4.2 TURNING OPERATION OF DUMP BODY

★Applicable to MST-300VDR

⚠ WARNING

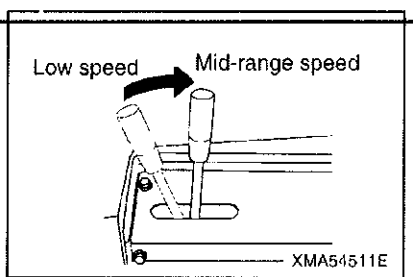
- **Be sure to stop the machine in advance when making turning operations of the dump body.**
- **When operating the dump body turn control lever, be sure to lower the dump body in advance. If the dump body is turned while the dump body is in raised position, collapsing accident may occur or safety of the surroundings may be endangered.**
- **When operating the dump body turn control lever, shift the engine speed down to low speed and operate it slowly. When the dump body is turned at a higher speed or when it is stopped abruptly, not only failures may occur but also the safety of the surroundings may be endangered.**

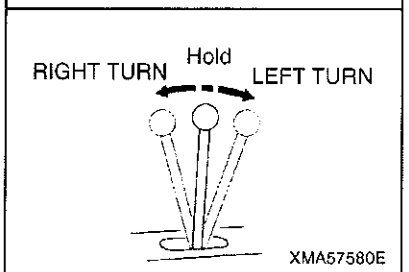
When making turning operations of the dump body, follow the procedure indicated below.

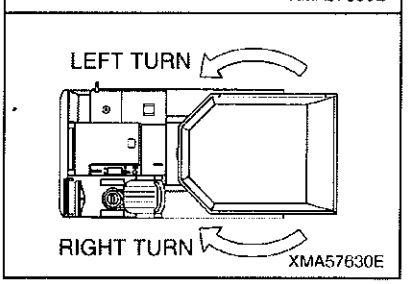
★The larger the dump body turn control lever is moved, the faster the turning speed of the dump body will become.

★When the control lever is released, it automatically returns to the HOLD position.

1. Stop the machine completely. For details, see "3.7 STOPPING MACHINE".
2. Pull the engine throttle lever back and raise the engine speed from low speed to around medium speed.
3. Pull the lever toward this side. The dump body will turn toward the right side (clockwise).
4. Push the lever away. The dump body will turn toward the left side (counterclockwise).







4.3 OPERATING SAFETY BAR

⚠ WARNING

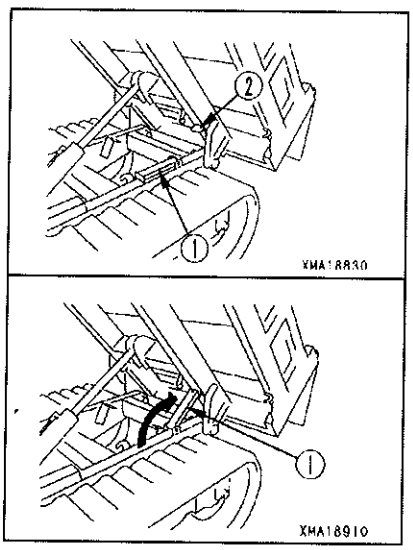
- **If it is necessary to go under the dump body to carry out inspection and maintenance, always use the safety bar to prevent the dump body from coming down.**
- **When using the safety bar, check that the bar is fitted securely to the dump body holder.**
- **The safety bar is a safety device used during inspection and maintenance. Do not use the safety bar to support the dump body when replacing the dump cylinder, valve, hydraulic hoses, or other equipment. In such cases always support the dump body with a crane.**

NOTICE

When setting the safety bar in position, never start the engine and operate the dump control lever to the LOWER position.
If this is done, the safety bar will hit the dump body and may break.

[1] INSTALLING SAFETY BAR

1. Raise the dump body to at least 45 degrees. For details, see "4.1 OPERATING DUMP BODY".
2. Raise safety bar (1) and set it in holder (2) in the bottom surface of the dump body.
3. Stop the engine and push the dump control lever down. The dump body will go down under its own weight.
   ★If the dump body does not go down under it own weight, start the engine and operate the dump control lever to lower it to a point where the dump body and safety bar still do not come into contact.



[2] REMOVING SAFETY BAR

1. Raise the dump body fully. For details, see "4.1 OPERATING DUMP BODY".
2. Return safety bar (1) to the fixed position on top of the frame.

4.4 PRECAUTIONS DURING OPERATION

⚠ WARNING

Always follow these precautions when carrying out operations.
Failure to follow these precautions may lead to a serious injury or accident.

[1] PRECAUTIONS FOR JOBSITES

• As far as possible, select firm, level ground.
When working on slopes or extremely uneven ground, the change in the center of gravity when the dump is operated may cause the machine tip over.

• As far as possible, avoid the edge of cliffs or ground which may collapse.
If work must be carried out in such places, set up blocks to prevent the machine from going near the edge or near retaining walls, or position a signalman and take other necessary steps for ensuring safety.

• When dumping a load from a high point, always position a signalman and follow the signals.
The signalman must always check the safety of the dumping point carefully.

[2] PRECAUTIONS FOR LOAD

• Do not overload the machine.
Do not fit side racks or plates, or make other modifications to extend the size of the dump body to increase the load.

• When loading the dump body, always spread the load uniformly.
Loading the dump body unevenly will cause instability and may cause the machine to tip over.

• Be careful not to let the loading bucket or crane hook hit the dump body or flaps.

• When loading large rocks, first load the dump body with fine soil, then load the rocks on top of that.

• When handling long objects, such as logs or steel beams, load carefully and pay careful consideration to the center of gravity so that the load does not collapse or sway excessively during hauling operations.
Tie down such loads securely with rope.
If necessary, use blocks and take steps to prevent the rope from slipping.

• When loading stacks of U-shaped ditch liners or concrete blocks, lay a steel sheet and secure with rope, and take other steps to prevent the load from slipping.

5. HANDLING RUBBER CRAWLER

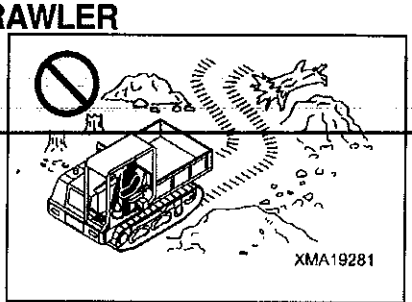
5.1 FEATURES OF RUBBER CRAWLER

The properties of the material used for the rubber crawlers gives it many advantages, such as low vibration, high drawbar pull, and ease of handling.

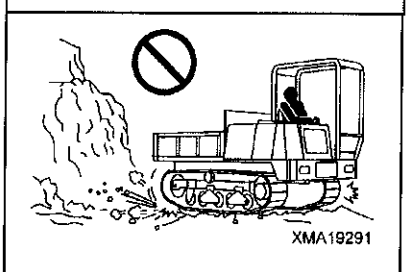
Make sure that you fully understand the advantages of rubber crawlers, and follow the content of "5.2 PROHIBITED OPERATIONS FOR RUBBER CRAWLER" and "5.3 PRECAUTIONS WHEN USING RUBBER CRAWLER" to extend the service life of the rubber crawlers and to realize the maximum advantages of the rubber crawler.

5.2 PROHIBITED OPERATIONS FOR RUBBER CRAWLER

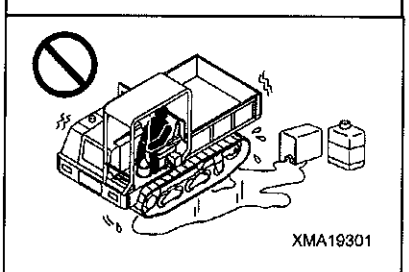
- Turning operations or other operations on hard rocky ground, extremely rough rockbed, in places with many tree stumps, on steel rods or steel scrap, or places with many sharp objects, or on concrete surfaces will cause damage to the rubber shoe.


XMA19281

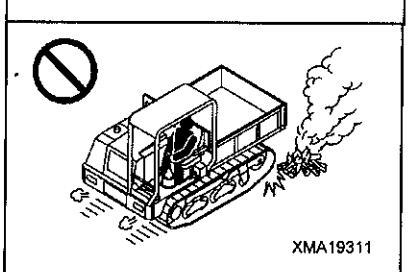
- On riverbeds or other jobsites where there are large numbers of rocks of different sizes, the rocks will get caught in the rubber shoe and damage the shoe or cause it to come off the roller.


XMA19291

- Do not let oil, fuel, or chemical solvent get on the rubber shoe. Do not travel in places where there is oil on the road surface.


XMA19301

- Do not let the machine enter any place where the ground is at high temperature, such as on asphalt or steel plates that have been left in the sun or in places where there have been fires.


XMA19311

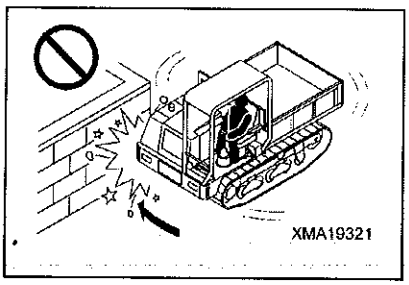
- When putting the machine in long-term storage (3 months or more), store the machine indoors where it is out of direct sunlight and rain.

5.3 PRECAUTIONS WHEN USING RUBBER CRAWLER

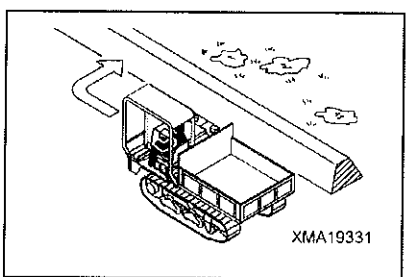
⚠ WARNING

Always follow these precautions when using rubber crawlers. Failure to follow these precautions may lead to a serious injury or accident.

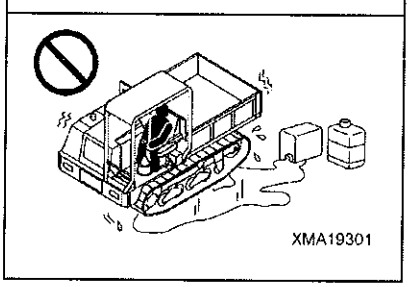
- Do not make sharp turns on concrete surfaces.
- Do not operate the machine in such away that the rubber track scrapes against concrete walls.
- Sudden changes of direction will cause damage and premature wear to the rubber shoes, so avoid sudden turns as far as possible.



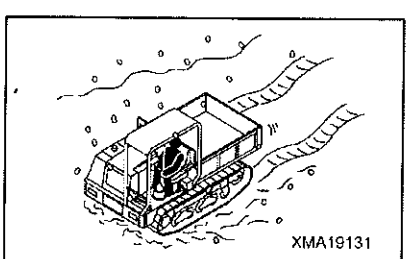
- Avoid traveling and turning in places where there is a large ridge. When traveling over a ridge, approach the ridge at a right angle.



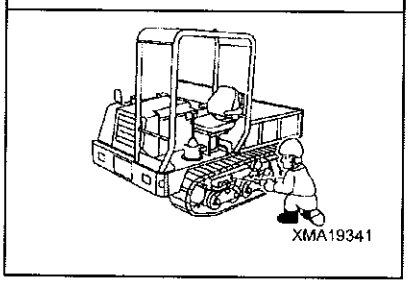
- As far as possible, avoid handling loads that produce oil when crushed (soy beans, corn, vegetables, etc.). If the machine is used for handling such products, be sure to wash the track thoroughly after use.
- When handling loads such as salt, ammonium sulphate, potassium chloride, potassium sulphate, or phosphates, be sure to wash the track thoroughly after use.



- On snow or frozen road surfaces, the rubber shoe will slip very easily. Be careful also of slipping when traveling or operating on slopes.



- To prevent the rubber shoe from coming off, always check that the tension is correct.
  If the tension is too loose, the rubber shoe will come off and there will be abnormal wear of the steel core and sprocket.
  If the tension is too tight, the travel speed will be reduced and there will be premature wear or damage to the undercarriage.



6. TRANSPORTATION

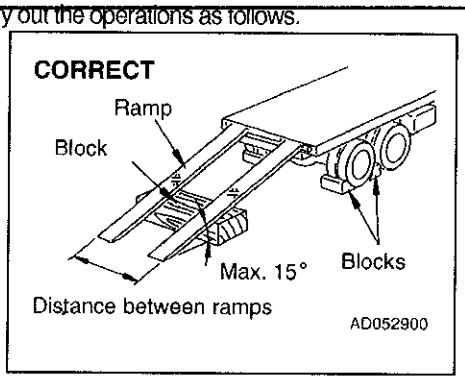
6.1 LOADING, UNLOADING WORK

⚠ WARNING

- **Make sure the ramp has sufficient width, length and thickness to enable the machine to be safely loaded and unloaded. If the ramp sags appreciably, reinforce it with blocks, etc.**
- **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 slopes. Be sure the ramp surface is clean and free of grease, oil, ice and loosen materials.**
- **Never change the direction of travel when on the ramps. If it is necessary to change direction, drive off the ramps and correct the direction, then drive on to the ramps again.**

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

1. Apply the brake securely to the truck or trailer and put blocks under the tires to prevent the machine from moving.
2. Set the ramps so that the center of the machine is aligned with the truck or trailer, and fix securely in position.
   ★Check that the left and right ramps are at the same height.
3. Align the machine with the ramps, and drive up or down the ramps slowly to the load or unload the machine.
4. To prevent the machine from moving during transportation, put wooden blocks under the front and rear of the rubber crawler and secure the machine with chains or wire rope.
   Be particularly careful to secure it so that it cannot slip to the side.



