OPERATION MANUAL

IC30-2
CRAWLER CARRIER

SERIAL NUMBER:
CC001001 and up

IHI

IHI Construction Machinery Limited

PUB. No.1
0410 USA

SAFETY INFORMATION

We offer you basic and important rules and precautions for safe operations.

Read, understand, and observe them before starting operation. This is the most essential way to prevent accidents.
Wrong operation, inspection, or maintenance can cause personal injury or death.

Throughout this manual and on the machine, precautions are provided with ⚠ marks and classified by the words **"DANGER", "WARNING",** and **"CAUTION"** according to their extent of danger.
The classification is as follows :

⚠ DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It may also be used to alert against possible damage to the machine and its components.

We have made every effort for you to prevent accidents during operation, however, we cannot be held responsible for predicting every kind of danger in all operating conditions.
It is the owner or user of the machine who is responsible for **ALWAYS** paying attention to operate the machine; as well as reading and understanding this manual enough to obtain the essential knowledge and skills fundamental to correct machine operation.

⚠ WARNING

- **BEFORE** inspection, operation, or maintenance of the machine, be sure to read and understand this manual.
- Incorrect operation or maintenance of the machine can cause the accident and serious injury or death.
- Keep this manual on hand during operation so that you can immediately consult it when necessary. If it should be missing or damaged, place an order from **IHI** distributor for a replacement.
- There are various kinds of federal, state, and local regulations that effect construction and industrial machinery. Since the regulations are subject to change, and differ from one locale to another, it is impossible for us to provide such information in this manual.
  It is the responsibility of the owner or user to be familiar with the regulations.
- Specifications and materials of the machine are subject to change without any obligation on the part of the manufacturer.

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FOREWORD

This manual contains safety, operation, maintenance, and adjustment information. The procedures are designed to provide the best performance of the machine in an effective and economical way, In order to obtain it, remembers the next basic rules.

- This manual should be stored in the operator's compartment in the literature holder or seat back literature storage area.

- Before inspection, maintenance or operating the machine, read and understand this manual completely.

- Since all of the explanations in this manual may not be thoroughly understood at first, repeat reading it until abilities as an operator are obtained and developed for proper operation.

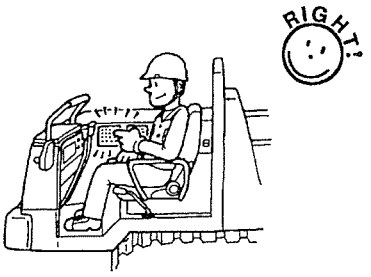
- Further abilities as an operator outside of descriptions in this manual can be obtained from the experience during normal operations and under proper supervision.

- The illustrations in this manual are used first of all to let you pay attention. They do not show all of illustrations in this manual. Because of continuing improvement and advancement of product design, the shape of machine in the illustrations may be partly different from your machine. Please understand it. Whenever a question arises regarding your machine, or this publication, please consult your local **IHI** distributor for the latest available information.

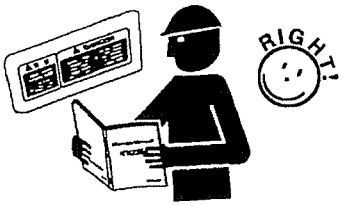
1 SAFETY

1 - 1 GENERAL

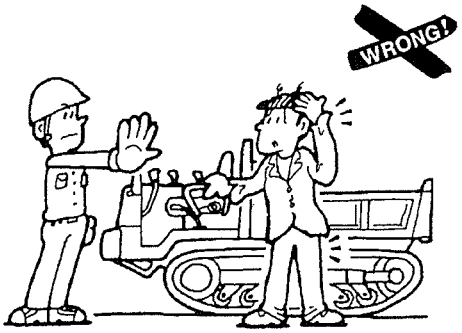
READ AND UNDERSTAND THE INSTRUCTIONS AND WARNINGS



This manual, plates, and labels on the machine contain necessary instructions and warnings for safe operation. You are supposed to read and understand them first.
If you should ignore them, injury or death may occur. Do not leave what you do not understand as it is. Your IHI distributor is glad to answer any question.
If the manual, plate, or label is missing or damaged, contact **IHI** distributor for replacement.



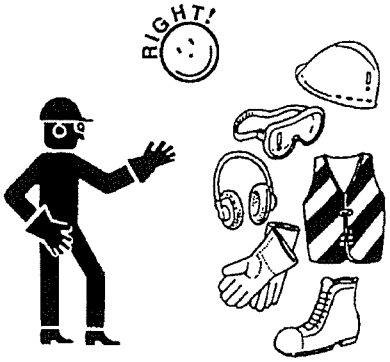
OPERATOR SHOULD BE IN GOOD HEALTH.



Operator should be physically and mentally alert, which is one of the best insurance against an accident.

NEVER operate the machine under the influence of alcohol, medication, or intoxication.

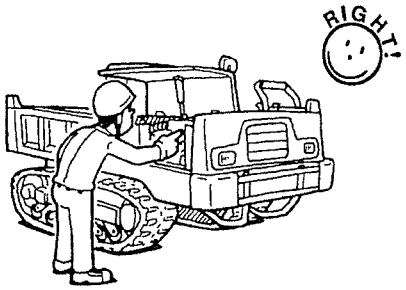
WEAR PROPER WORKING CLOTHES.



Wear working clothes that closely fit operators. Avoid loose jackets, shirt sleeves, rings, and other jewelry which may be caught in moving parts. Avoid also oil stained or damaged garments. Shoes should be clear of grease or mud before operation.
Always wear required protective items such as hard hats, safety glasses, reflective clothing, safety shoes, and ear protection as required,

PERFORM "WALK-AROUND" INSPECTION.

Walk around the machine to check safety guards, plates, and other related parts are set in place. Do not attempt to operate the machine when any unsafe condition is detected.

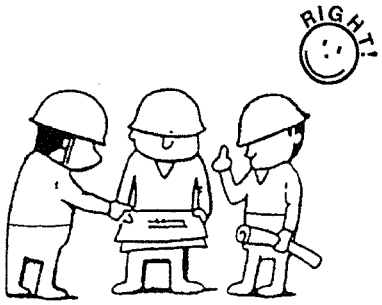


NEVER ASSUME ANYTHING GUARANTEED.

Never assume that everything is all right at the start of a work day just because it seemed satisfactory at the end of the previous work day. Before beginning each days operation, thoroughly inspect the entire crawler carrier for signs of vandalism.

MAKE A WORK PLAN.

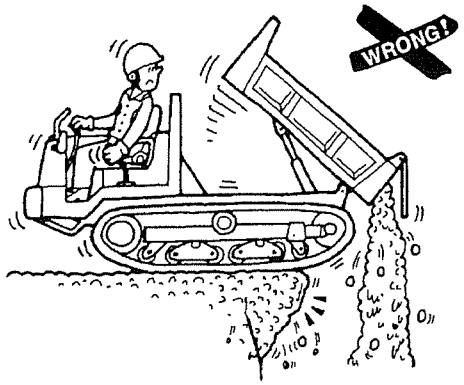
Prior to operation, investigate your job site sufficiently. When any obstruction or hazards are detected, mark it so that all personnel are aware of it. Avoid any oversight that may cause serious accident.
Observe a local weather forecast and discuss well work procedures and let all personnel know them without exception.



CHECK THE JOB SITE.

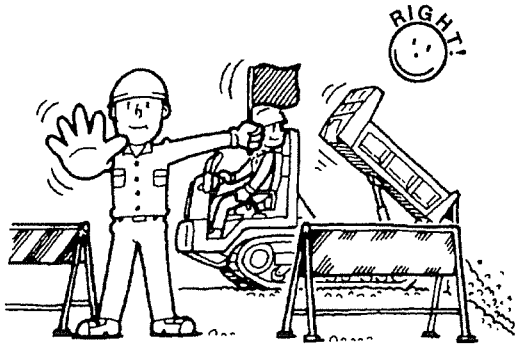
ALWAYS check the job site for grade and stability of the ground, ventilation, depth of water and ambient obstructions. Avoid operating your equipment too close to an overhang.

Since this machine is not provided with anti-explosion design, **NEVER** use it inside a tunnel or in explosive environment to avoid hazard coused by an explosion.



CLEAR ALL PERSONNEL FROM THE MACHINE AND AREA.

Be sure to barricade the job site to prevent entry of the unauthorized. Confirm that there is no one around the machine before starting the engine or operating the machine.



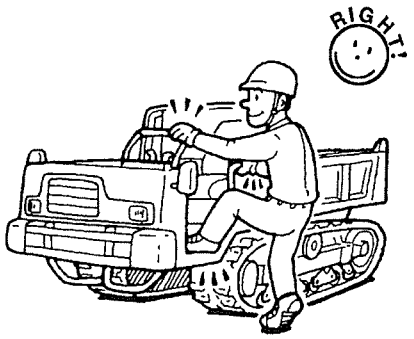
MAINTAIN GOOD VENTILPLTION.

Take a countermeasure to vent the exhaust gas to the outside to start and operate the engine in a pit, tunnel, or trench. In such a place, the air trends to stagnate. It is very dangerous to inhale the exhaust gas. Remember, exhaust gas can kill you.

1 - 2 MOUNTING AND DISMOUNTING

CAREFULLY MOUNT AND DISMOUNT THE MACHINE.

ALWAYS use steps and handholds to mount and dismount the machine.
Hold the handholds with both hands and face the machine keeping a contact with at least three points of the steps and handrails.



NEVER hold control levers at mounting and dismounting.

NEVER not try to mount or dismount the moving machine.

NEVER jump off the machine.

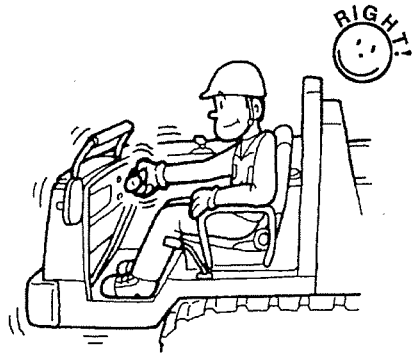
Do not try to climb on or oft the machine with implements or supplies in your hand.

1 - 3 STARTING THE ENGINE

- **ALWAYS** start the engine only from the operator's seat following the starting procedure in this manual.

- When the start switch or controls are tagged with **"Do Not Operate"**, do not start the engine or move any of the controls.

- **NEVER** short across the starter terminals or across the battery.