6.2 PRECAUTIONS FOR LOADING

⚠ WARNING

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.

After loading the specified position, secure the machine as follows.

1. Lower the dump body slowly.
2. Push the parking brake switch in to apply the parking brake.
3. Return the engine throttle lever to the low-speed position, turn the starting switch to the OFF position and stop the engine. Remove the starting key.
4. When transporting the machine, place rectangular timber underneath the front and rear track shoes to prevent the machine from moving about. Also, hold it down with chains or rope. Be particularly careful to ensure that the machine does not slip sideways.

6.3 PRECAUTIONS FOR TRANSPORTATION

⚠ WARNING

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

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

7. COLD WEATHER OPERATION

7.1 PRECAUTIONS FOR LOW TEMPERATURE

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

[1] FUEL AND LUBRICANTS

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

For details of the specified viscosity, see "MAINTENANCE 3. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".

[2] COOLANT MIXTURE RATIO IN COOLING WATER

⚠ WARNING

Antifreeze is flammable, so keep it away from flames. Never smoke when handling antifreeze.
Antifreeze is added to the coolant to prevent the water from freezing when the machine is not being used.

NOTICE

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

To prevent engine overheating, rust, corrosion or freezing in the cooling system, use a mixture of long life coolant with tap water for engine cooling water.

The coolant serves anti-rust, anti-corrosion, and antifreeze. It should be used year around.

The coolant mixture ratio must be 30% or higher to ensure anti-rust and anti-corrosion properties.

[COOLANT MIXTURE RATIO]

Use the following table as a guide. The table shows examples when the amount of cooling water is "9 liters (2.38 US gal) [1.98 UK gal]".

Item	Unit				
Min. temperature	Deg C	-10	-15	-20	-25
	Deg F	14	5	-4	-13
Amount of coolant	Litter	2.7	2.7	3.2	3.6
	US gal	0.71	0.71	0.85	0.95
	UK gal	0.59	0.59	0.70	0.79
Amount of cooling water	Litter	6.3	6.3	5.8	5.4
	US gal	1.67	1.67	1.53	1.43
	UK gal	1.39	1.39	1.28	1.19
Coolant mixture ratio	%	30	30	35	40

When the vehicle is delivered, the cooling water is mixed with 30% long life coolant of the brand as shown below.

★COOLANT GREEN (ENEOS): Non-amine type

[3] BATTERY

⚠ DANGER

- **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 a doctor.**

When the ambient temperature drops, the capacity of the battery will also drop. If the battery charge ratio is low, the battery electrolyte may freeze. Maintain the battery charge as close as possible to 100%, and insulate it against cold temperature so that the machine can be started easily the next morning.

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

Rated of charge (%)	Temp. of battery electrolyte [deg C (deg F)]			
	20 (68)	0 (32)	-10 (14)	-20 (-4)
100	1.28	1.29	1.30	1.31
90	1.26	1.27	1.28	1.29
80	1.24	1.25	1.26	1.27
75	1.23	1.24	1.25	1.26

7.2 AFTER COMPLETION OF WORK

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

- Mud and water on the machine body should be completely removed. This is to prevent damage to the seal caused by mud or dirt getting inside the seal with frozen drops of water.

- Park the machine on concrete or hard ground. If this is impossible, park the machine on wooden boards.

- Open the drain valve and drain any water collected in the fuel system to prevent it from freezing.

- As the battery capacity drops markedly in low temperatures, cover the battery or remove it from the machine, keep it in a warm place, and install it again the next morning.

- If electrolyte level is found low, add distilled water in the morning before beginning work. Do not add the water after day's work so as to prevent fluid in the battery from freezing in the night.

7.3 AFTER COLD WEATHER

When season changes and the weather becomes warmer, do as follows.

- Replace the fuel and oil for all parts with oil of the viscosity specified.
  For details, see "MAINTENACE 3.USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".

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

8. LONG-TERM STORAGE

8.1 BEFORE STORAGE

When putting the machine in storage for more than one month, do as follows.

- After every part is washed and dried, the machine shall be housed in a dry building. Never leave it outdoors. In case it is indispensable to leave it outdoors, park the machine on the flat ground and cover it with canvas etc.

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

- Apply a thin coat of grease to metal surface of the hydraulic piston rods and the idler adjusting rods.

- Disconnect the negative terminals of the battery and cover it, or remove it from the machine and store it separately.

- If the temperature will go below 0 deg C, add anti-freeze to the cooling wafer. When not using anti-freeze, drain all the cooling water, and put a "No coolant" sign in the operator's compartment.

8.2 PRECAUTIONS DURING STORAGE

⚠ WARNING

If warming-up operation must be carried out inside a building, open the windows and doors to ensure good ventilation and prevent gas poisoning.

- When the machine is in long-term storage, start the engine once a month and carry out the warming-up operation thoroughly.
  In addition, move the machine for a short distance, and carry out the raise and lower operation thoroughly for the dump body.

★If the cooling water has been drained from the machine, always fill with cooling water before starting the engine.

★Before operating the dump body, wipe off the coat of grease from the piston rods of the hydraulic cylinders.

8.3 PRECAUTIONS AFTER STORAGE

Carry out the following procedure when using the machine after long-term storage.

- Wipe off the coat of grease from the piston rods of the hydraulic cylinders.

- Remove the drain plugs from the hydraulic tank, fuel tank, engine oil pan, and travel motors, and drain the water.

- Drain the water from the engine oil filter, fuel filter, and hydraulic line filter.

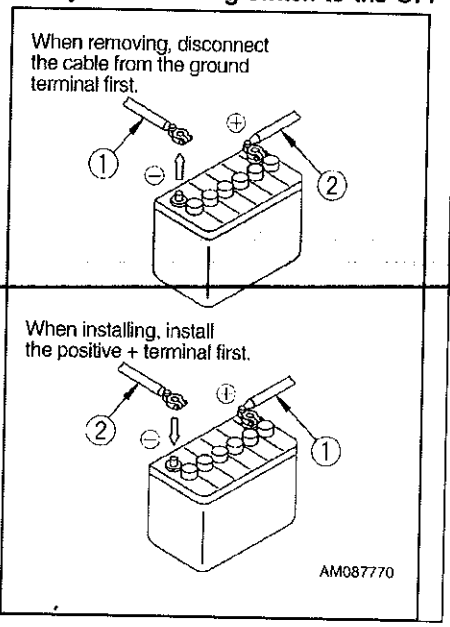
- Carry out the checks before starting and warm up the machine thoroughly, then check all parts of the machine carefully.

9. HANDLING BATTERY

When handling batteries, always do as follows.

⚠ DANGER

- **Before working with the battery, stop the engine and turn the key in the starting switch to the OFF position.**
- **When working with the battery, always wear safety glasses.**
- **Batteries generate hydrogen gas, so there is danger of explosion.**
  Do not smoke, use a lighter, or create any spark near the battery.
- **Battery electrolyte contains sulphuric acid. If you get acid on yourself, immediately flush the area with large amounts of water. If acid gets into your eyes, flush them immediately with large amounts of fresh water, then go to a doctor for treatment.**
- **When removing the battery, first disconnect the negative (-) terminal of the cable from the ground.**
  When installing, install the positive (+) terminal first.
- **If a tool touches the cable connecting the positive terminal and the chassis, there is danger that it will cause sparks. Do not carry tools in your breast pocket.**
- **Defective contact caused by loose battery terminals can generate sparks and lead to an explosion.**
  Tighten the battery terminals securely.



9.1 PRECAUTIONS WHEN HANDLING BATTERY

- Always be careful not to let the battery become discharged.
  Do not wait for the battery to become discharged before recharging it; measure the specific gravity of the battery electrolyte beforehand and charge the battery if necessary.
  Always keeping the battery in good condition will extend the life of the battery.

- When operating the machine in high temperatures, check the level of the battery electrolyte at shorter intervals than specified for periodic inspection and maintenance.

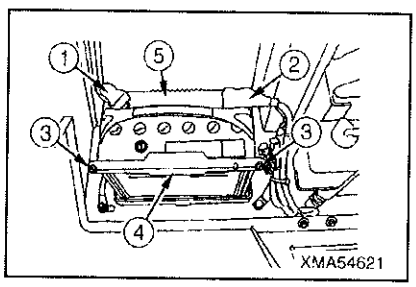
- When working in low temperatures, the capacity of the battery will drop considerably, so maintain the battery charge as close as possible to 100%, and insulate it against cold temperatures so that the machine can be started easily the next morning.
  When adding distilled water, to prevent the electrolyte from freezing, always add the distilled water immediately before starting operations on the following morning.

9.2 REMOVAL AND INSTALLATION OF BATTERY

The battery is installed in front of the fuel tank on the front right side of the machine.

[1] REMOVAL

1. Open the engine hood. For details, see "2.10 ENGINE HOOD".
2. Disconnect the battery cable from negative (-) terminal (1) for the ground, then disconnect at positive (+) terminal (2).
3. Remove nuts (3) (left and right x 2), remove battery holder (4), then take out battery (5).



[2] INSTALLATION

Install the batteries in the reverse order to removal.

★When connecting the battery cables, always install the negative (-) terminal at the ground end last.

9.3 PRECAUTIONS WHEN CHARGING BATTERY

If the battery becomes discharged or the battery charge is low, charge the battery.

To charge the battery when it is still mounted on the machine, do as follows.

⚠ WARNING

It is dangerous if the temperature of the battery electrolyte exceeds 45 deg C during charging, so stop charging and wait for the temperature to go down.

- Disconnect the wiring from the battery terminals before charging.
  There is danger of abnormal voltage being applied to the alternator and damaging it.
  When disconnecting the wiring, always disconnect the negative (-) terminal wiring first; and when connecting the wiring, always connect the negative (-) terminal wiring last.

- During charging, remove all the plugs from the battery cells to allow any gas to escape.

- When the charging is completed, stop the charging immediately.
  If the battery is overcharged, overheating of the battery will cause damage to the battery.

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

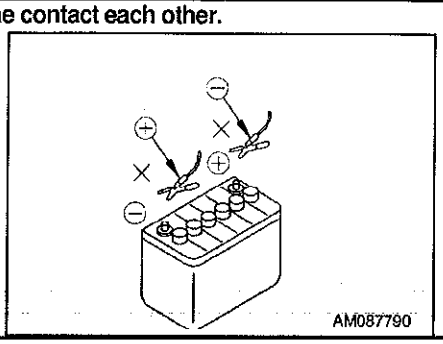
Rated of charge (%)	Temp. of battery electrolyte [deg C (deg F)]			
	20 (68)	0 (32)	-10 (14)	-20 (-4)
100	1.28	1.29	1.30	1.31
90	1.26	1.27	1.28	1.29
80	1.24	1.25	1.26	1.27
75	1.23	1.24	1.25	1.26

9.4 STARTING ENGINE WITH BOOSTER CABLE

If the battery is discharged and booster cables are used to start the engine, do as follows

⚠ DANGER

- **Be careful not to let the normal machine and problem machine contact each other.**
- **When connecting the cables, never let the positive (+) and negative (-) terminals contact each other.**
- **Make sure that there is no mistake in the booster cable connection.**
  When the final connection is made to the negative (-) terminal, sparks will be generated, so do not connect to the negative (-) terminal of the battery on the problem machine. Connect to the engine block.
- **When starting the engine with a booster cable, always wear safety glasses.**



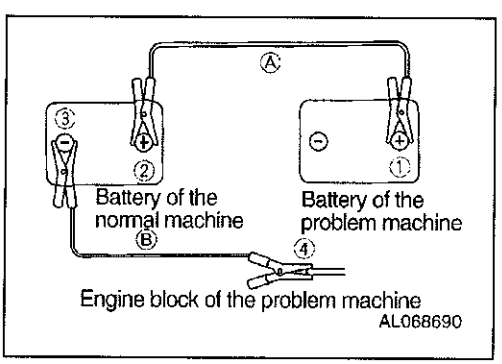
NOTICE

- **The size of the booster cable and clip should be suitable for the battery capacity. Check that they are not corroded or damaged.**
- **The battery on the normal machine must be the same capacity as that on the problem machine.**

[1] CONNECTING THE BOOSTER CABLES

★The numbers in the diagram on the right show the order for connecting the cables.

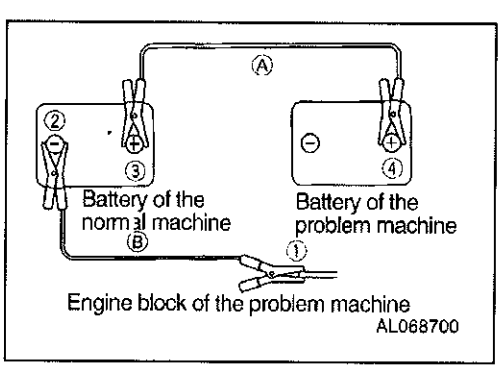
1. Make sure that the starting switches of the normal machine and problem machine are both at the OFF position.
2. Connect the clips at the ends of booster cable **A** to the positive (+) terminal of the problem machine and the normal machine.
3. Connect one clip of booster cable **B** to the negative (-) terminal of the normal machine.
4. Connect the other clip of booster cable **B** to the engine block of the problem machine.
5. Start the problem machine.