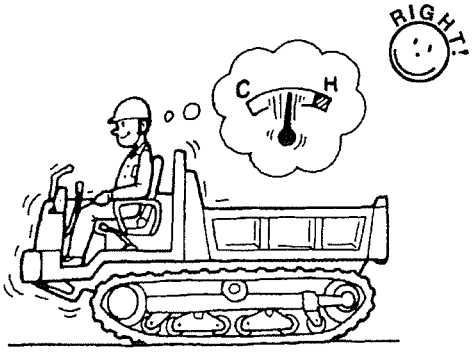


1 - 4 BEFORE OPERATING THE MACHINE

CONDUCT WARM-UP BEFORE OPERATION.

It is **ESSENTIAL** to conduct warm-up operation after starting the engine in order to run the hydraulic fluid smoothly.

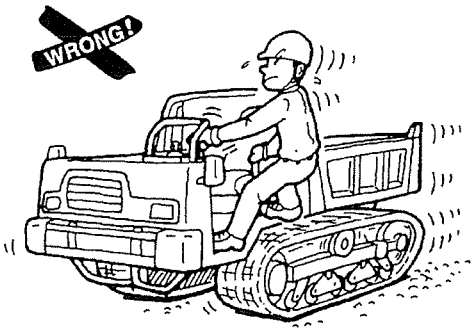
The pumps may squeak because of the cold and thick hydraulic fluid, which results in the damage to the pumps.
ALWAYS take a time to warm up the fluid with running the engine at a low speed to maintain the **FREE FLOW OF OIL**.



1 - 5 OPERATING THE MACHINE

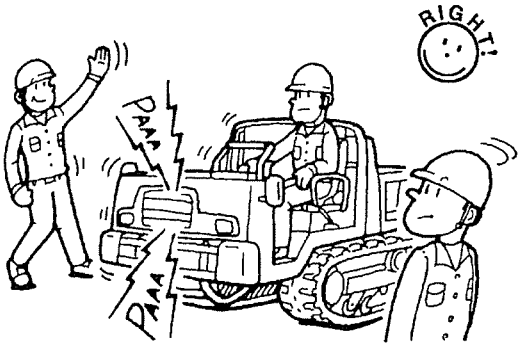
STAY SEATED WHILE OPERATING

Trying to operate while standing or from a position other than the operator's seat wilt cause mistakes and hazardous situations.
Always travel only while seated in the operator's seat.



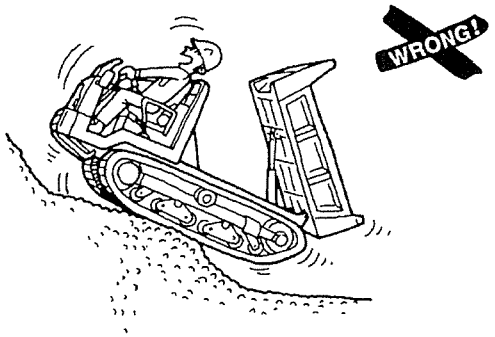
PREVENT ACCIDENTS WHILE MOVING

Always sound the horn to signal others nearby that you are moving the machine.
Check that no one is within the working area of the machine before attempting to move it.



DO NOT TRAVEL WITH THE BODY IN DUMP POSITION

Travelling with the body in dump position not only makes the vehicle unstable but limits driver visibility causing hazardous situations.
Never attempt to travel with the body in dump position.



DO NOT OVERLOAD

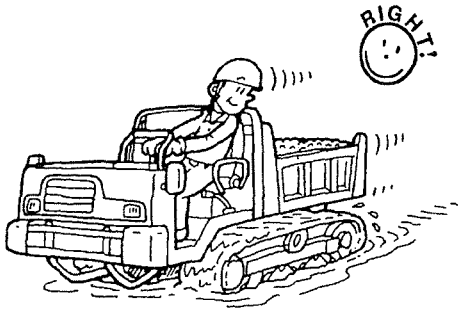
Loads that exceed machine capacity, reduce safety factors and cause machine performance and service life to drop.

- Never exceed the maximum load limits.
- Never place a load onto the sideracks.

DO NOT EXCEED THE WATER DEPTH LIMIT

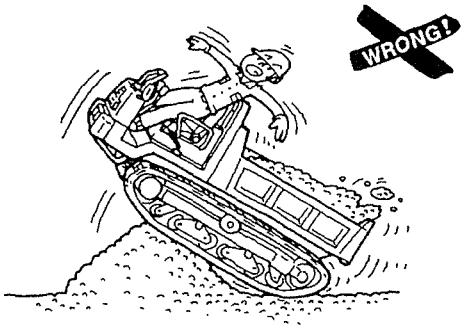
The acceptable water limit is up to the lower frame.

Check the water depth, foundation and strength of water current and other safety factors before operating. Do not place the machine in locations exceeding the lower frame of the vehicle.



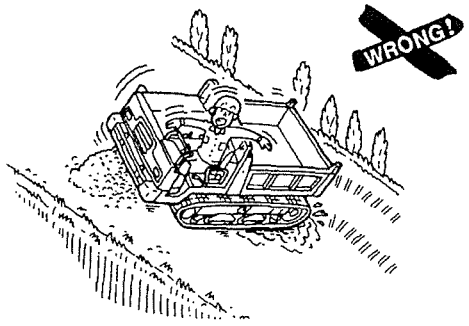
DO NOT TRY TO TRAVEL OVER OBSTRUCTIONS

Trying to travel over obstacles could cause the machine to lose its balance and topple over.
Avoid potential obstacles in your path.



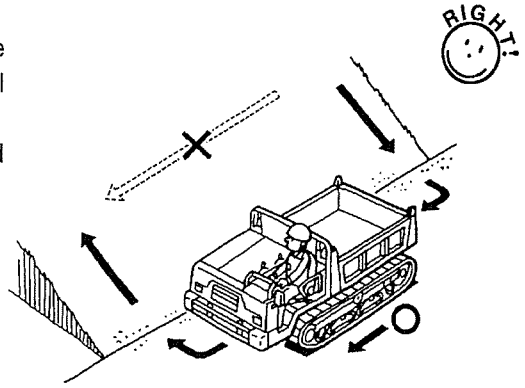
DO NOT CHANGE DIRECTIONS WHILE ON A SLOPE

Avoid changing directions on a slope as this can cause the machine to slip and possibly fall over.
When changing directions is unavoidable, do so on a gentle slope with stable ground.



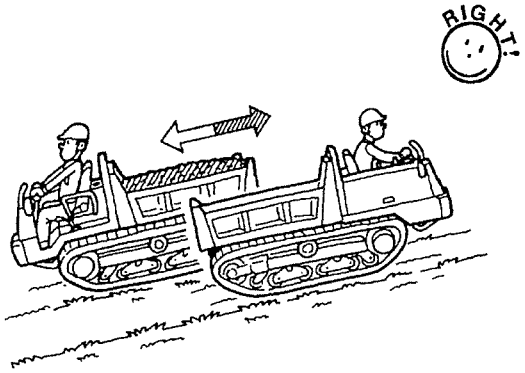
MOVE UP AND DOWN SLOPES DIRECTLY NOT SIDEWAYS

Moving sideways or parallel to the slope while on it may cause the machine to slide and fall over.
To prevent such accidents, only move up and down slopes at a direct angle.



WATCH THE VEHICLE POSITION WHILE TRAVELLING ON SLOPES

The vehicle center of gravity tends to quickly change while travelling on sloping surfaces. This can create hazardous situations where the vehicle may tip over.
Observe the following points regarding vehicle position.
Go forward up the hill and back down the hill **WHEN NOT CARRYING A LOAD**.
Reverse up the hill and go forward down the hill **WHEN CARRYING A LOAD**.

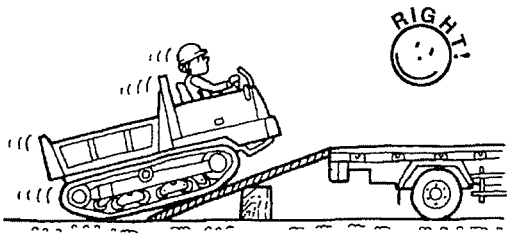


NEVER ALLOW PERSONNEL RIDE ON THE MACHINE OTHER THAN OPERATOR.

Only operator is authorized to be on the

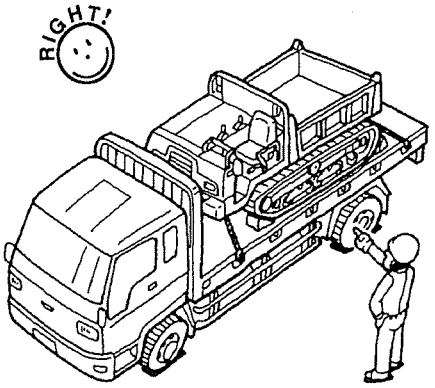
1 - 6 SAFE TRANSPORTATION

CAREFULLY LOAD AND UNLOAD THE MACHINE.



ALWAYS load and unload the machine on the level ground.
Use a ramp that has sufficient strength, width, length, and thickness.
Remove ice, snow, or slippery material from the ramp and truck deck before loading.
NEVER make a turn on a ramp.

OBSERVE PRECAUTIONS ON TRANSPORTATION.

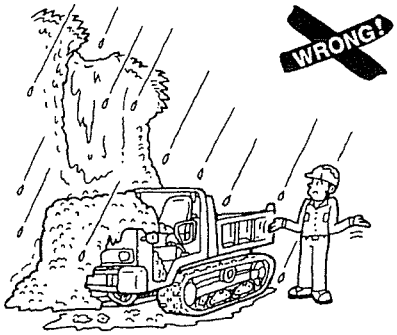


Block tracks and secure the machine to the truck before transporting.
Prior to transportation, check the travel route for clearances around the truck and the machine.

1 - 7 PARKING THE MACHINE

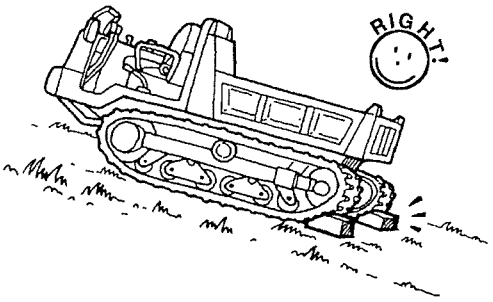
BANKS AND SLOPES

NEVER leave the machine on or near any bank which may cace, or on the edge of an excavation which might give way. Back the machine away from such from such areas which it is to be left idle or unattended for more than a brief period. Whenever possible, park on level ground.