[2] DISCONNECTING THE BOOSTER CABLE

★The numbers in the diagram on the right show the order for connecting the cables.

When the engine on the problem machine starts, remove the cables in the reverse order to connecting.



10. TROUBLESHOOTING

If it is felt that there is any abnormality, investigate the cause immediately and take the necessary action to prevent any serious failure.

If the cause is unknown, please contact your distributor for repairs.

When contacting your distributor, please give the machine serial number and engine number.

10.1 PROBLEMS WITH ENGINE RELATED PARTS

Problem	Main causes	Remedy
Starting motor does not turn when starting switch is turned to START	• Insufficient battery charge • Defective wiring • Failure in starting motor, relay	• Charge • Check, repair • Contact your distributor
Starting motor turns, but cranks engine slowly	• Insufficient battery charge • Defective ground connection wiring • Viscosity of engine oil is too high	• Charge • Check, repair • Change to proper viscosity
Starting motor turns, but engine does not start	• Lack of fuel • Air in fuel line • Failure in fuel injection pump •Failure in engine	• Check, add fuel • Bleed air • Contact your distributor • Contact your distributor
After warming-up operation, Engine oil pressure lamp on instrument panel stays lighted up even when engine speed is raised (Engine oil pressure does not rise)	• Lack of engine oil • Clogged engine oil filter • Failure in engine parts	• Check, add oil • Replace new parts • Contact your distributor
Engine water temperature gauge points to around red range, or steam spurts out from near radiator system	• Lack of coolant • Leakage of oil from coolant system • Loose fan belt • Clogged radiator fin • Defective thermostat • . Overloading, operation under excessive load	• Check, add water • Check, repair or ccontact your distributor • Check, adjust, or replace new belt • Check, clean • Replace new parts • Reduce to below max. payload
Engine water temperature gauge points does not reach around green range	• Defective thermostat • Defective engine water temperature gauge	• Replace new parts • Replace new parts
Engine exhaust color is white	• Engine oil level is too high • Improper fuel	• Adjust to correct amount • Change to specified fuel
Engine exhaust color is too black	• Clogged air cleaner • Improper fuel • Failure in engine	• Check, clean • Change to specified fuel • Contact your distributor
Engine does not run smoothly	• Air in fuel line • Fuel filter clogged with dirt, water in fuel filter • Leakage of fuel from fuel system • Failure in engine	• Bleed air • Check, replace new parts, or repair • Check, repair • Contact your distributor
Engine stops when set to low speed	• Failure in engine	• Contact your distributor
Engine suddenly stops during operation	• Lack of fuel • Lack of engine oil • Failure in engine	• Check, add fuel • Check, add oil • Contact your distributor

10.2 PROBLEMS WITH CHASSIS RELATED PARTS

Problem	Main causes	Remedy
Machine does not move	• Parking brake still applied • Leakage of oil from hydraulic system • Travel lever cable disconnected • Failure in hydraulic equipment	• Release parking brake, or check brake piping • Check, repair • Check, repair • Contact your distributor
Abnormal noise generated from around pump	• Clogged strainer inside hydraulic tank • Leakage of oil from hydraulic system • Failure in hydraulic equipment	• Check, clean, or replace new parts • Check, repair • Contact your distributor
Hydraulic oil temperature rises too high	• Lack of oil inside hydraulic tank • Loose fan belt • Clogged oil cooler fin • Leakage of oil from hydraulic system • Overloading, operation under excessive load	• Check, add oil • Check, adjust, or replace new belt • Check, clean • Check, repair • Reduce to below max. payload
Rubber crawler comes off	• Rubber crawler tension too loose	• Check, adjust
Abnormal wear of sprocket	• Rubber crawler tension too tight	• Check, adjust

10.3 PROBLEMS WITH ELECTRIC RELATED PARTS

Problem	Main causes	Remedy
[Battery charge lamp] on instrument panel stays lighted up during operation (Battery is not being charged)	• Defective wiring • Loose fan belt • Defective alternator • Defective function of battery	• Check, repair • Check, adjust, or replace new belt • Contact your distributor • Check, repair, or replace
Head lamp is dim	• Insufficient battery charge • Defective alternator	• Charge • Contact your distributor
None of lighting equipment lights up	• Blown fuse • Defective wiring • Defective lamp switch	• Check, replace • Check, repair • Check, replace
Individual head lamps, instrument panel lighting do not light up	• Blown bulb • Defective wiring	• Replace • Check, repair
Horn does not sound	• Blown fuse • Defective wiring • Defective horn relay • Defective horn • Defective horn switch	• Check, replace • Check, repair • Check, replace • Check, replace • Check, replace
Left and right turn signal lamps do not flash	• Blown fuse • Defective wiring • Defective flasher relay • Defective turn signal switch	• Check, replace • Check, repair • Check, replace • Check, replace

1. BASIC OUTLINE OF MAINTENANCE

[1] OIL

- Oil is used under extremely heavy-duty conditions (high temperature, high pressure) in the engine, hydraulic pump, motor, and work equipment. Therefore, it deteriorates as time passes.
  Always use the grade of oil and the oil which matches the ambient temperature listed in this operation manual.
  Even if the oil is not dirty, always change it at the specified interval.
- When adding oil, do not mix oils of different grades or brands.
- Always add oil to the specified oil level. Too much oil and too little oil are both the cause of problems.
- When changing the oil, always replace the related oil filter at the same time.
- Always be careful when handling oil to prevent water, dirty, or other impurities from getting into the oil.
  A large proportion of problems with the machine are caused by impurities getting into the oil, so be extremely careful not to let impurities get into the oil: always store the oil indoors and carry out oil-filling operations in a dust-free environment.
- If the oil is a milky white, there is probably water or air in the circuit. In such cases, please contact your distributor.

[2] FUEL

- Do not use any fuel except diesel oil.
- Always use the fuel specified for the ambient temperature listed in this operation manual.
- The fuel pump is a precision instrument, so if fuel containing water or dirt is used, the fuel pump will stop working. Be extremely careful not to let impurities get into the fuel: always store the fuel indoors and carry out refueling operations in a dust-free environment.
- If fuel is stored in drum cans, store the drum cans on their sides so that the ports in the drum cans are in a straight line to the side. This action will prevent damp air from being sucked in.
- To prevent moisture in the air from getting into the fuel tank, always fill the tank after the completion of each day's work.
- If the machine runs out of fuel, or when the fuel filter has been replaced, it is necessary to bleed the air the circuit. Always read the separate operation manual for the engine when carrying out this operation.

[3] COOLANT

- Do not use river water, well water, or water from simple water lines as the coolant.
  Such kinds of water contain many impurities, such as calcium and dirt, so scale will collect inside the engine and radiator. This will cause improper heat exchange, and will lead to overheating.
- If the engine overheats, allow the engine to cool down, then add coolant.
- When using antifreeze, always follow the precautions given in the operation manual.

[4] GREASE

- Grease is used at the connecting points of the dump body or travel lever linkage to prevent gouging or noise.
- The grease nipples not listed in this manual are nipples used for overhaul, so there is no need to add grease to them. However, if any gouging or noise occurs during use, add grease.
- When adding grease, pump in grease until the old grease is completely forced out, then wipe off all the old grease. Be particularly careful to wipe off the grease at points where mud and dirty may stick and cause wear of the rotating parts.

[5] FILTERS

- Filters are used to prevent trouble caused when impurities in the oil, fuel, or air enter important equipment. When the replacement interval listed in this manual is reached, always replace or clean the filters.
  However, when using this machine under heavy-duty conditions, replace the filters before the specified replacement interval has passed.
- Do not wash and reuse oil filters or fuel filters. Always replace them with new parts.
- When replacing the oil filter, check the old filter for any metal particles or pieces of rubber from the hoses.
  If any rubber or metal is found, please contact your distributor. This action is important to prevent any failure before it occurs.
- When using new filters, do not remove the wrapping until immediately before using them.

[6] ELECTRICAL COMPONENTS

- It is extremely dangerous if electrical components become wet or the film covering them is broken. This may lead to electrical leakage and may cause misoperation of the machine. When washing the machine, take care not to get water onto electrical components.
- Never remove any electrical components from the machine or disassemble them.
- Always contact your distributor before installing additional electrical equipment to your machine.
- After the machine has been used near the sea or after it has been used for spreading fertilizer, wipe the electrical components carefully with a dry cloth to prevent corrosion.

[7] HYDRAULIC SYSTEM

- The hydraulic equipment is at high temperature and high pressure during operations and immediately after operations have been completed.
  When carrying out inspection and maintenance of the hydraulic equipment, always do as follows.
  (1) Stop the machine on level ground, and lower the work equipment to the ground so that there is no pressure in the hydraulic cylinder circuit.
  (2) Always stop the engine.
  (3) Loosen the hydraulic tank cap slowly, then remove it.
  (4) Always wait for the temperature to go down before starting maintenance. Even when the temperature goes down, the circuits are still under internal pressure, so when removing plugs or hoses, do not stand directly in front of them, and loosen the connections slowly before removing.
- If high-pressure hoses, connections, or hydraulic equipment have been removed, always replace the O-ring.
- When replacing or cleaning the hydraulic line filter or strainer, or when replacing or repairing the hydraulic equipment or hoses, always bleed the air from the circuit after completion of the operation.

2. PRECAUTIONS FOR MAINTENANCE

⚠ WARNING

- **Before carrying out inspection and maintenance, always read "2. PRECAUTIONS FOR INSPECTION AND MAINTENANCE in the SAFETY" volume and make sure that you understand the safety procedures for operations.**
- **Do not carry out any operation not listed in this manual for inspection and maintenance. When carrying out inspection and maintenance of the engine, always read the separate engine operation manual and make sure that you understand it.**

[1] CHECK HOURMETER

- Read the hourmeter every day to check if the required interval has been reached for any maintenance item.

[2] USE GENUINE PARTS

- When replacing parts, always use the genuine parts specified in the parts list.

[3] PRECAUTIONS WHEN ADDING OR CHANGING OIL OR GREASE

- When adding or changing fuel, oil, or grease, always use the type specified by Morooka. Be sure to use the viscosity specified for the ambient temperature.
- Never mix types of oil or brands of oil from different makers.
- The oil used when the machine is shipped from the factory is as shown in the table below.

Item	Type	Brand
Engine oil pan	CF class DH-1 10W-30	-
Hydraulic tank	Hydraulic oil ISO VG46	Idemitsu Kosan Super Hydro X 46
Travel motor reduction gear case	SAE90 GL-5	Shin Nihon Sekiyu Gear Lube SP 90

[4] PRECAUTIONS WHEN WASHING OR CLEANING MACHINE

- Wash or clean the machine to make it easier to locate problem points. In particular, wash the oil filler, level gauge, and greasing plugs to prevent dirt or mud from entering when adding oil or grease.
- Cover electrical parts, such as the starting motor or alternator, with a sheet to prevent water from getting on them.
- Do not carry out high-pressure washing for the radiator or oil cooler parts.

[5] BE CAREFUL OF OIL AND COOLANT TEMPERATURE

- It is dangerous to drain the oil or coolant or replace the filters immediately after stopping the engine. Wait for the machine to cool down before carrying out such operations.
- When draining the oil, warm up the oil to a suitable temperature (approx. 20 – 40°C) before carrying out the operation.

[6] PRECAUTIONS WHEN CHECKING OIL LEVEL, ADDING OIL

- When checking the oil level or adding oil, choose a place where there is no dust to prevent dirt from entering the oil line.
- Use clean oil and grease. Use a clean container to prevent dirt from getting in.
- If there is a strainer fitted to the oil filler port, do not remove the strainer when adding oil.
- Check that the lubricating oil is at the correct level. The oil level should not be too high or too low.

[7] CHECKING DRAINED OIL, FILTER

• When the oil has been changed or the filter replaced, always check the drained oil and removed filter to check for metal particles or other foreign materials.

[8] SETTING UP WARNING SIGNS

• When the oil or coolant has been drained, put warning signs (Part No.: 1-41010-1210) in the operator's compartment to prevent anyone from starting the engine by mistake.

[9] PRECAUTIONS WHEN WASHING PARTS

• When washing parts, use a non-flammable washing agent or diesel oil.
When using diesel oil, do not bring lighted cigarettes or cigarette lighters close.

[10] PRECAUTIONS WHEN INSTALLING PARTS

• When O-rings, gaskets, or other seals are used for the mounting surface, clean the mounting surface and always replace the seal with a new part.

[11] PRECAUTIONS WHEN CARRYING OUT INSPECTION AND MAINTENANCE OF A MACHINE AFTER OPERATIONS IN DUSTY AREAS

• Check carefully for clogging of the air cleaner, and clean the air cleaner element more frequently.
• Clean the radiator core and oil cooler core more frequently to prevent clogging.
• Replace the fuel filter more frequently.
• Clean electrical parts carefully (in particular, the starting motor or alternator) to prevent dust from collecting.

[12] PRECAUTIONS WHEN CARRYING OUT INSPECTION AND MAINTENANCE ON MACHINES BEFORE STARTING OPERATIONS IN SWAMPY AREAS, RAIN, RIVERBEDS, OR SNOW

• Before starting operations, check that the drain plug under the engine and the greasing plugs for the track rollers are securely tightened.
• After completion of operations, wash the machine carefully and check for cracks and damage, and for loose or missing nuts and bolts.

3. USE OF FUEL AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE

3.1 FUEL, COOLANT, AND LUBRICANT TABLE

NOTICE

- **The quality of engine oil influences significantly on the engine performance and start ability. Always use the engine oil of CF-4 class, JASO DH-1 or higher and of specified viscosity (refer to the table below) according to the ambient temperatures.**
- **Always use diesel fuel. Never use additives such as anti-freeze and water-removing agents. Otherwise, the fuel injection system may be damaged. Never use kerosene, as it may cause a trouble.**

- Select the fuel and oil from the table below according to the ambient temperature.
- The specified capacity is the total amount of oil, including the oil in the piping of the various components.
- The refill capacity is the amount of oil added when changing the oil during inspection and maintenance.
- When starting the engine in an ambient temperature of lower than 0 deg C, always use a grade specified for temperatures below 0 deg C, even if the temperature goes up to 10 deg C during the daytime.
- For the coolant mixture ratio of cooling water, see "Operation 8. Cold Weather Operation" in "[2] Coolant Mixture Ratio in Cooling Water ".

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE -22 -4 14 32 50 68 86 104°F -30 -20 -10 0 10 20 30 40 °C	CAPACITY	
			Specified	Refill
Engine oil pan	Engine oil	SAE30 SAE15W-40 SAE10W-30	9.7ℓ 2.56 US gal 2.13 UK gal	9.7ℓ 2.56 US gal 2.13 UK gal
Hydraulic oil tank	Hydraulic oil	ISO VG56 ISO VG46 ISO VG32	54 ℓ 14.27 US gal 11.88 UK gal	50 ℓ 14.27 US gal 11.88 UK gal
Travel motor reduction gear case(each)	Gear oil	SAE90	1.2ℓ 0.32 US gal 0.26 UK gal	1.2ℓ 0.32 US gal 0.26 UK gal
Fuel tank	Diesel fuel	ASTM D975 No.2 ASTM D975 No.1	45 ℓ 13.74 US gal 11.44 UK gal	-
Cooling system	Water	*Long Life Coolant	9 ℓ 2.38 US gal 1.98 UK gal	-

REMARK

• When fuel sulphur content is less than 0.5 %, change oil in the oil pan every periodic maintenance hours described in this manual.

Change oil according to the following table if fuel sulphur content is above 0.5%.

Fuel sulphur content	Change interval of oil in engine oil pan
0.5 to 1.0%	1/2 of regular interval
Above 1.0%	1/4 of regular interval

• When starting the engine in an atmospheric temperature of lower than 0 deg C, be sure to use engine oil of SAE10W-30 and SAE15W-40, even though an atmospheric temperature goes up to 10 deg C more or less in the day time.

• Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.

• There is no problem if single grade oil is mixed with multigrade oil (SAE10W-30, 15W-40), but be sure to add single grade oil that matches the temperature in the table.

• We recommend genuine oil which has been specifically formulated and approved for use in engine and hydraulic work equipment applications.

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 Material
SAE: Society of Automotive Engineers
API: American Petroleum Institute

• Hydraulic oil: Nihon Sekiyu Highland Wide KV46.
★ When changing the hydraulic oil, please contact your distributor.

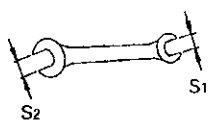
4. TOOLS AND TIGHTENING TORQUES

4.1 INTRODUCTION OF NECESSARY TOOLS

The following tools are needed when carrying out maintenance.

If the tools are broken or worn, please order new tools from your distributor.

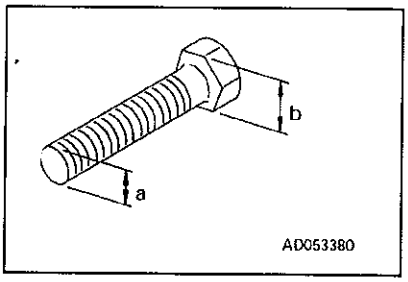
No.	Name of tool	Part No.	Remarks
1	Wrench set	0-9100-00000	Width across flats (S1 x S2)
		0-9100-00709	7mm x 9mm
		0-9100-00810	8mm x 10mm
		0-9100-01113	11mm x 13mm
		0-9100-01214	12mm x 14mm
		0-9100-01719	17mm x 19mm
		0-9100-02224	22mm x 24mm
2	Wrench	0-9105-04600	Width across flats 46mm
3	Screw driver (+)	0-9210-00150	
4	Screw driver (-)	0-9200-00200	



4.2 TORQUE LIST FOR BOLTS AND NUTS

Unless otherwise specified, tighten the metric bolts and nuts to the torque shown in the table below.

The tightening torque is determined by the width across flats (b) of the nut and bolt.



NOTICE

When tightening panels or other parts with tightening fixtures made of plastic, be careful not to use excessive tightening torque. Tightening excessively will damage the plastic parts. Be extremely careful when tightening.

Thread diameter x Width across thread pitch flats (a) (mm x mm)	Width across flats (b) (mm)	Tightening torque (kgf-m) {N-m}	
		Tensile strength 4T	Tensile strength 11T
3x0.5	5.5	0.05 {0.5}	0.2 {1.8}
4x0.7	7	0.1 {1.0}	0.4 {4.1}
5x0.8	8	0.2 {2.2}	0.8 {8.2}
6x1.0	10	0.4 {3.6}	1.4 {14.0}
8x1.25	13	0.9 {8.9}	3.5 {34.0}
10x1.5	17	1.8 {17.7}	6.9 {67.4}
12x1.75	19	3.2 {30.9}	12.0 {117}
14x2.0	22	5.0 {49.1}	19.1 {187}
16x2.0	24	7.8 {76.7}	29.7 {291}
18x2.5	27	10.7 {105}	40.9 {401}
20x2.5	30	15.3 {149}	58.1 {570}
22x2.5	32	20.8 {203}	79.0 {775}
24x3.0	36	26.4 {258}	100 {983}
27x3.0	41	38.6 {378}	147 {1440}
30x3.5	46	52.4 {513}	199 {1955}
33x3.5	50	71.3 {699}	271 {2660}
36x4.0	55	91.6 {898}	348 {3416}
39x4.0	60	119 {1162}	451 {4421}

5. PERIODIC REPLACEMENT OF CRITICAL PARTS

5.1 PERIODIC REPLACEMENT INTERVAL (EVERY 2 YEARS)

In order to further increase the safety of the machine Morooka recommends periodic inspection and replacement of critical parts (hydraulic hoses, fuel hoses, etc.) which are related to causes of fire and to efficiency in the raising and lowering of the dump body and traveling and stopping functions of the machine.

With these parts, the material changes as time passes, and 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. Always replace them with new genuine parts to ensure that the machine always maintains its function completely.

5.2 PERIODIC INSPECTION

⚠ WARNING

- **Check the hydraulic hoses and fuel hoses carefully to check for cracks, deterioration, or other damage, and to check that there is no leakage from the connections.**
  When carrying out checks before starting, always check the ground under the machine to check for traces of oil leakage.
- **When replacing the hydraulic hoses or fuel hoses, always order genuine parts. Never use any imitation or substitute parts.**
- **When any hydraulic hose is replaced, always replace the O-rings at the same time. Failure to do this will cause oil leakage.**

If the monthly inspection or checks before starting show any abnormality, such as leakage of oil or deformation and cracking, tighten the parts immediately or replace them with new genuine parts.

When doing this, check the hose clamps at the same time, and replace them if they are deformed or cracked.

Check and repair any hydraulic hoses, even if they are not listed as critical parts.

The table below shows the checks to be carried out during periodic maintenance.

Periodic maintenance interval	Inspection items
Checks before starting	• Leakage of oil from caulked portions, connections of fuel hoses, hydraulic hoses
Monthly inspection	• Leakage of oil from caulked portions, connections of fuel hoses, hydraulic hoses • Damage to fuel hoses, hydraulic hoses (cracks, wear, gouging, swelling, crushing) • Interference with other parts
Every 2 years inspection	• Replacement of critical parts • Leakage of oil from caulked portions, connections of fuel hoses, hydraulic hoses • Damage to fuel hoses, hydraulic hoses (cracks, wear, gouging, swelling, crushing) • Interference with other parts

5.3 SPECIFIED PERIODIC REPLACEMENT PARTS

⚠ CAUTION

- **The list of periodic replacement parts specified by Morooka does not include the fuel hoses on the engine. Refer to the separate engine parts list (parts book) and carry out replacement in the same way as for the periodic replacement parts specified by Morooka.**
- **For details of the part numbers for periodic replacement parts specified by Morooka, see the parts list (parts book), and contact your distributor to place orders.**

As the periodic replacement parts, the parts shown in the table below should be used.

For details of the parts, see the parts list (parts book).

No.	No. Periodic replacement parts	Q'ty	Replacement interval
1	Fuel hose (fuel tank to fuel filter)	1	
2	Fuel hose (fuel filter to fuel pump)	1	Replace every 2 years
3	Fuel hose (fuel pump to fuel injection pump)	1	
4	Fuel hose (fuel injection pump to fuel tank)	1	
5	Hydraulic hose (main pump to/from travel motor)	4	
6	Hydraulic hose (gear pump to main control valve)	1	
7	Hydraulic hose (main control valve to dump cylinder)	2	Replace every 3 years

6. MAINTENANCE SCHEDULE CHART

7. SERVICE PROCEDURE

7.1 OUTLINE OF INSPECTION AND MAINTENANCE PROCEDURES

This section explains the methods for inspection and maintenance operations listed in "6. MAINTENANCE SCHEDULE CHART".

Always observe the precautions related to safety for each item, and carry out the operation safely.

If the operation is difficult, do not try to carry it out; please contact your distributor.

• The operations in this section require the following parts to be removed or opened, and then installed or closed. For details of the procedure, see the following sections.

(1) Engine hood: See OPERATION, 2.10 ENGINE HOOD.

(2) Operator's compartment side cover: See OPERATION, 2.11 OPERATOR'S COMPARTMENT SIDE COVER.

(3) Engine rear side cover: See OPERATION, 2.12 ENGINE REAR SIDE COVER.

(4) Undercover: See OPERATION, 2.13 UNDERCOVER.

7.2 INITIAL 100 HOURS SERVICE

Carry out the following maintenance after the initial 100 hours breaking-in operation for new machines.

[1] CHANGE ENGINE LUBRICATING OIL, REPLACE ENGINE OIL FILTER

For details of the method of maintenance, see EVERY 200 HOURS SERVICE.

[2] CHANGE OIL IN HYDRAULIC TANK

For details of the method of maintenance, see EVERY 500 HOURS SERVICE.

[3] REPLACE HYDRAULIC LINE FILTER

For details of the method of maintenance, see EVERY 500 HOURS SERVICE.

7.3 INITIAL 500 HOURS SERVICE

Carry out the following maintenance after the initial 500 hours breaking-in operation for new machines.

[1] CHANGE OIL INSIDE TRAVEL MOTOR REDUCTION GEAR CASE

For details of the method of maintenance, see EVERY 1500 HOURS SERVICE.

7.4 WHEN REQUIRED

[1] CHECK, ADJUST RUBBER CRAWLER TENSION

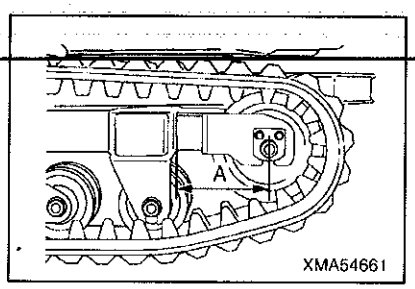
⚠ WARNING

The tension adjuster for the rubber crawler is charged with grease. The grease is kept under high pressure by the recoil spring inside the tension adjuster.
Always follow the precautions given below. Failure to follow these precautions may cause the valve to fly out, resulting in serious injury or accident.
- **Never loosen the tension adjustment valve more than one turn. There is danger that the valve may fly out.**
- **When adjusting the tension, never stand directly in front of the valve. It is dangerous.**

• CHECKING TENSION

1. Drive the machine a short distance forward and backward, then stop the engine.
2. Measure distance **A** from the rear end of the track frame to the center of the idler, and check that it is within the following range.
   ★ Dimension **A**: 290 ± 5 mm

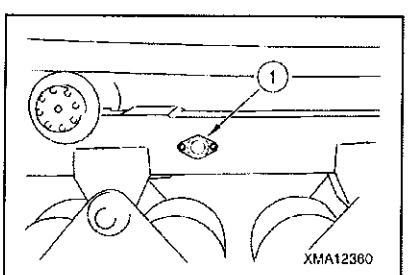
★ If the result of the measurement shows that dimension **A** is greater than the specified range, adjust the rubber crawler tension. For details, see "ADJUSTING TENSION".



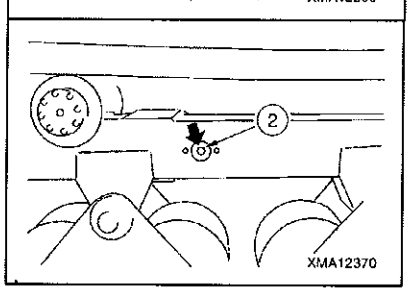
• ADJUSTING WHEN TENSION IS LOOSE (When measurement is below range for dimension A)

★ Before adjusting, prepare a grease pump.