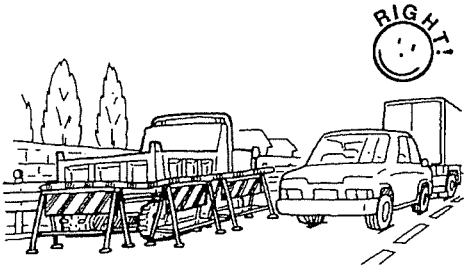
DO NOT PARK THE MACHINE ON A GRADE.

If you have to park the machine on a grade, **ALWAYS** block the machine.



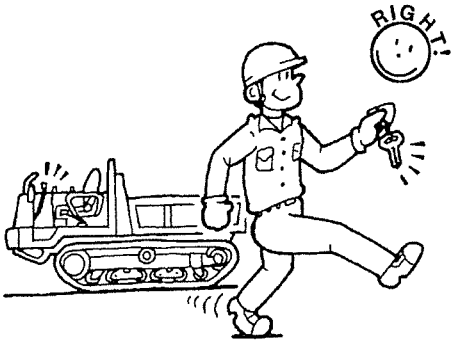
OBSERVE PRECAUTIONS WHEN PARKING THE MACHINE ON THE ROAD.

If you have to park the machine on the road, use appropriate flags, barriers, flares, and warning signals.



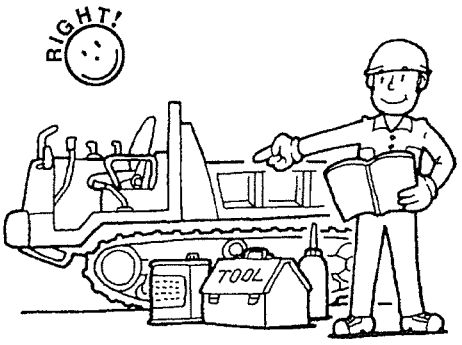
OPERATOR LEAVING MACHINE

ALWAYS lower the body and stop engine before leaving the machine unattended. Engage all locks, turn off the start switch, and remove the start key. Lock the doors.



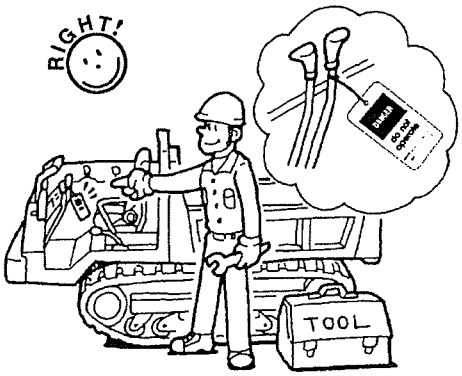
1 - 8 SAFE MAINTENANCE

KEEP ROUTINE MAITENANCE



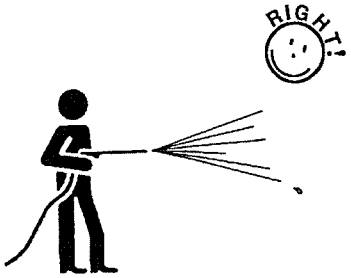
Maintenance work can be hazardous if not done in a careful manner. All personnel should realize the hazards and strictly follow safe practices. before performing any maintenance or repair work, consult the instruction manual.
Before maintenance, stop the engine and do not conduct any operations.

PERFORM MAINTENANCE WORK CORRECTLY.



While maintenance work is being done, that starting controls should be TAGGED. the tag should be removed only by someone who is aware of the circumstances, and who can assure that it is safe to do so.

ALWAYS CLEAN THE MACHINE.



Maintain the machine clean for safe operation.
Remove dirt, grease, maintenance tool from the operator's cab for secured control.
Clean the window to obtain good sight.
Do not place anything flammable around the machine.

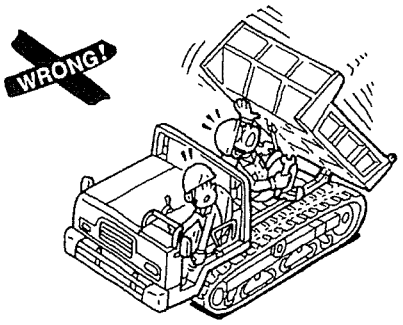
SET HYDRAULIC PRESSURE CORRECTLY.

Only qualified person is allowed to gauge and adjust the hydraulic pressure following the specified procedure and using the correct gauge if necessary.
If there is no qualified person, consult your local IHI distributor.

PREVENT CRUSHING OR CUTTING

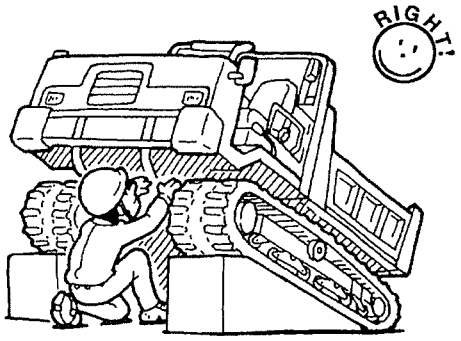
Before **ANY** kind of adjustment or service of the machine, stop the engine and do not operate the machine.

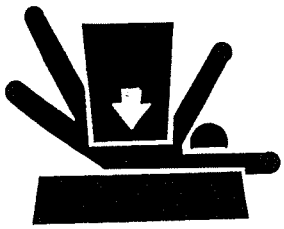
NEVER fuel or lubricate when the engine is running.



SUPPORT THE UNDERCARRIAGE WHEN WORKING UNDER TRACKS.

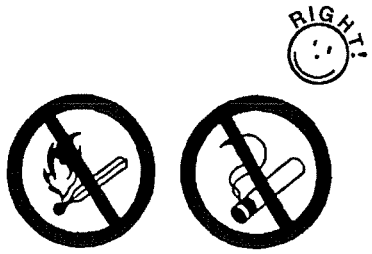
NEVER allow anyone to work undercarriage that is lifted and not properly blocked.
Check that the machine is supported sufficiently by the blocks and will not fall down.
Attach a warning tag to warn, **"DO NOT OPERATE"**.





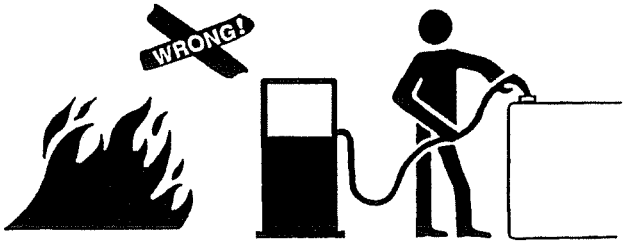
PREVENT FIRE OR EXPLOSIONS.

Keep away fuel, lubricant, and coolant from any fire or heat. Most of them are very flammable.
NEVER place flammable materials or objects close to fire or heat.



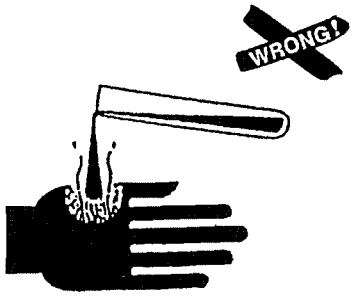
NEVER SMOKE WHILE REFUELLING.

NEVER smoke while refuelling or in a place close to flammable objects.



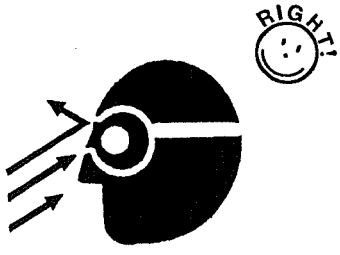
DO NOT TOUCH BATTERY ELECTROLYTE.

Battery acid will **burn skin**, eat holes in clothing, and **cause blindness** if splashed into eyes. If you spill acid on yourself flush skin immediately with lots of water. Apply baking soda to help neutralize the acid.
If acid gets in your eyes, flush immediately with large amount of water and seek proper medical treatment immediately.



When servicing battery remember that a lead-acid storage battery generates (when charging or discharging) hydrogen and oxygen- a very explosive mixture. A spark or flame could ignite these gases.

Always wear **safety grasses and groves** when working with battery.

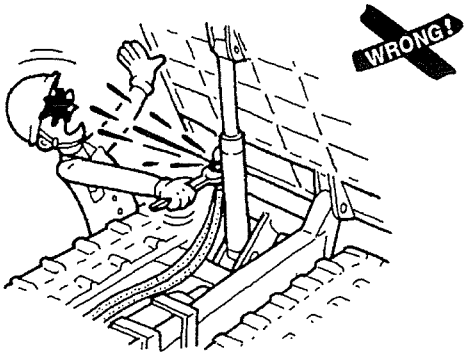


Eye protection required

ALWAYS RELEASE PRESSURE BEFORE DISASSEMBLING HYDRAULIC LINES.

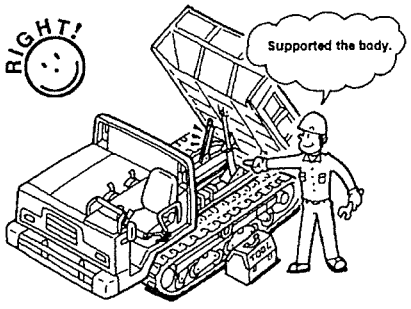
Before disconnecting **hydraulic fluid lines** on a hydraulic machine, be sure you.

- Set the safety bar to the body.
- Shut off engine.
- Always release any pressurized air on hydraulic tank.
- Move dump control lever up and lower to relieve pressures.

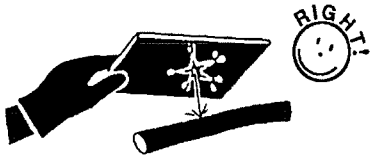


PRESSURIZED HYDRAULIC FLUID CAN PENETRATE THE SKIN AND CAUSE SERIOUS INJURY OR DEATH.

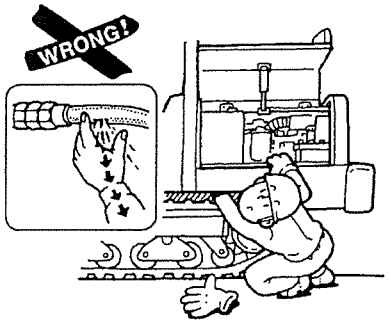
Therefore, be sure all connection are tight and that lines, pipes, and hoses are in good condition before starting the engine.