1. Remove 2 bolts, and then remove grease valve cover (1).

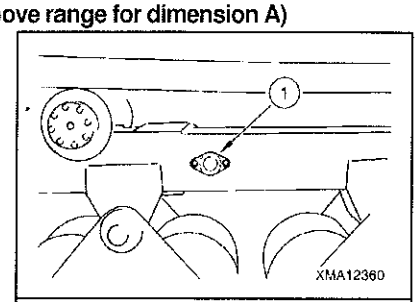


2. Using the grease pump, pump in grease through valve (2) until dimension **A** is within the range given for "CHECKING TENSION".
   ★ If dimension **A** does not enter the range above even when grease is pumped in, the rubber crawler must be replaced, or there is probably some abnormality in the tension adjuster, so please contact your distributor.
3. Drive the machine a short distance forward and backward to make the tension uniform, then repeat the steps for "CHECKING TENSION" to measure dimension **A**.
4. Install grease valve cover (1), and then tighten the bolts.

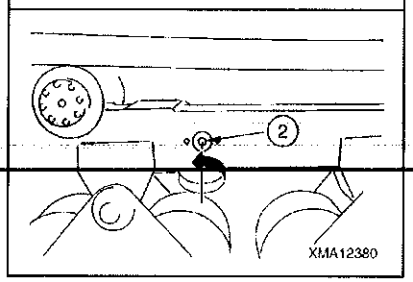


• ADJUSTING WHEN TENSION IS TIGHT (when measurement is above range for dimension A)

1. Remove 2 bolts, and then remove grease valve cover (1).



2. Loosen valve (2) until dimension **A** is within the range given for "CHECKING TENSION".
   - ★ If the grease comes out slowly, push the idler end of the rubber crawler strongly. Never loosen valve (2) more than 1 turn.
   - ★ If the grease still comes out slowly, start the engine and drive the machine a short distance forward and backward.
3. Tighten valve (2) securely.
4. Drive the machine a short distance forward and backward to make the tension uniform, then repeat the steps for "CHECKING TENSION" to measure dimension **A**.
5. Install grease valve cover (1), and then tighten the bolts.



[2] CHECK RUBBER CRAWLER FOR DAMAGE, WEAR

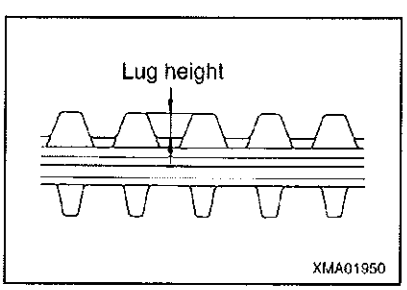
⚠ WARNING

If there are any large cracks or damage to the rubber crawler, replace the rubber crawler immediately. There is danger that the rubber crawler may break suddenly without warning during operations.

NOTICE

- **When checking the rubber crawler, remove all mud and snow from the crawler before checking.**
- **Using the rubber crawler when it has exceeded the wear limit will cause slipping and will reduce the drawbar pull. If the rubber crawler is in the following condition, replace it with a new rubber crawler.**

- If the height of the lug is less than 1/3 of the standard dimension, replace the rubber crawler.
  - ★ Standard height: 25 mm
  - ★ Wear limit: 8 mm
- If there are cracks or deep cuts and the wire in the core of the rubber crawler can be seen, replace the rubber crawler.



[3] CLEAN, REPLACE AIR CLEANER

⚠ WARNING

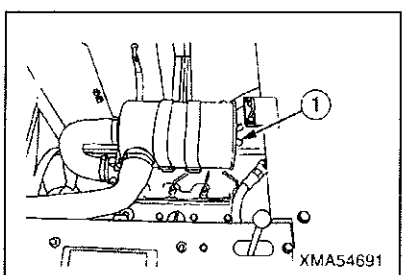
- **Never clean, or replace the air cleaner when the engine is running.**
- **When using compressed air to clean the element, there is danger that dirt and dust may fly and get into eyes. Always wear safety glasses.**

NOTICE

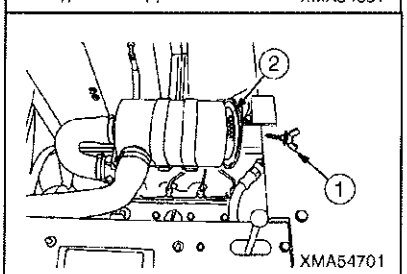
- **When cleaning the outer element, do not hit it or knock it against other objects.**
- **Do not use the outer element if the folds or seal are damaged.**
- **Replace the outer element with a new part if it has been cleaned three or four times, or if it has been used for one year. When replacing the outer element, replace the inner element at the same time.**
- **After cleaning the outer element, if the engine exhaust gas color is black or there is lack of power, replace the outer element. When replacing the outer element, replace the inner element at the same time.**
- **Never clean the inner element and use it again. Always replace it with a new element.**

• METHOD OF CLEANING ELEMENT

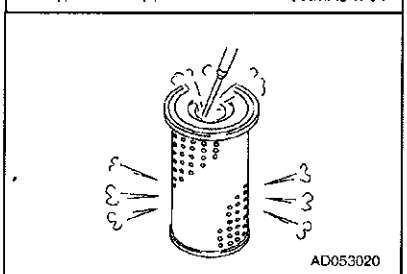
1. Open the engine hood.
2. Remove the engine rear side cover.
3. Loosen the air cleaner wing bolt (1).



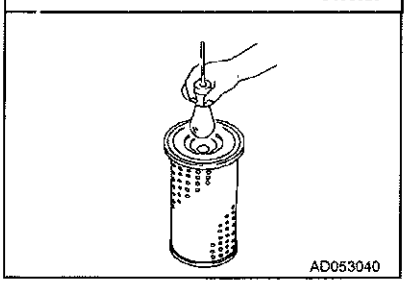
4. Remove and pull out the element (2) from the engine rear side cover.



5. Direct dry compressed air (max. 0.68Mpa {max. 7 kgf/cm^2}) from the inside of element e along its folds.
   Then blow with air along the folds from the outside, and finally blow again from the inside.



6. After cleaning the element, shine an electric light bulb from the inside and check if any small holes or thin parts are found on the element. If such parts are found, replace the element.
7. Set element (2) in the body.
8. Set the wing bolt (1) and then tighten.



• REPLACING ELEMENT

Remove the element and install a new part.
For details, see Method of cleaning element.

[4] CLEAN INSIDE OF COOLING SYSTEM AND CHANGE COOLANT

⚠ WARNING

- **Immediately after the engine is stopped, the coolant is at high temperature, so there is danger of burns if you drain the coolant immediately.**
  Wait for the engine to cool down before draining the coolant.
- **Do not suddenly remove the cap when the radiator water temperature is high. Boiling water will spurt out and cause burns.**
  Wait for the water temperature to go down before removing the cap. When removing the cap, turn it slowly to fully release the internal pressure, then remove the cap.

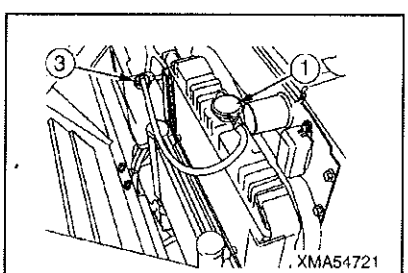
NOTICE

- **Replace the cooling water (coolant) every year or 2000 running hours whichever comes first.**
- **For the coolant mixture ratio of cooling water, see "Operation 8. Cold Weather Operation" in "[2] Coolant Mixture Ratio in Cooling Water ".**

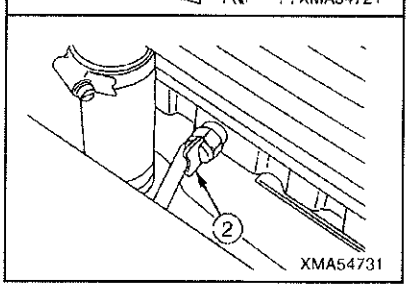
Clean the cooling water circuit as follows.

★Use tap water for the coolant.
Do not use river water, well water, or untreated water supplies.

1. Stop the machine on level ground and stop the engine.
2. Open the engine hood.
3. Turn radiator cap (1) slowly to fully release the internal pressure, and remove it.

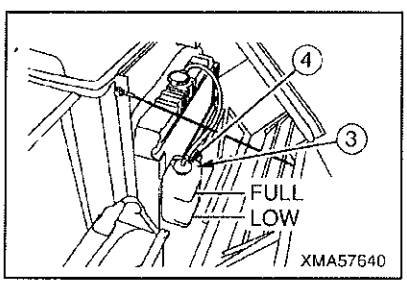


4. Remove the undercover.
5. Drain the water from the following two places.
   (1) Open radiator drain valve (2).
   (2) Open the drain valve on the engine.
   ★For details of the position of the drain valve on the engine, see the separate engine operation manual.
   ★If there is antifreeze in the coolant, put containers to catch the water under each of the drain valves.



6. After draining the water, close the two drain valves opened in Step 5, then add tap water through the water filler to fill the radiator.
7. Open the 2 drain valves in Step 5, then start the engine, run at low idling, and run water through the system to flush it for 10 minutes.
   ★While running water through the cooling system to flush it, be careful to adjust the water flow so that the radiator is always full.
   ★While running water through the cooling system to flush it, be careful that the water supply hose does not slip out of the water filler.
8. After flushing the system, stop the engine, stop the water supply, then drain the water.
9. After draining the water, close the 2 drain valves in Step 5, then add cleaning agent through the water filler.
   ★For details of the method of cleaning, see the instructions on the cleaning agent.

10. After flushing with cleaning agent, open the 2 valves in Step 5, drain the water, then start the engine, run at low idling, and flush with water until clean water comes out.
    ★While running water through the cooling system to flush it, be careful to adjust the water flow so that the radiator is always full.
    ★While running water through the cooling system to flush it, be careful that the water supply hose does not slip out of the water filler.
11. When clean water comes out, stop the engine, and close the 2 drain valves in Step 5.
12. Add tap water through the water filler to fill the radiator.
13. Start the engine, run for 5 minutes at low idling, then run for a further 5 minutes at high idling to remove the air from the coolant.
    ★Leave the radiator cap removed when doing this.
14. Stop the engine, leave for approx. 3 minutes, then add tap water to near the top of the water filler, and tighten the radiator cap.
15. Remove the reservoir tank (3), drain the water being stored in the reservoir reservoir tank and, after that, wash the inside of the tank.
16. Install the reservoir tank (3) to the original position and remove the cap (4) to feed the tap water to a level between the FULL line and the LOW line. After that, tighten the cap (4) securely.
17. Close the engine hood.
18. Install the undercover.



[5] CHECK, CLEAN RADIATOR, OIL COOLER FINS

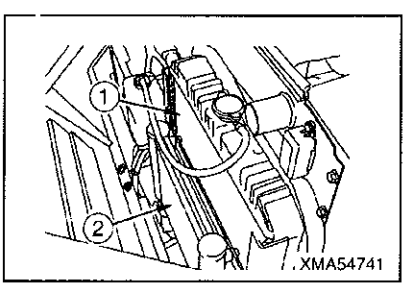
⚠ WARNING

- **Never inspect or clean the fins when the engine is running. Always stop the engine before starting the operation.**
- **When using compressed air to clean the fins, there is danger that dirt and dust may fly and get into eyes. Always wear safety glasses.**

NOTICE

- **When cleaning the fins, use compressed air at a pressure of less than 0.29Mpa {3 kgf/cm^2} , and stand away from the fins when directing the compressed air.**
  If the compressed air is blown directly against the radiator or is blown at high pressure, the fins will be damaged and this will cause leakage of water or oil.
- **When cleaning the fins, do not use steam or water instead of compressed air. This causes clogging.**

1. Open the engine hood.
2. Check for mud, dirt, dead leaves, or waste paper clogging radiator fins (1) or oil cooler fins (2).
3. If the result of the inspection shows that the fins are clogged, blow with dry compressed air (0.29Mpa {3 kgf/cm^2}) to clean.
4. Close the engine hood.



7.5 CHECK BEFORE STARTING

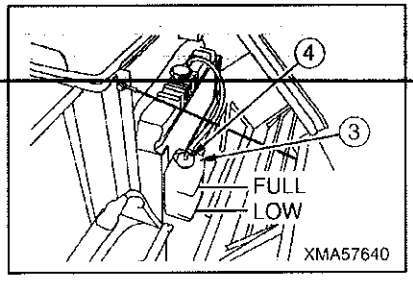
[1] CHECK COOLANT LEVEL, ADD WATER

⚠ WARNING

When checking the coolant level and adding water, always carry out the operation at the reserve tank. Never remove the radiator cap to check.

NOTICE

If the result of the coolant level check shows that more water must be added than usual, there is probably a water leak, so search for the cause and repair the problem immediately.



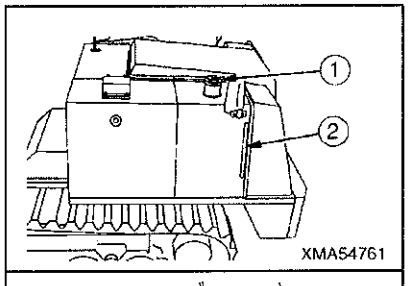
1. Open the engine hood.
2. Check the level of the section (3) of the reservoir tank to make sure that the cooling water level is between the "FULL" line and the "LOW" line.
   If the cooling water is in short, feed the tap water.
3. Remove tha cap (4) of the reservoir tank (3) and feed tap wateruntil the cooling water level comes up between the "FULL" line and the "LOW" line.
4. After adding water, tighten cap (4) securely.
5. Close the engine hood.

[2] CHECK FUEL LEVEL, ADD FUEL

⚠ DANGER

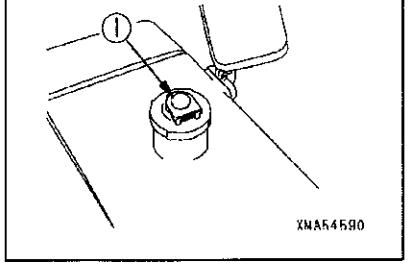
When adding fuel, never let the fuel overflow from the tank. This will cause fire.

1. Check the fuel level with level gauge (2) at the side face of the fuel tank.



2. Release the lock on the cap (1) with a key and remove the cap (1) from the fuel tank and add fuel through the fuel filler.
3. Check the breather hole on the inside of the cap, and if it is clogged, wash it.
4. After adding fuel, tighten the cap (1) securely and lock up it with a key.

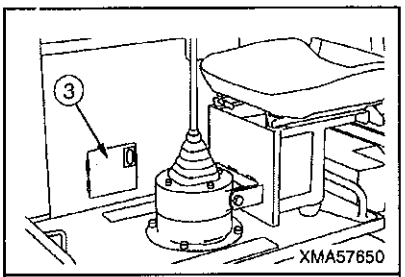
★Always fill the fuel tank after completing the day's operation.



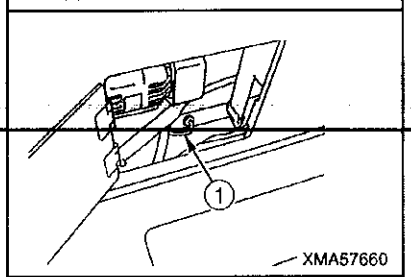
[3] CHECK ENGINE LUBRICATING OIL LEVEL, ADD OIL

• CHECKING OIL LEVEL

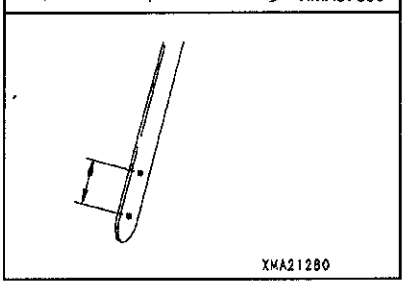
1. Open the inspection cover (3) at the operator's compartment side cover.



2. Pull out dipstick (1) and wipe the oil off with a cloth.
3. Insert dipstick (1) fully into the gauge guide, then pull it out again.

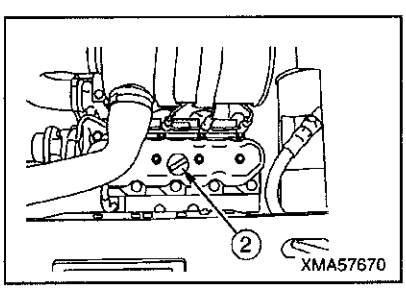


4. The oil level should be between the top and bottom marks at the tip of dipstick (1).
   If the oil level is below the bottom mark, add engine oil.



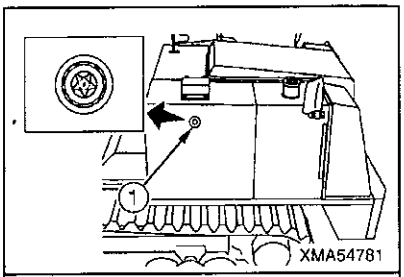
• FILLING WITH OIL

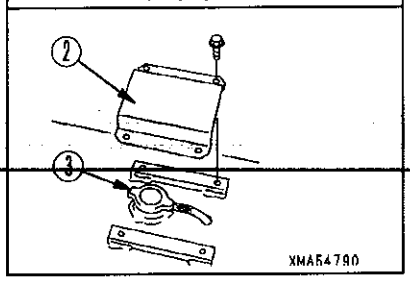
1. Open the engine hood.
2. Remove cap (2) and add engine oil.
   ★ For details of the engine oil, see "3. USE OF FUEL AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
   ★ Use a container with an attached hose when filling with oil.
3. Check the oil level again, and if it is within the specified range, tighten cap (2) securely.
4. Close the engine hood.
5. Close the inspection cover (3).



[4] CHECK OIL LEVEL IN HYDRAULIC TANK, ADD OIL

1. Check the oil level with level gauge (1) at the side of the hydraulic tank, and check the condition of contamination of the oil. The oil level should be within the range of the glass surface of the gauge.
2. If the oil level is low, remove cover (2) from the hydraulic tank, then remove cap (3) and add hydraulic oil through the oil filler.
   ★For details of the hydraulic oil, see "3. USE OF FUEL AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
3. Check the breather hole on the inside of cap (3), and if it is clogged, wash it.
4. After adding oil, tighten cap (3) securely, then install cover (2).

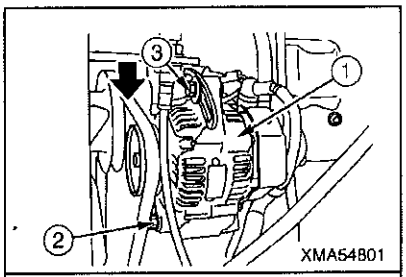




[5] CHECK FAN BELT TENSION, ADJUST

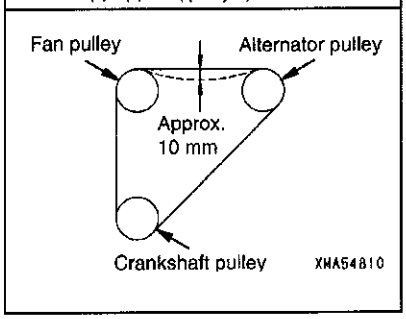
• CHECKING TENSION

1. Remove the operator's compartment side cover.
2. Press the fan belt at a point midway between fan pulley and alternator pulley with a finger pressure of approx. 58.8N {6 kg}. The deflection should be approx. 10 mm.
3. If the deflection is excessive, see "ADJUSTING TENSION" below to adjust the belt tension.



• ADJUSTING TENSION

1. Loosen bolt (2) at the bottom of alternator (1) and adjustment bolt (3).
2. Move alternator (1) so that the belt deflection is approx. 10 mm.
3. When the belt tension is correct, tighten bolt (2) at the bottom of the alternator (1) first, then tighten adjustment bolt (3).
4. Check the belt tension again.
   For details, see "CHECKING TENSION".
5. Install the operator's compartment side cover.



[6] CHECK ELECTRIC WIRING

⚠ DANGER

If any tool touches between the battery positive (+) terminal and the chassis, there is danger that sparks will be caused. Do not put tools and other metal objects in your breast pocket. They may fall out.

Open the engine hood and check the electric wiring and the electric components.

- Check for loose battery terminals or ground wiring and for traces of short circuits.
- Check for loose starting motor wiring and for traces of short circuits.
- Check for loose alternator wiring and for traces of short circuits.

After checking, close the engine hood.

[7] CHECK OPERATION OF SWITCHES, LAMPS, GAUGES

- Turn the starting switch to the ON position and operate the light switch to the ON position, and then check that the monitor lamps and charge lamp light up.

  ★If any lamp does not light up, there is probably blown bulb or disconnection, so please contact your distributor.
- Turn the starting switch to the ON position and operate the light switch to the ON position, and then check head lamps light up. Then operate the head lamp switch to the HIGH BEAM position and check head lamps light up at high beam. Also, operate the head lamp switch to the UPWARD position to check if the HIGH BEAM of the headlamp will turn on.

  ★If head lamps does not light up, there is probably blown bulb or disconnection, so please contact your distributor.
- Turn the starting switch to the ON position, operate the turn signal lamp switch and check that the turn signal lamps flash.

  ★If turn signal lamps does not flash, there is probably blown bulb or disconnection, and malfunctioning of the flusher relay so please contact your distributor.
- Turn the starting switch to the ON position and operate the Hi-Lo speed range selector switch to the HIGH SPEED position, and then check the high speed travel lamp on the instrument panel lights up.

  ★If head lamps does not light up, there is probably blown bulb or disconnection, and malfunctioning of the travel speed relay so please contact your distributor.

[8] CHECK OPERATION OF HORN

- Turn the starting switch to the ON position, press the horn switch, and check that the horn sounds.

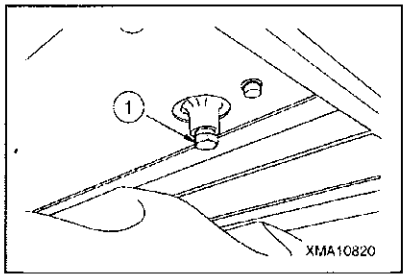
  ★If the horn does not sound, there is probably blown horn or disconnection. and malfunctioning of the horn relay so please contact your distributor.

7.6 EVERY 50 HOURS SERVICE

[1] DRAIN WATER, SEDIMENT FROM FUEL TANK

★ Set a container under the fuel tank to catch the fuel.

1. Turn the plug (1) under the fuel tank to the left slightly.
   The water and sediment accumulated at the bottom of the tank will be drained together with the fuel.
2. After completely draining the sediment and water, tighten the plug (1) under the fuel tank.



7.7 EVERY 100 HOURS SERVICE

★ Carry out "every-50 hours service" at the same time.

[1] CHECK BATTERY ELECTROLYTE LEVEL, ADD DISTILLED WATER

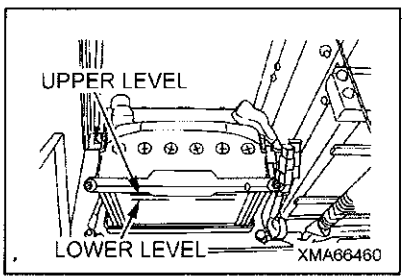
⚠ DANGER

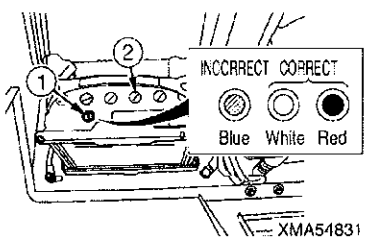
- **If any tool touches between the battery positive (+) terminal and the chassis, there is danger that sparks will be caused. Do not put tools and other metal objects in your breast pocket. They may fall out.**
- **Be careful not to get battery electrolyte on yourself or on your clothes.**
- **Do not bring any lighted cigarette or cigarette lighter close.**

1. Open the engine hood.
2. Check the electrolyte level in battery case to confirm that the electrolyte is between the UPPER LEVEL and LOWER LEVEL lines.
3. If the battery electrolyte level is low, remove all battery caps and add distilled water.

★ From time to time, measure the specific gravity of the battery, and charge if necessary.

4. Close the engine hood.





7.8 EVERY 200 HOURS SERVICE

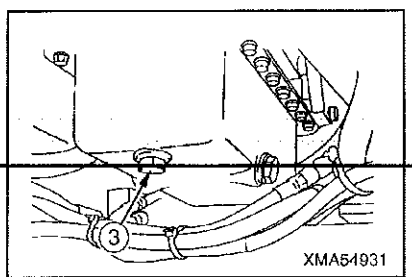
Carry out "every-50 hours and every-100 hours service" at the same time.

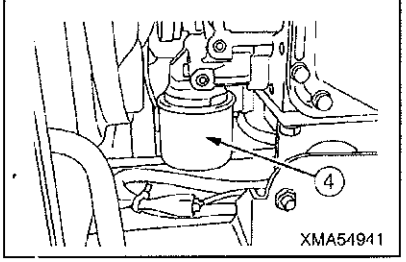
[1] CHANGE ENGINE LUBRICATING OIL, REPLACE ENGINE OIL FILTER

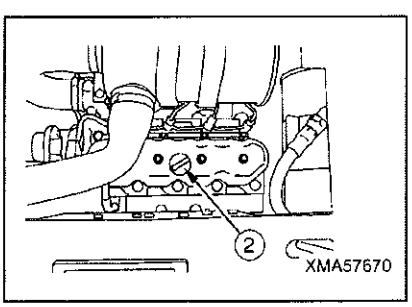
⚠ WARNING

- **Stop the engine and wait for the temperature to go down.**
- **After adding oil, tighten the cap and drain plug securely, then wipe up any spilled oil.**

1. Remove the undercover.
2. Remove drain plug (3) from the engine oil pan and drain the oil.
   ★Set the container under the engine oil pan to catch the oil.
   ★Be careful not to get oil on yourself.
3. Check the drained oil.
   ★If there are large amounts of metal particles or dirt in the drained oil, please contact your distributor.
4. After completely draining the oil, tighten drain plug (3).
5. Using the filter wrench, turn oil filter cartridge (4) to the left and remove it.
6. Clean the oil filter mount, coat the packing surface of the new oil filter cartridge with engine oil, then install it to the mount.
   ★Fill the Engine oil into the new filter cartridge.
   ★When installing a new filter cartridge, always tighten it by hand, and be careful not to tighten it too much.
   For details, see the separate Operation and Maintenance Manual for the engine.
7. Open the engine hood.
8. Remove cap (2) and add the specified amount of engine oil.
   ★For details of the oil to use, see "3. USE OF FUEL AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
   ★Engine oil refill amount: 9.7 liters (2.56 US gal, 2.13 UK gal)
   ★Use a container with an attached hose when filling with oil.
9. Start the engine, run at idling for several minutes, then check that the oil is within the range between the top and bottom marks on the engine oil level gauge.
   For details, see "7.5 CHECK BEFORE STARTING".
10. Close the engine hood.
11. Install the undercover.