Fluid escaping from a small hole can be almost invisible. Use a piece of cardboad or wood, instead of your hands, to search for suspected leaks.

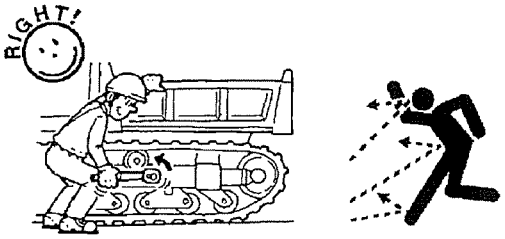


If you are struck by escaping hydraulic fluid under pressure, serious reactions can occur if proper medical treatment is not administed immediately.



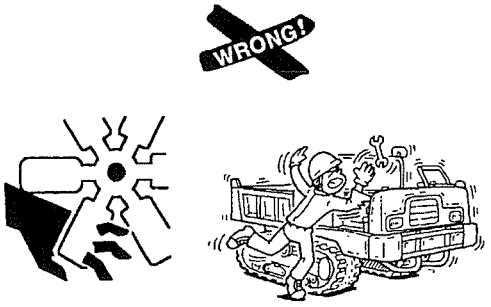
NEVER WATCH THE RELIEF VALVE WHEN ADJUSTING TRACKS.

NEVER watch the relief valve when servicing the tracks. Position yourself not to be splashed with grease. Grease used to adjust the tracks is highly pressurized and can cause serious injury or death.
Carefully read and understand the maintenance procedure for track adjustment.



BE CAREFUL TO ROTATING AND MOVING PARTS.

Do not come close to all rotating or moving parts such as a fan belt.
Do not allow any object to come near moving parts.
It will be repelled and thrown out, which may cause personal injury.



BE CAREFUL TO HOT ENGINE AFTER THE MACHINE STOPS.

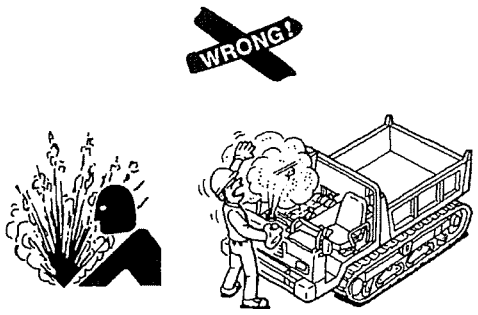
NEVER touch the engine or muffler right after the machine is stopped. It is very hot and causes burns.

CAREFULLY HANDLE THE ENGINE COOLANT.

NEVER try to open the coolant filler cap while the engine is running or right after the engine is stopped. If the cap is open, the very hot steam will blow out, which causes serious burns. Wait until the coolant temperature goes down.

Slowly open the filler cap to release the pressure.

Do not touch the engine coolant directly. It may cause injury to your skin. Wear gloves or use a cloth to handle it. **NEVER** drink it, or **NEVER** let it come in contact with your eyes.



Before draining the engine coolant, cool down the radiating systems.

If you drink antifreeze, **IMMEDIATELY** have it thrown out and call for emergency medical cure.

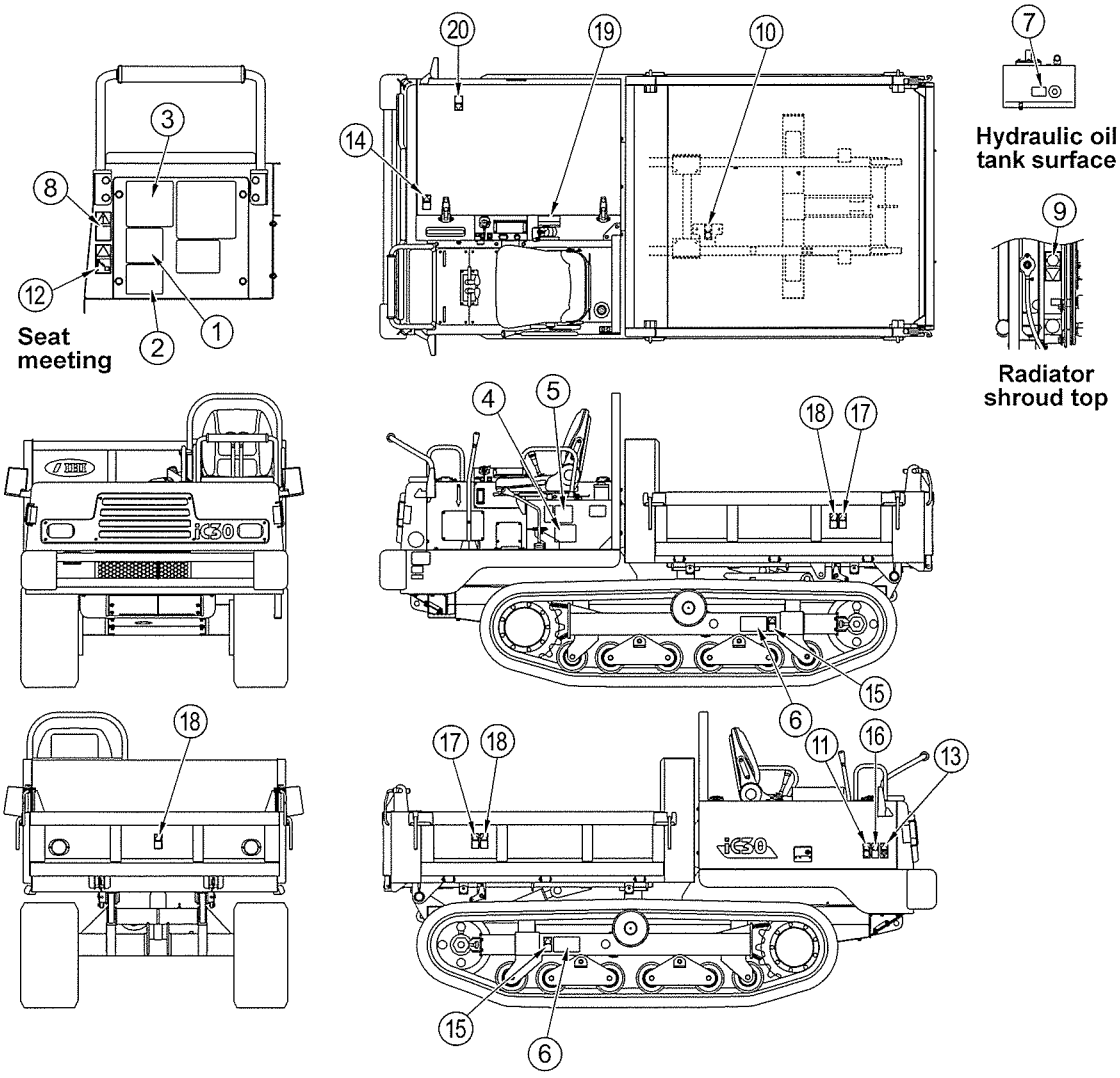
Do not leave any tool on the machine after maintenance and place it in place before re-starting operation.

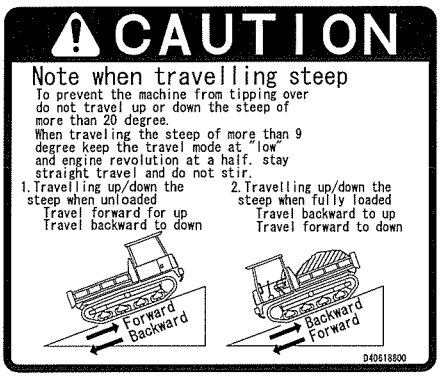
1 - 10 WARNING SIGNS AND LABELS

There are several specific safety signs on your machine. Their exact location and description of the hazard are reviewed in this section.
Please take the time to familiarize yourself with these safety signs.

Make sure that you can read all safety signs. Clean or replace these if you cannot read the words or see the pictures. When cleaning the labels use a cloth, water and soap. Do not use solvent, gasoline, etc.

You must replace a label if it is damaged, missing or cannot be read.
If a label is on a part that is replaced, make sure a new label is installed on the replaced part.
See your IHI dealer for new labels.



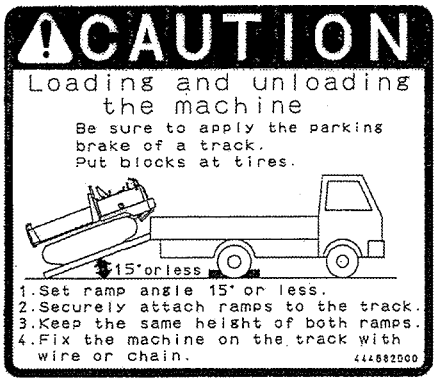


① Note when travelling steep

To prevent the machine from tipping over do not travel up or down the steep of more than 20 degree.

When travelling the steep of more than 9 degree keep the travel mode at "low" and engine revolution at a half. Stay straight travel and do not stir.

1. Travelling up/down the steep when unloaded
   - Travel forward for up.
   - Travel backward to down.
2. Travelling up/down the steep when fully loaded
   - Travel backward to up.
   - Travel forward to down.



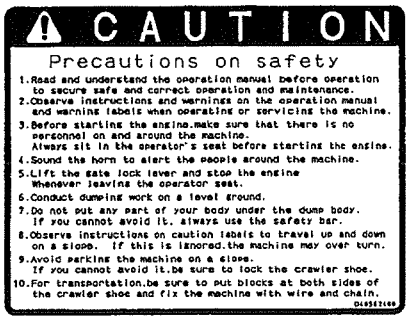
② Loading and unloading the machine

Be sure to apply the parking brake of a track.

Put blocks at tires.

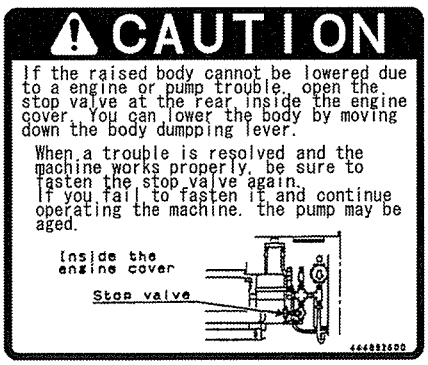
1. Set ramp angle 15° or less.
2. Securely attach ramps to the track.
3. Keep the same height of both ramps.
4. Fix the machine on the track with wire or chain.

Located in the cab.