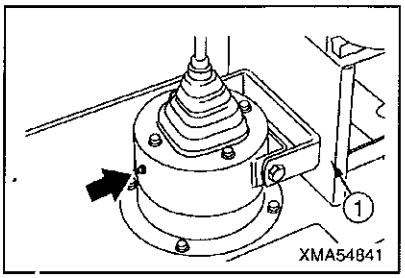
7.9 EVERY 250 HOURS SERVICE

Carry out "every-50 hours service and every-100 hours service" at the same time.

[1] GREASE ROTATING PORTION OF OPERATOR'S SEAT

★Prepare a grease pump.

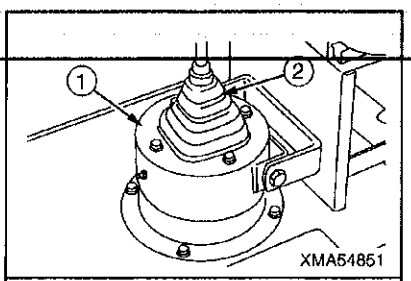
1. Grease the rotating portion of operator's seat frame (1).



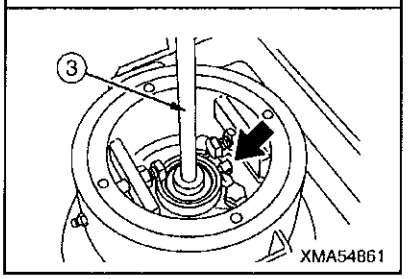
[2] GREASE TRAVEL LEVER, LINKAGE

★Prepare a grease pump.

1. Remove the 4 mounting bolts of cover (1).
2. Move rubber boot (2) and cover (1) upward.



3. Grease the pillow block of travel lever (3).
4. After greasing, move rubber boot (2) and cover (1) downward, and then tighten mounting bolts.

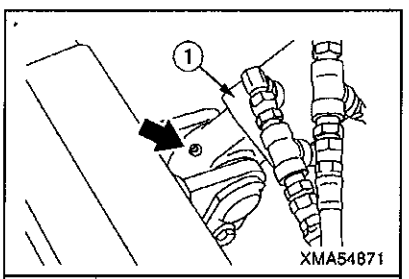


[3] GREASE ALL PARTS OF DUMP CYLINDER

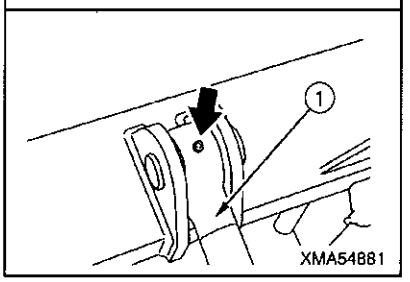
★Applicable to MST-300VD

★Prepare a grease pump.

1. Raise the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".
2. Grease the bottom of the dump cylinder (1).



3. Grease the piston rod of the dump cylinder (1).
4. Lower the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".

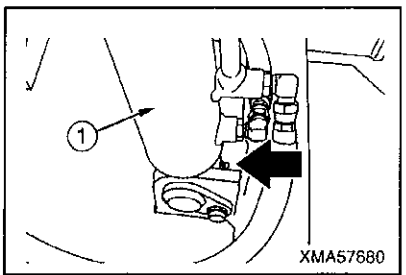


[3] GREASE ALL PARTS OF DUMP CYLINDER

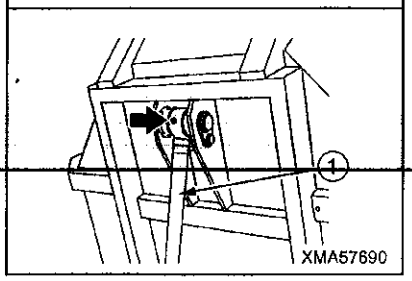
★Applicable to MST-300VDR

★Prepare a grease pump.

1. Raise the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".
2. Grease the bottom of the dump cylinder (1).



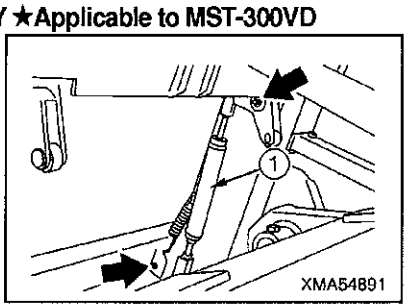
3. Grease the piston rod of the dump cylinder (1).
4. Lower the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".



[4] GREASE OPENING ROD OF FLAP AT REAR OF DUMP BODY ★Applicable to MST-300VD

★Prepare a grease pump.

1. Raise the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".
2. Grease the pin portion (left and right: 4 places) of opening rod (1) of the flap.
3. Lower the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".

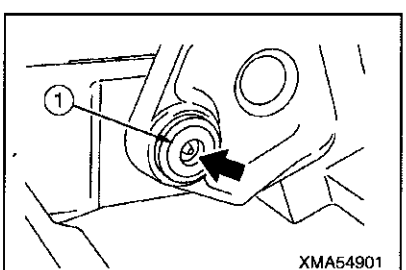


[5] GREASE DUMP BODY HINGE PIN

★Applicable to MST-300VD

★Prepare a grease pump.

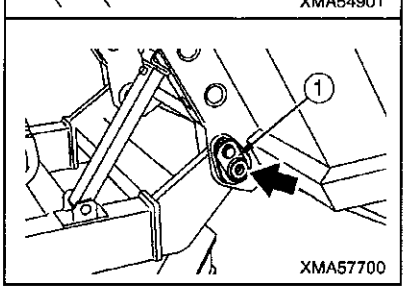
1. Grease the dump body hinge pins (1) (left and right: 2 places).



★Applicable to MST-300VDR

★Prepare a grease pump.

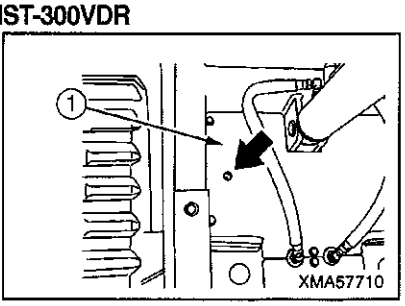
Grease the dump body hinge pins (1) (left and right: 2 places).



[6] GREASE DUMP BODY SWING GEAR PART ★Applicable to MST-300VDR

★Prepare a grease pump.

1. Raise the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".
2. Grease the swing gear at the dump body swing gear cover (1).
3. Lower the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".



7.10 EVERY 500 HOURS SERVICE

Carry out "every-50 hours, every-100 hours, every-200 hours and every-250 hours service" at the same time.

[1] REPLACE FUEL FILTER

⚠ WARNING

- **Stop the engine and wait for the engine to cool down.**
- **Do not smoke or bring any flame close.**

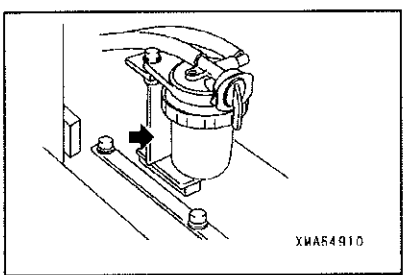
NOTICE

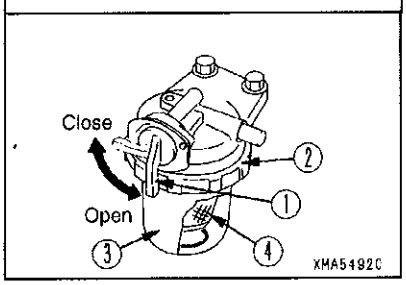
After replacing the fuel filter, bleed the air from the fuel circuit. For details, see the separate Operation and Maintenance Manual for the engine

★ Set a container under the fuel filter to catch the fuel.

★ Prepare a filter wrench.

1. Raise the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".
2. Remove the engine rear side cover.
3. Close the valve (1) at the top of the filter.
4. Using the filter wrench, loosen ring (2), remove the element cup (3), and take out the element (4).
5. Wash the element cup (3) with diesel fuel or flushing oil, then install the new element (4).
6. Fill the element cup (3) with fuel, and then install it to the filter holder.
   ★When replacing the filter, replace the O-ring at the same time.
7. Open the valve (7) at the top of the filter.
8. Install the engine rear side cover.
9. Lower the dump body.
   For details, see "OPERATION, 4.1 OPERATING DUMP BODY".





[2] REPLACE HYDRAULIC LINE FILTER

⚠ WARNING

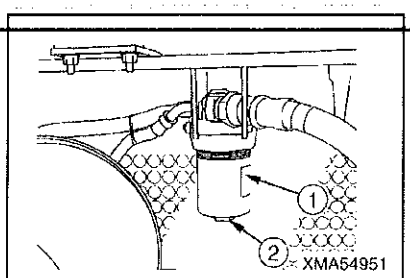
- **Raise the dump body, stop the engine, then wait for the oil temperature to go down.**
- **Loosen the cap of the hydraulic tank slowly to release the internal pressure completely, then remove the cap.**
- **Operate the travel lever and dump control lever 2 or 3 times to the end of their stroke to completely release the remaining pressure in the hydraulic circuit.**

NOTICE

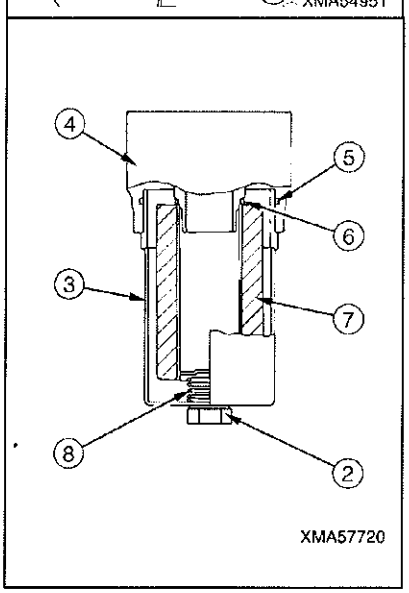
When replacing the hydraulic line filter, always change the oil in the hydraulic tank at the same time.

★ Set a container under the hydraulic line filter to catch the oil.

1. Open the engine hood.
2. Setting a spanner to the nut portion (2) being positioned at the lower section of the case of the line filter, turn it toward left side (counterclockwise) to remove the filter case (3).



3. Remove the o-rings (5), (6) inside the filter head (4).
4. Clean the filter head (4).
5. Take out the element (7) in the filter case (3), and wash the filter case (3).
6. Fit the new o-rings (5), (6) in to the filter head (4).
7. Inserting a new element (7) into the filter case (3), screw it in into the filter body section (4).
   ★When inserting the element into the filter case, be careful not to let the spring (8) inside the filter case collapse.
   ★Fill the hydraulic oil to the filter case.
8. Close the engine hood.



[3] CHANGE OIL IN HYDRAULIC TANK

⚠ WARNING

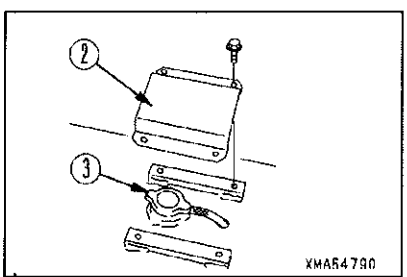
- **Lower the dump body, then stop the engine and wait for the temperature to go down.**
- **Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank, then remove the cap.**
- **Make full stroke operations of the travel lever and the damp control lever to release the remaining pressure inside the hydraulic circuits totally.**
- **After adding oil, tighten the cap and drain plug securely, then wipe up any spilled oil.**

NOTICE

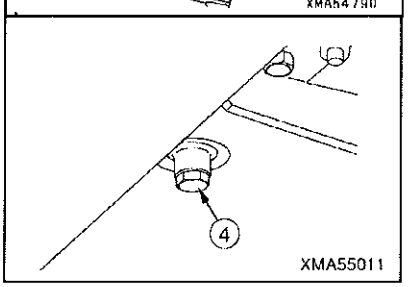
- **When changing the oil in the hydraulic tank, always replace the hydraulic line filter at the same time.**
- **Always replace the O-ring used inspection cover inside the hydraulic tank with a new O-ring.**

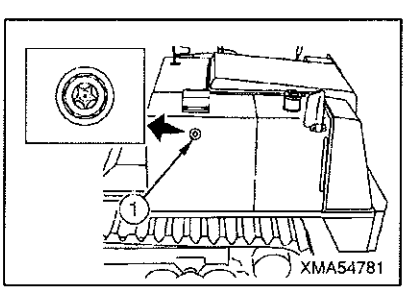
★Set a container under the hydraulic tank to catch the oil.

1. Remove 4 mounting bolts and then remove the cover (2) of the hydraulic tank.
2. Remove the filler cap (3).



3. Turn drain plug (4) at the bottom of the hydraulic tank to the left and drain the oil from the hydraulic tank.
   ★Set the container under the hydraulic tank to catch the oil.
   ★Be careful not to get oil on yourself.
4. Inspect the drained oil.
   ★If there are large amounts of metal particles or dirt in the drained oil, please contact your distributor.
5. After completely draining the oil, tighten drain plug (4).
6. Add hydraulic oil through the oil filler.
   ★For details of the hydraulic oil to use, see "3. USE OF FUEL, COOLANT, AND LUBRICANT ACCORDING TO AMBIENT TEMPERATURE".
   ★Hydraulic oil refill amount: 50 liters (13.21 US gal, 11.00 UK gal)
   ★Use a container with an attached hose when filling with oil.
7. Check that the oil level is in the range of the glass surface of the level gauge (1) at the side of the hydraulic tank.
   For details, see "7.5 CHECK BEFORE STARTING, [4]".





7.11 EVERY 1500 HOURS SERVICE

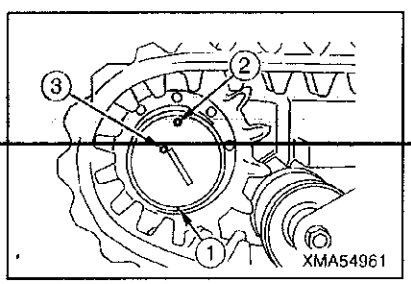
Carry out "every-50 hours, every-100 hours, every-200 hours, every-250 hours and every-500 hours service" at the same time.

[1] CHANGE OIL INSIDE TRAVEL MOTOR REDUCTION GEAR CASE

⚠ WARNING

- **Stop the engine and wait for the oil temperature to go down.**
- **After adding oil, tighten the plugs securely and wipe up any spilled oil.**

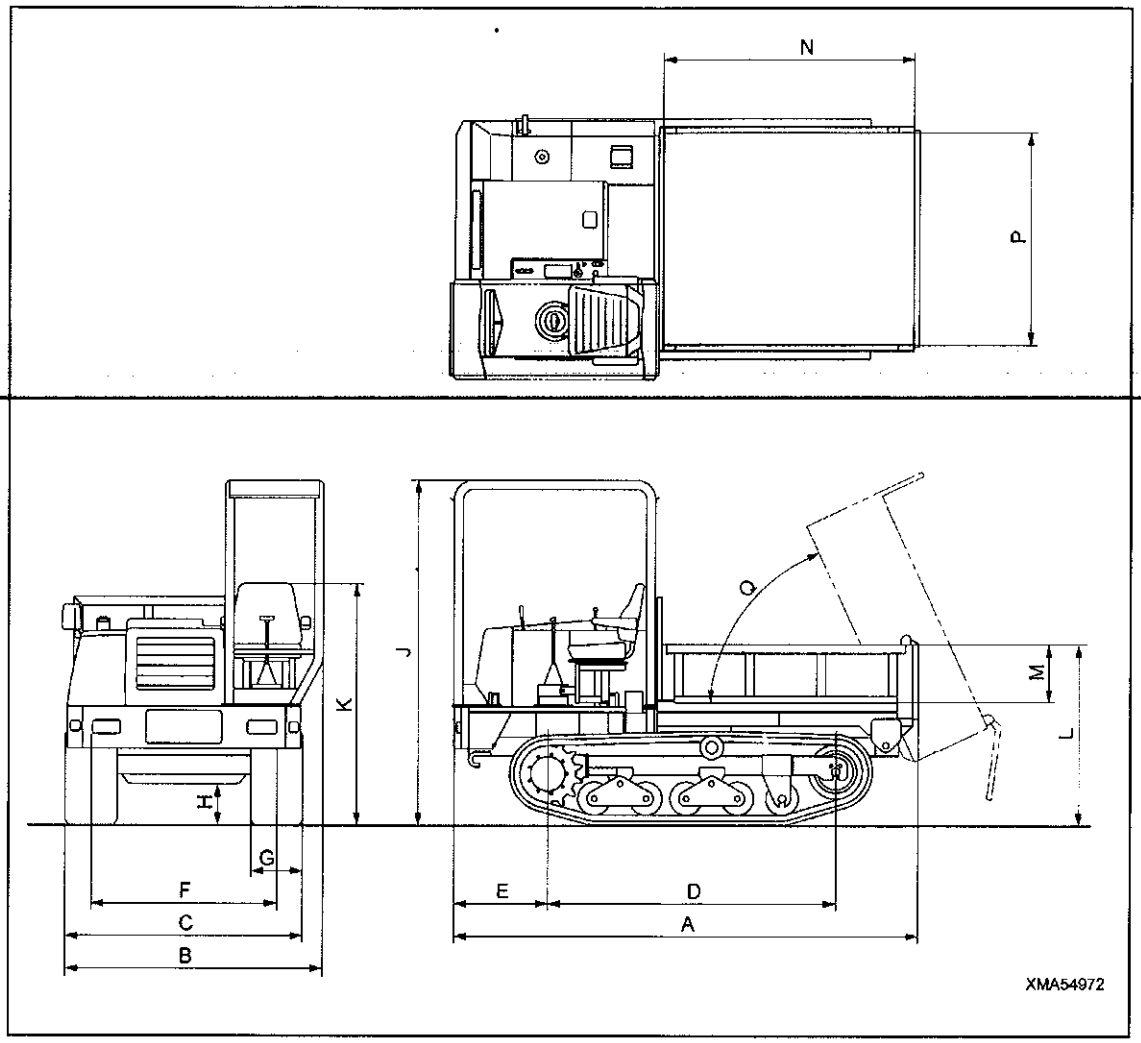
★ Set a container under the travel motor reduction gear case to catch the oil.



1. Drive the machine forward or backward to position drain plug (1) of the reduction gear case at the bottom, and then stop the engine.
2. Remove oil level inspection plug (3), oil filler plug (2), and drain plug (1), and drain the oil from the case.
   ★Set the container under the travel motor to catch the oil.
3. Inspect the drained oil.
   ★If there are large amounts of metal particles or dirt in the drained oil, please contact your distributor.
4. After the oil has been completely drained, tighten drain plug (1).
5. Add the specified amount of gear oil through the oil filler, and check that oil comes out from the oil level inspection plug (3) hole.
   ★ For details of the gear oil, see "3. USE OF FUEL AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
   ★Specified amount of gear oil: 1.2 liters (0.32 US gal, 0.26 UK gal)
6. Tighten oil level inspection plug (3) and oil filler plug (2).

SPECIFICATIONS

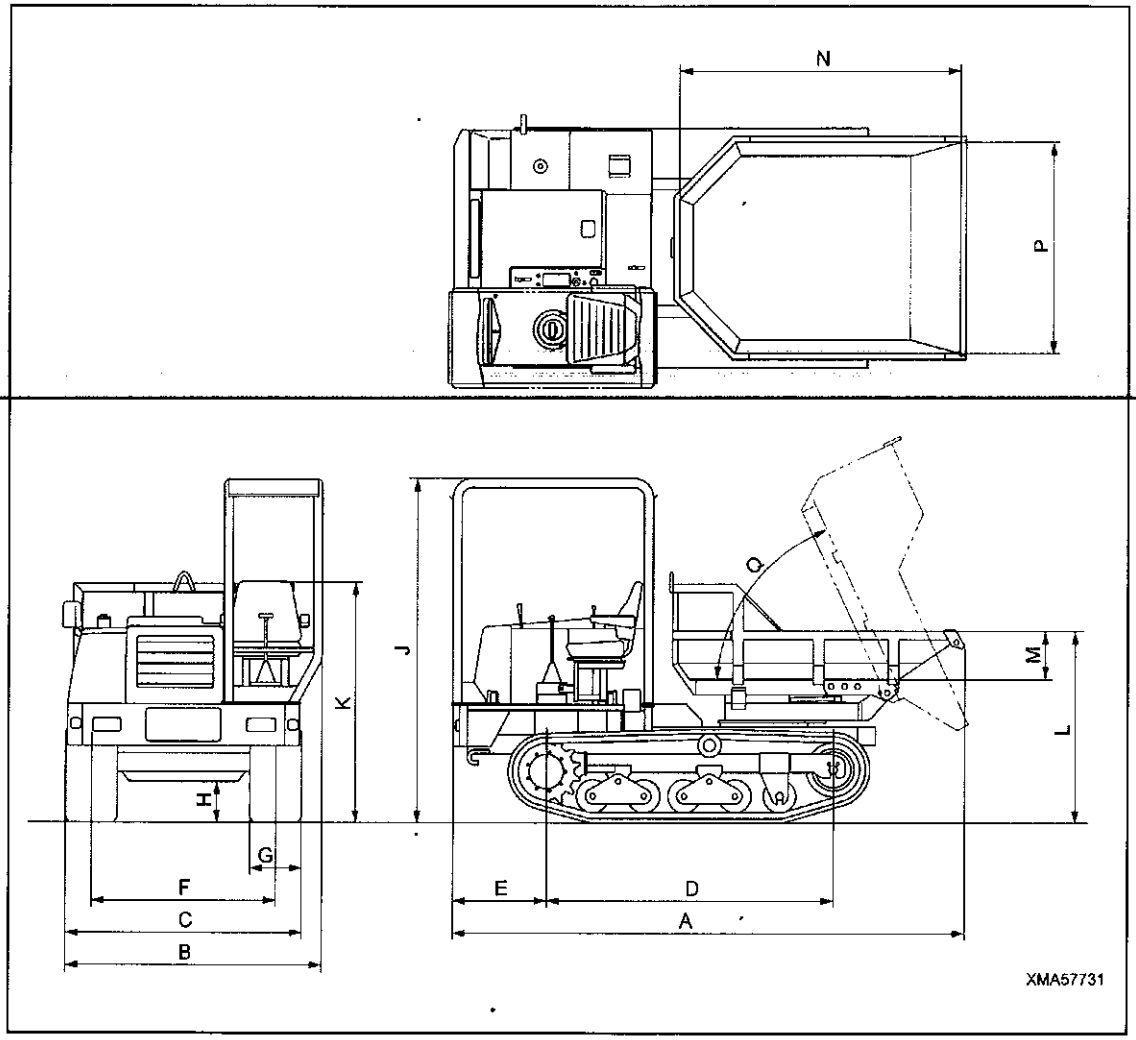
1. DIMENSION DRAWING ★Applicable to MST-300VD



2. SPECIFICATIONS TABLE ★Applicable to MST-300VD

Model name			MST-300VD
A	Overall length	(mm)	3,150
B	Overall width (ROPS canopy)	(mm)	1,745
C	Overall width (Machine body)	(mm)	1,600
D	Distance between center of idler and center of sprocket	(mm)	1,955
E	Distance between front of machine and center of sprocket	(mm)	630
F	Track gauge	(mm)	1,250
G	Track width	(mm)	350
H	Min. ground clearance	(mm)	275
J	Overall height (ROPS canopy)	(mm)	2,380
K	Overall height (Operator's seat)	(mm)	1,610
L	Distance between ground and top of dump body	(mm)	1,215
M	Dump body height	(mm)	370
N	Dump body length	(mm)	1,675
P	Dump body width	(mm)	1,410
Q	Max. dumping angle	(deg)	65
Mass (weight) of machine		(kg)	2,685
Max. payload		(kg)	2,500
Drive system			Fully hydraulic system (HST)
Speed change system			Step-less speed change
Travel speed (at high speed range)		(km/h)	0 – 9km/h
Travel speed (at low speed range)		(km/h)	0 – 6km/h
Ground contact pressure (unloaded)		(kPa {kg·f/cm²})	19.2 {0.20}
Ground contact pressure (loaded)		(kPa {kg·f/cm²})	37.2 {0.38}
Hydraulic oil tank rated capacity		(liter)	54
Engine model			Kubota V2203-EDM
Engine type			Water-cooled, 4-cycle, in-line upright, swirl chamber type
No. of cylinders – bore x stroke		(mm)	4 – 87 x 92.4
Piston displacement		(liter)	2.197
Rated output/engine speed		(kW/min^{-1})	35.6/2,800
Max. torque/engine speed		($N·m/min^{-1}$)	144/1,700
Fuel			Diesel oil
Fuel tank capacity		(liter)	45
Battery			12V, 64Ah

3. DIMENSION DRAWING ★Applicable to MST-300VDR



4. SPECIFICATIONS TABLE ★Applicable to MST-300VDR

Model name			MST-300VDR
A	Overall length	(mm)	3,490
B	Overall width (ROPS canopy)	(mm)	1,745
C	Overall width (Machine body)	(mm)	1,600
D	Distance between center of idler and center of sprocket	(mm)	1,955
E	Distance between front of machine and center of sprocket	(mm)	630
F	Track gauge	(mm)	1,250
G	Track width	(mm)	350
H	Min. ground clearance	(mm)	275
J	Overall height (ROPS canopy)	(mm)	2,330
K	Overall height (Operator's seat)	(mm)	1,610
L	Distance between ground and top of dump body	(mm)	1,275
M	Dump body height	(mm)	310
N	Dump body length	(mm)	1,965
P	Dump body width	(mm)	1,465
Q	Max. dumping angle	(deg)	60
Mass (weight) of machine		(kg)	2,710
Max. payload		(kg)	2,500
Drive system			Fully hydraulic system (HST)
Speed change system			Step-less speed change
Travel speed (at high speed range)		(km/h)	0 – 9km/h
Travel speed (at low speed range)		(km/h)	0 – 6km/h
Ground contact pressure (unloaded)		(kPa {kg·f/cm²})	19.4 {0.20}
Ground contact pressure (unloaded)		(kPa {kg·f/cm²})	37.3 {0.38}
Hydraulic oil tank rated capacity		(liter)	54
Engine model			Kubota V2203-EDM
Engine type			Water-cooled, 4-cycle, in-line upright, swirl chamber type
No. of cylinders – bore x stroke		(mm)	4 – 87 x 92.4
Piston displacement		(liter)	2.197
Rated output/engine speed		(kW/min^{-1})	35.6/2,800
Max. torque/engine speed		($N·m/min^{-1}$)	144/1,700
Fuel			Diesel oil
Fuel tank capacity		(liter)	45
Battery			12V, 64Ah

RUBBER CRAWLER CARRIER MST−300VD･VDR

OPERATION AND MAINTENANCE MANUAL

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