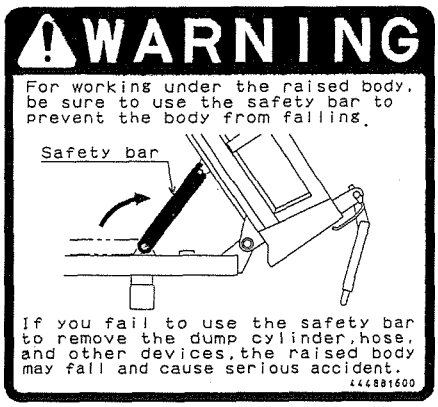
③ Precautions on safety

1. Read and understand the operation manual before operation to secure safe and correct operation and maintenance.
2. 0bserve instructions and warnings on the operation manual and warning labels when operating or servicing the machine.
3. Before starting the engine, make sure that there is no personnel on and around the machine.
   Always sit in the operator's seat before starting the engine.
4. Sound the horn to alert the people around the machine.
5. Lift the gate lock lever and stop the engine.
   Whenever leaving the operator seat.
6. Conduct dumping work on a level ground.
7. Do not put any part of your body under the dump body.
   If you cannot avoid it, always use the safety bar.
8. 0bserve instructions on caution labels to travel up and down on a slope. If this is ignored, the machine may over turn.
9. Avoid parking the machine on a slope.
   If you cannot avoid it, be sure to lock the crawler shoe.
10. For transportation be sure to put blocks at both sides of the crawler shoe and fix the machine with wire and chain.



④ If the raised body cannot be lowered due to an engine or pump trouble, open the stop valve at the rear inside the engine cover. You can lower the body by moving down the body dumping lever.

When a trouble is resolved and the machine works properly, be sure to fasten the stop valve again.
If you fail to fasten it and continue operating the machine, the pump may be aged.

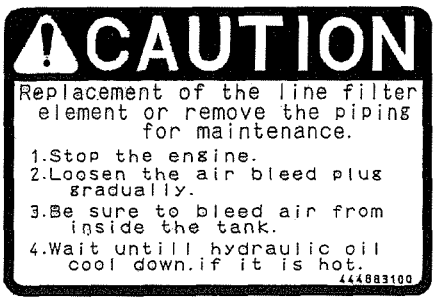


⑤ For working under the raised body, be sure to use the safety bar to prevent the body from falling.
If you fail to use the safety bar to remove the dump cylinder, hose, and other devices, the raised body may fall and cause serious accident.

Located in the cab.

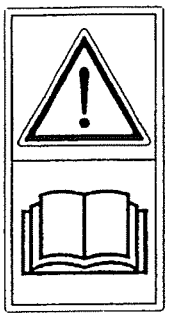
⑥ About crawler shoe tension adjustment
The grease cylinder is highly pressured by spring force and improper handling may cause injury.
Read and understand the instruction manual before adjusting track shoe tension.

1. On the level ground, put a weight of 60kg onto the middle of the idler and the upper roller.
   Adjust the clearance to 20 to 30 mm long.
2. To tense the crawler shoe, inject grease through the grease fitting (A) by a grease gun.
3. To release the crawler shoe, unscrew the valve seat (B) by a box wrench and drain grease.



⑦ Replacement of the line filter element or remove the piping for maintenance.

1. Stop the engine.
2. Loosen the air bleed plug gradually.
3. Be sure to bleed air from inside the tank.
4. Wait until hydraulic oil cool down, if it is hot.



⑧ Warning!
Read manual before operation, maintenance, disassembly, assembly and transportation.

Located in the cab.

(D405 359 00)

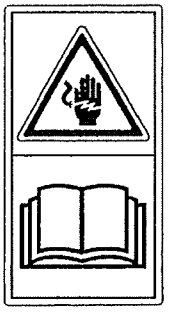
⑨ Sign indicates a burn hazard from spurting hot water or oil if radiator or hydraulic tank is uncapped while hot.
Allow radiator or hydraulic tank to cool before removing cap.

(D405 360 00)

⑩ Sign indicates a burn hazard from touching heated parts, such as engine, motor, or muffler during or right after operation.
Never touch when hot.

Located on the engine cab.

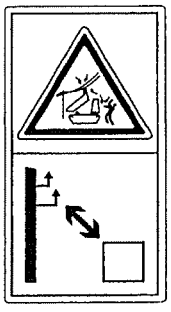
(D405 361 00)



⑪ Sign indicates an electrical hazard from handling the cable.
Read manual for safe and proper handling.

Located on the engine cab side.

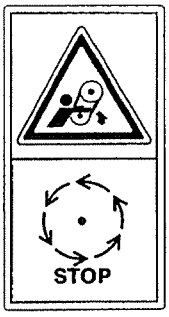
(D405 363 00)



⑫ Sign indicates an electrocution hazard if machine is brought too near electric power lines.
Keep a safe distance from electric power lines.

Located in the cab.

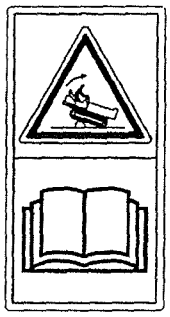
(D405 364 00)



⑬ Sign indicates a hazard of rotating parts, such as belt.
Turn off before inspection and maintenance.

Located on the both body.

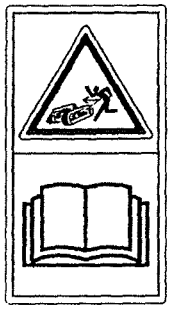
(D405 366 00)



⑭ Sign indicates a hazard of falling out when vehicle goes over an obstacle.
Read manual and follow instructions for safe and proper operation.

Located in the cab.

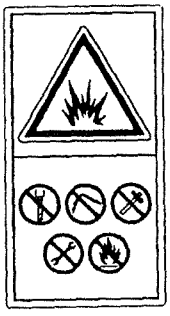
(D405 368 00)



⑮ Sign indicates a hazard of a flying plug from track adjuster that could cause injury.
Read manual before adjusting track for safe and proper handling.
Never touch when hot.

Located on the both track flame.

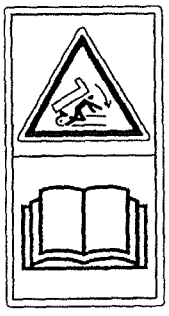
(D405 369 00)



⑯ Sign indicates an explosion hazard.
Never drill, cut with gas, hit or disassemble.
Also, keep open flame away.

Located on the engine cab side.

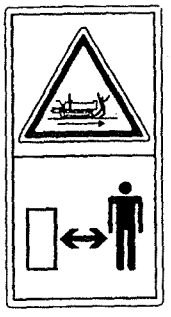
(D405 362 00)



⑰ Sign indicates a crush hazard from falling body.
Read manual and follow safety instructions when holding the body in a raised position.

Located on the both body.

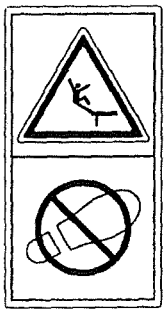
(D405 487 00)



⑱ Sign indicates a hazard of being run over by moving equipment.
Keep away from equipment when it is moving.

Located on the both body.

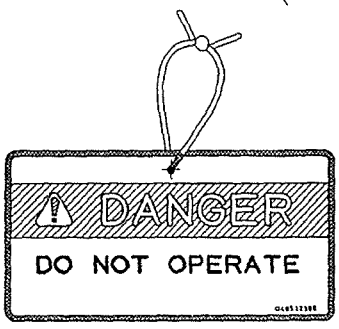
(D405 488 00)



⑲ Sign indicates a hazard of falling.
Do not stand on this place.

Locate on the engine.

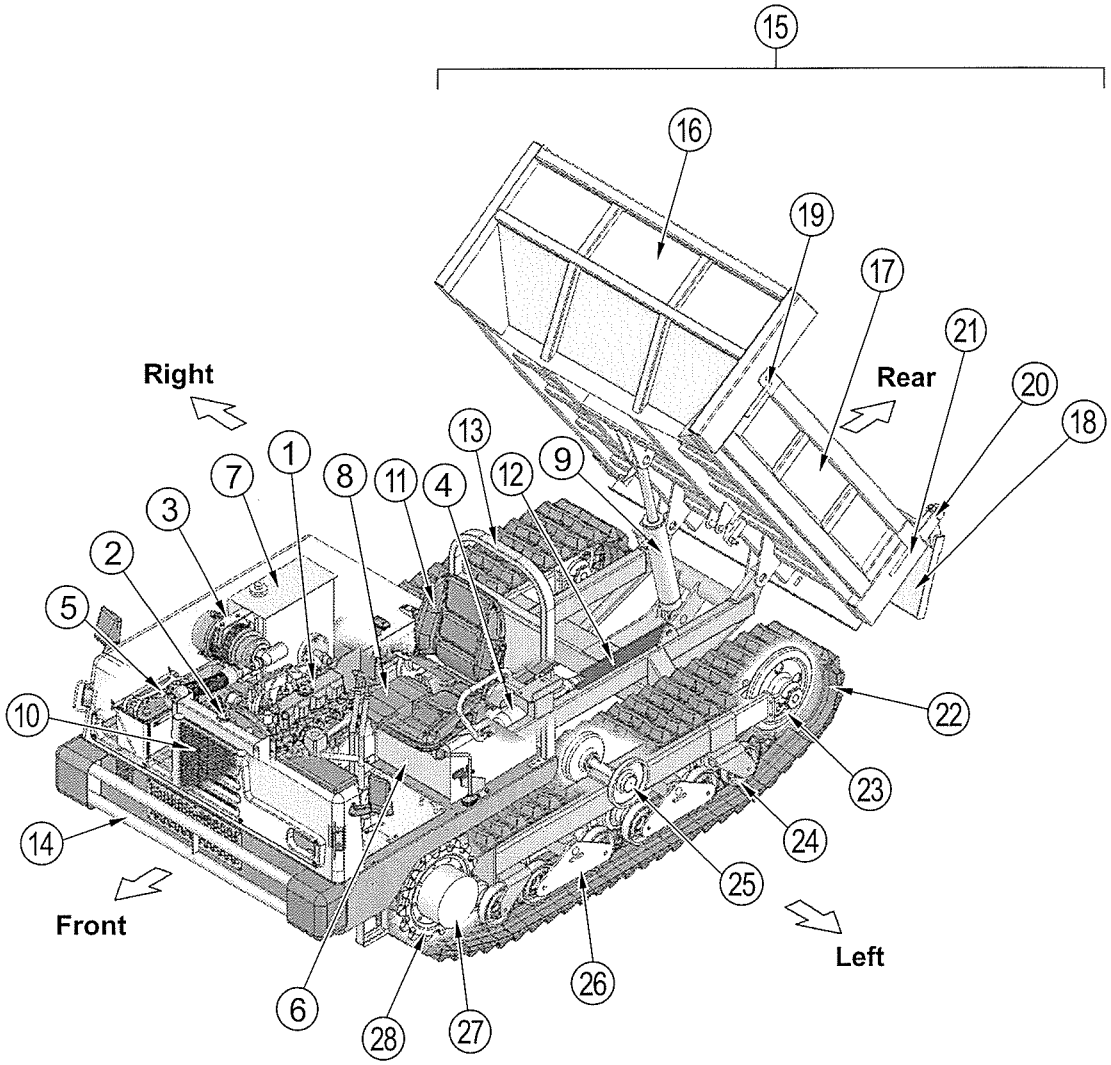
(D405 365 00)



⑳ DENGER!
Attach a DO NOT OPERATE warning tag to start switch or controls before servicing or repairing the machine.
Do not start the engine or move any of the controls if there is DO NOT OPERATE or similar warning tag attached to the start switch or controls.
(D405 323 00)

2 OPERATION

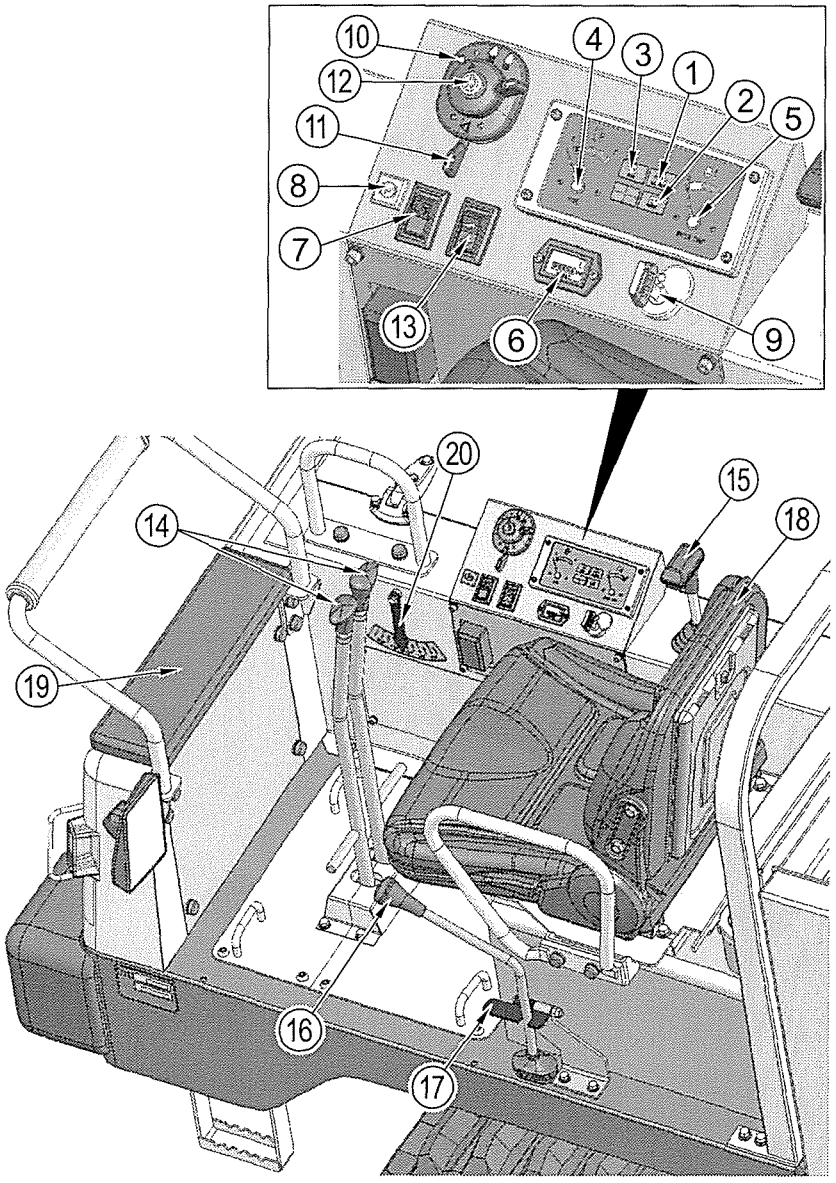
2 - 1 NOMENCLATURE



(1) Engine
(2) Radiator
(3) Air Cleaner
(4) Muffler
(5) Battery
(6) Fuel tank
(7) Hydraulic tank
(8) Hydraulic pump
(9) Dump cylinder
(10) Oil cooler
(11) Operator seat
(12) Safety bar
(13) Rear guard
(14) Front bumper
(15) Body
(16) Protector
(17) Side gate
(18) Rear gate
(19) Side gate lock lever
(20) Upper hinge
(21) Rear corner post
(22) Rubber crawler
(23) Idle tumbler
(24) Lower roller
(25) Upper roller
(26) Rotary link
(27) Travel motor reduction gear
(28) Drive sprocket

The directions as used in this manual are indicated by the direction of the arrows in the above drawing.

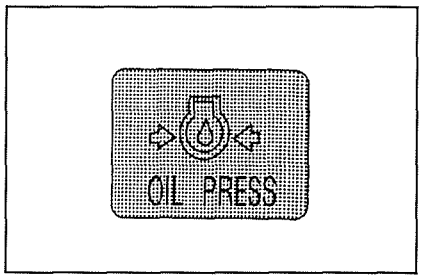
2 - 2 CONTROLS AND INSTRUMENTS



(1) Engine Oil Pressure Warning Lamp
(2) Charge Warning Lamp
(3) Grow Indicate Lamp
(4) Fuel Level Gauge
(5) Water Temp. Gauge
(6) Service Hour Meter
(7) Parking Brake Switch
(8) Parking Lamp
(9) Engine Start Switch
(10) Head Light Switch
(11) Direction Indicator Switch
(12) Horn Switch
(13) Travel Speed Select Switch
(14) Travel Lever
(15) Engine Throttle Lever
(16) Dump Lever
(17) Dump Lock Lever
(18) Operator's Seat
(19) Front Second Seat
(20) Anglemeter

① **Engine Oil Pressure Warning Lamp**

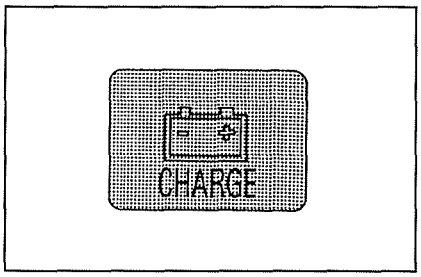
This warning lamp indicates that engine oil pressure has fallen. If it lights and buzzer sounds during operation, stop the engine immediately and check the cause of engine oil pressure's falling.



② **Charge Warning Lamp**

Illuminated lamp indicates abnormal condition in battery charging circuit.

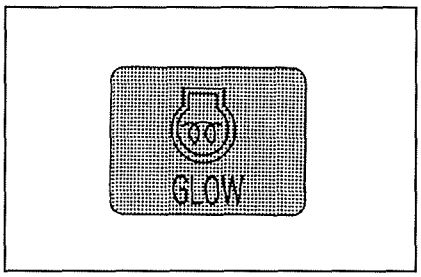
The charge indication light should turn OFF when engine is started. If the light remains ON, there is-some trouble in the charging circuit.



③ **Glow Indicate Lamp**

This lamp glows when the starter switch is set to the HEAT position.

The glow lamp stays lit for 10 to 15 seconds.

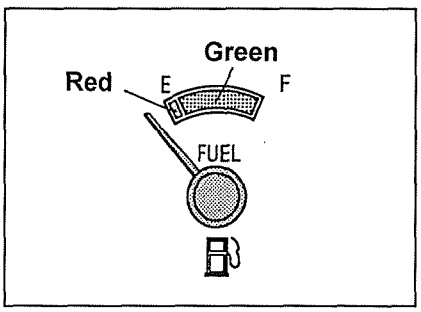


④ **Fuel Level Gauge**

It indicates the fuel level in the fuel tank.

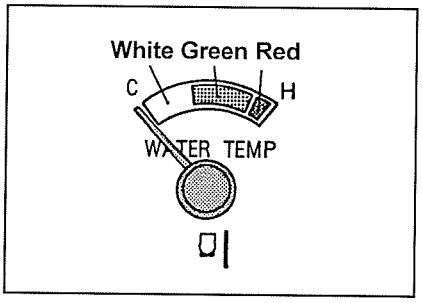
F: The fuel tank is full.

E: Fuel level is too low. Add the fuel.



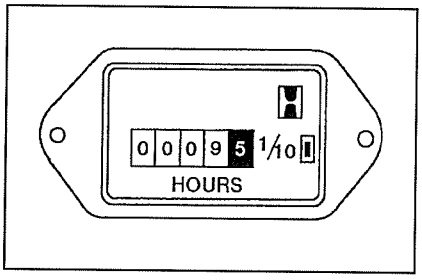
⑤ Water Temperature Gauge

This indicates the engine water temperature.
Upon start-up, the lowest **"White"** range indicate.
While running the engine, with out load and low idling warming up.
Indicate the **"Green"** range, that the water temperature is in the normal operating temperature range.
If the water temperature rise to an overheated situation, the **"Red"** range will indicate. If this situation aries, set the engine throttle at low idle until the engine temperature lowers. **SHUT** the engine **OFF**, check the radiator and determine the cause.



⑥ Service Hour Meter

Indicates the total service hours on the engine.
Use it to determine the service intervals.
While the engine is running, the hour meter is operated.

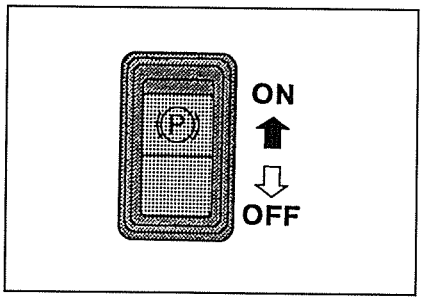


⚠ CAUTION

1. When leaving the operation seat, pres the "P" side of switch and engage the parking brake.
2. You cannot travel the machine by the travel lever while the "P" side of switch is depressed.
3. Do not press the parking switch to stop the machine while travelling. Stop travelling without the parking brake first, then engage the parking brake.

⑦ Parking Brake Switch

- These are for the parking brake.
- Depress "P" side of the switch to engage the parking brake.
  Then the parking brake lamp lights to indicate that the brake is engaged.
  Depress unmarked side to release the brake.
  Then the goes off to indicate that the brake is released.

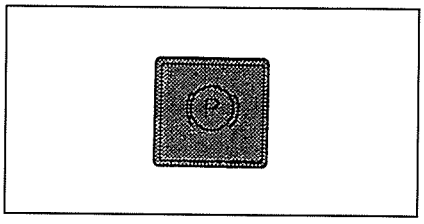


⑧ Parking lamp

When the starter switch is **ON**, this lamp is lit or extinguished according to operation of the parking brake switch.

ON: The parking lamp is lit.

OFF: The parking lamp is extinguished.



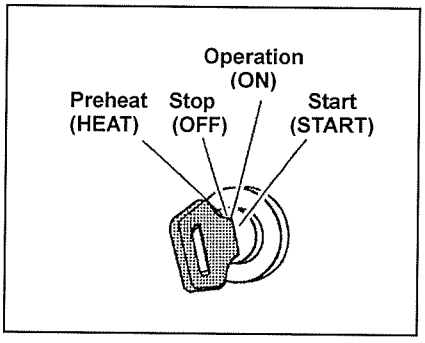
⑨ Engine Start Switch

A four position switch energizes the electrical circuits, cranks the engine and also heats the glow plugs for cold weather starting.

Turn key fully clockwise and hold in the start position to complete the electrical circuit between the start switch and engine starter.

For cold weather start-ups, turn key fully counterclockwise and hold for 10 seconds to allow heating of the glow plugs.

If the engine does not start, or is being restarted after shutdown, turn the key to **OFF** before returning it to **START**.



CAUTION

ALWAYS remove key when machine is not in use.

⑩ Head Light Switch

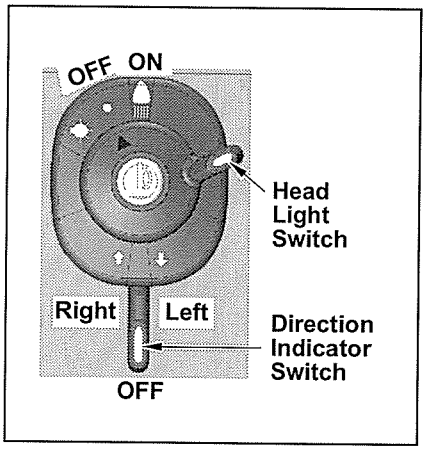
This switch turns on the front vehicle lights when the starter switch is set to ON. This switch is used to change the brightness and turn off the front lights.

⑪ Direction Indicator Switch

Use with the starter switch set to ON.

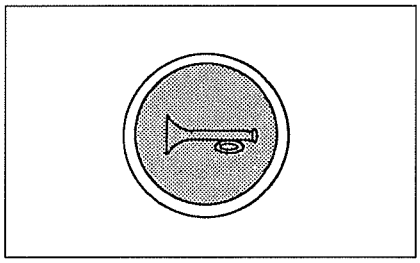
Turn the lever left to light the left direction indicator.

Turn the lever right to light the right direction indicator.



⑫ **Horn Switch**

Depress this switch sound horn.

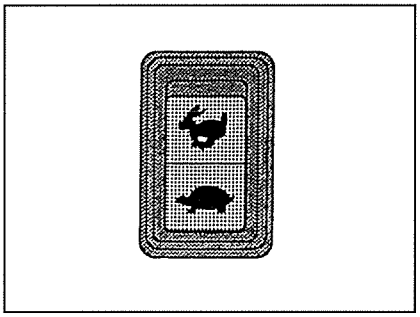


⑬ **Travel speed Select Switch**

Low speed ·····press the mark.

High speed ·····press the mark.

NOTE : Stop the vehicle before attempting to switch speeds..

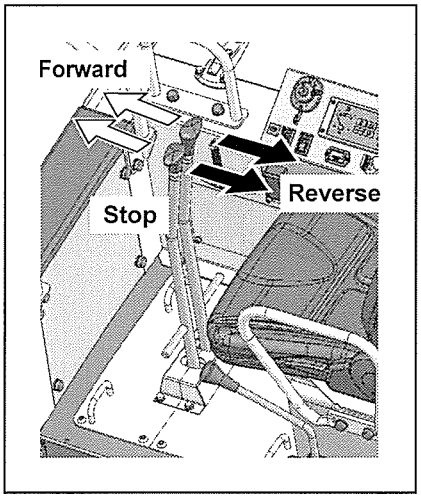


⑭ **Travel Levers(Left and right)**

Control these levers to move the carrier forward or backward, stop the carrier, and control travel speed.

- To travel forward, move the levers toward the front of the machine.
- To travel backward, move the levers toward yourself.
- To stop travelling, set levers at neutral position.
- To control travel speed, change the stroke of levers.

The bigger stroke increases the speed.



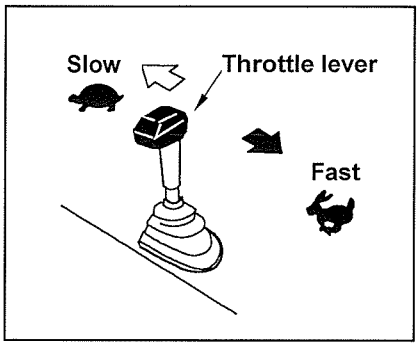
⚠ CAUTION

At the front second seat, you should turn the levers in the opposite directions to the above mentioned.

⑮ Engine Throttle Lever

Slow : Move the lever to this position to decrease the engine speed.

Fast : Move the lever to the right and rear, to increase the engine speed. Use this position for maximum production work.



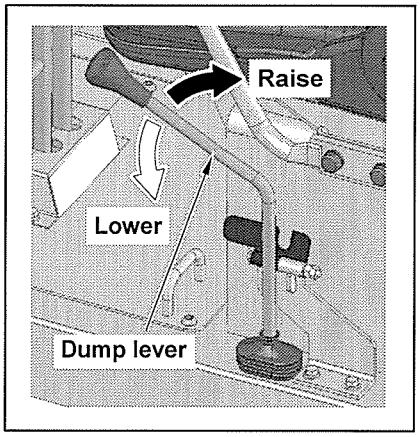
⑯ Dump Lever

⚠ CAUTION

When working underneath the body while it is raised, always place a safety bar at the body, stop the engine, and set the lever lock on the dump lever to lock position.

Control this lever to raise or lower the body.

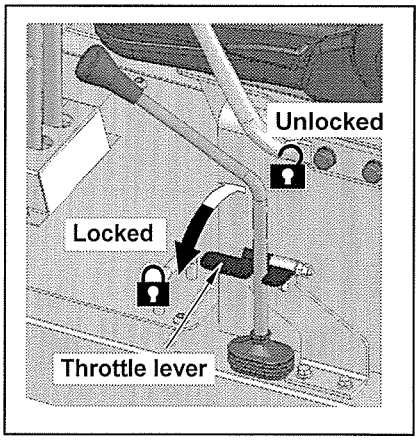
- To raise the body, pull up the lever.
- To lower the body, push down the lever.



⑰ Dump Lever Lock

Locked : Push lever lock down and dump lever is inoperable.

Unlocked : Pull the lever lock up and dump lever is operable.



⑱ Operator's Seat

⚠ CAUTION

Do not adjust the operator seat while driving. Sudden seat movement can cause operating errors or unforeseen accidents.

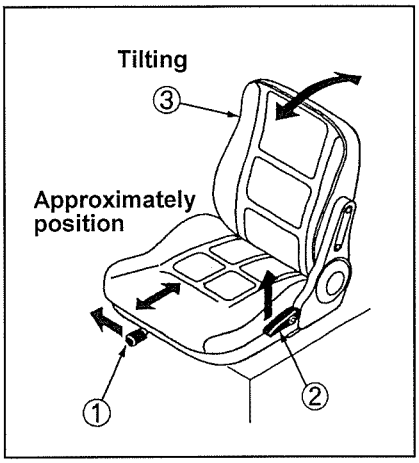
Seat Adjustment

NOTE: Adjust the seat at the beginning of each shift or when changing operators.

Adjust the seat to allow full travel of the levers when the operator is seated against the seat back.

To adjust seat forward or backward.
Push the slide lever ① to the operator's left, to allow moving the seat forward or backward.

To adjust seat back tilt
Pull the back tilt lever ② to the operator's rear, to allow moving the seat front or rear tilt.

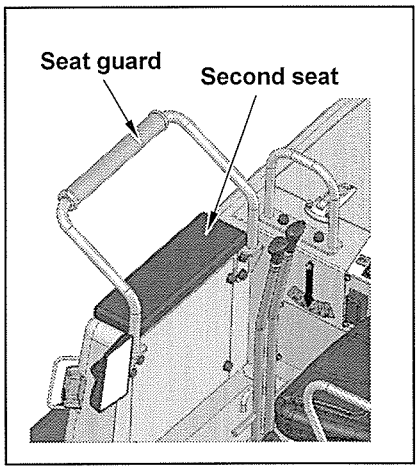


⑲ Front Second Seat

⚠ CAUTION

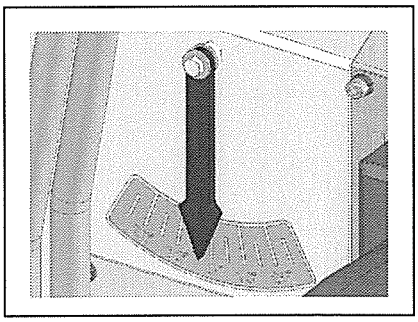
(1) Driving without seat guard is not permitted. Be sure to attach the seat guard if you are using the front second seat.
(2) Do not use the front second seat if the carrier is tilted significantly or upon driving on a slope.
(3) If the front second seat is used, the seated direction is opposite to the advance direction shown on the operation nameplate.

- You can use the front second seat for backward running over a long distance.



⑳ Anglemeter

- Tilting of the body in longitudinal direction is displayed.
- Align the body direction with the tilting direction, measure the tilting angle, and run according to Cautions. (See Cautions on Running on a Slope in Chapter 3.)



■ Seat Belt

⚠ CAUTION

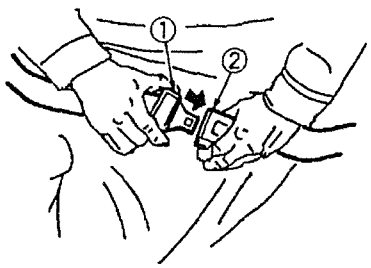
- ALWAYS fasten the seat belt while operating the machine.
- ALWAYS check the condition of the seat belt and mounting hardware before operating the machine.
- Replace the seat belt at least once every three years, regardless of appearance.

Inspect for worn or frayed webbing.

Check for worn or damaged buckle, retractor, extrusion and mounting hardware. Replace them if they are worn or damaged.

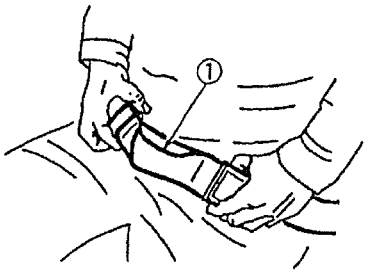
If the bolts and nuts of the mounting hardware are not correctly installed, the seat belt can separate from its mounting. Make certain the bolts and nuts are correctly installed.

If a bolt and nut are not correctly installed, remove them. Install a new bolt and nut.



To Fasten the Belt

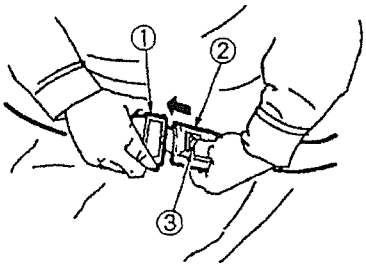
1. Confirm that the seat belt ① is not twisted and put it into the buckle ② securely.



2. Adjust the seat belt length according to your body size.
   Slightly pull the belt and confirm the belt ① is locked.

To Unfasten the Belt

Press the button ③ of the buckle ② and unfasten seat belt.



2 - 3 PRE-START CHEKCS

The following items should be checked each day before start-up or the start operations.

Inspect the operator's compartment for cleanliness. Keep it clean.

Inspect lights for broken bulbs and lenses. Replace if broken.

Inspect and remove any trash build up the engine compartment.

Inspect any cracks in body and gate hinges. Repair if it damaged.

Inspect the cooling system for leaks, faulty hoses and trash buildup. Correct any leaks and remove any trash from radiator.

Inspect the hydraulic system for leaks. inspect the tank, hoses, tubes, plugs, joints and fittings. Correct any leaks.

Inspect the hydraulic level . Mainten the oil level. Add oil if necessary.

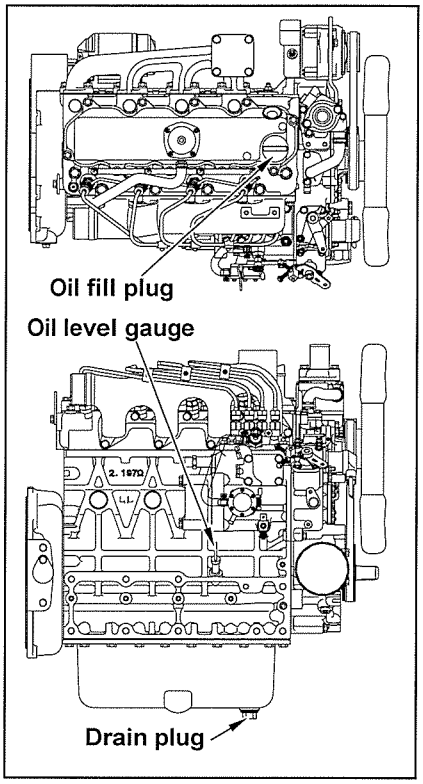
Check the engine oil level. Mainten the oil level. Add oil if necessary.

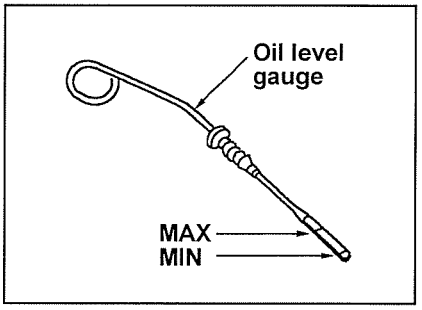
Check the coolant level on the collant reserve tank. Mainten the level. Add collant if necessary.

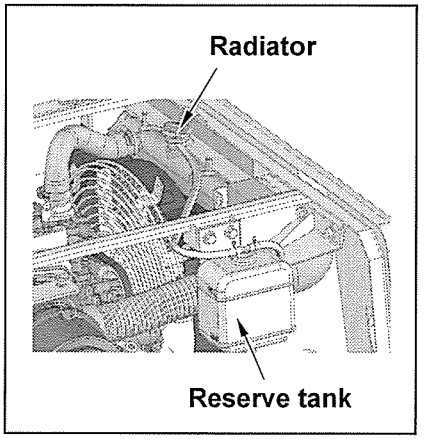
Check the air filter dust indicator. If the indicator is in the red zone, service the engine air filter.
After servicing, push the reset button to reset the dust indicator.

Inspect and repair any travel reduction leaks. Check the oil level if leakage is noticed.

Refer to Daily Maintenance and Checks in the Maintenance Section for more detailed information.



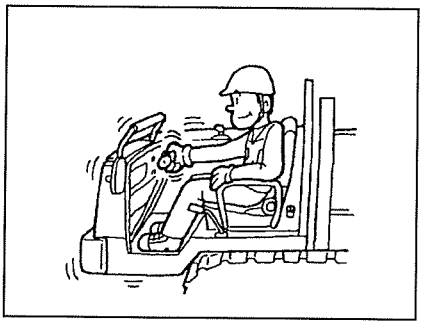




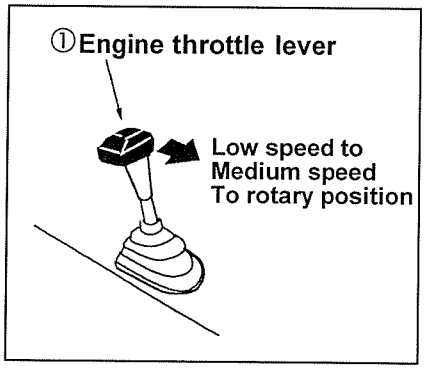
2 - 4 STARTING ENGINE

Once the pre-start inspection has been completed, the engine may be started.

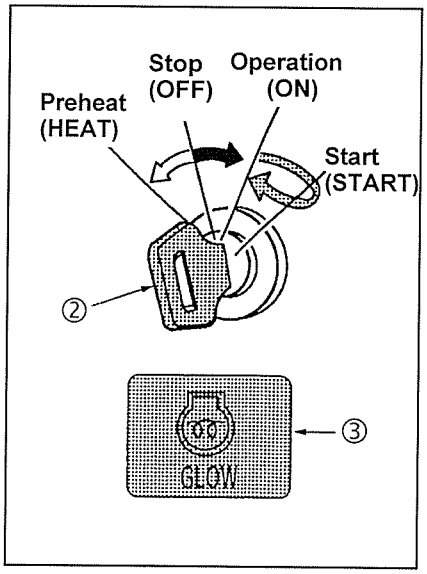
1. Depress the Parking Brake switch to the parking position.
2. Set the operation levers to the neutral position.
3. Move the engine throttle lever ① above the **LOW IDLE** position (advance about one-third to one-halt).
4. Turn the start switch ② to the **START** position.



NOTE: Under low temperature conditions, turn the start switch key to **PRE-HEAT** for about 15 seconds **BEFORE** turning to **START** position. The **GLOW** indicate lamp 3 turns on during engine preheating.



5. Release the start switch key when the engine starts.



⚠ CAUTION

1. Do not engage the starter motor for more than 15 seconds at a time. Should the engine fail to start within 15 seconds, allow the starter motor to cool for 2 minutes, before attempting to start the engine again.
   Turn the key to **OFF** before trying to restart the engine.
2. The **"OK"** warning monitor should be observed immediately after starting and during operations. If the display does not register normal readings, stop the engine and determine cause.
3. Allow the engine to warm up until operating temperature and required oil pressure are obtained.
4. Before attempting any working operations, warm up the hydraulic oil as described in "Preoperation Warm-Up"

⚠ DANGER

DO NOT USE ETHER FOR STARTING AID

2 - 5 JUMPER CABLE STARTING

⚠ CAUTION

Battery give off flammable fumes that can explode.

Improper jump procedures can cause an explosion resulting in personal injury.

The ground cable must be **ATTACHED LAST** and removed FIRST to prevent sparks from occurring near the battery, which could cause battery vapors to explode.

Attach the ground cable from the booster battery to a point away from and below the battery (Use starter groundpost of machine to be started).

To prevent possible personal injury, care must be used when removing the cables from the machine that has been started.
Do not allow the cable ends to contact each other or the machine.

⚠ CAUTION

Jump only with a battery source and with the stalled voltage as the stalled machine.

Be sure the start switch is in the **OFF** position **BEFORE** attaching the jumper cables to the machine to be started.

Always connect battery **POSITIVE** (+) to battery **POSITIVE** (+) and **NEGATIVE** (-) to battery NEGATIVE (-).

1. Attach one cable to under grounded **POSITIVE** (+) terminal of battery on machine to be started.
   Attach opposite end of cable to **POSITIVE** (+) terminal of external starting source.
2. Attach second cable to **NEGATIVE** (-) terminal of starting souce. Attach remaining cable end to the starter ground post of machine to be started.
3. Start engine.
4. After engine starts, **FISRT** remove cable attached to starter ground post of started machine. Remove opposite end of cable from starting source.
5. Remove cable from **POSITIVE** (+) terminal of battery on machine started.
   Remove opposite end of cable from starting source.

2 - 6 PRE-OPERATION WARM-UP

With any piece of hydraulically operated equipment, it is **EXTREMELY IMPORTANT** that the hydraulic fluid be thoroughly warmed fluid-up **BEFORE** any work is begun. A warm-up period is time well spent in preventive maintenance.

Practice the following warm-up procedure before attemping full load operations.

1. Perform the engine start - up procedure previously described and allow the engine to idle for 4-5 minutes at approximately 1000 rpm. (1000-1200 rpm in cold weather). Depending on the ambient temperatures, the following conditions may exist when the engine is first started:

2. The engine oil pressure warning lamp will come on. Within 10-15 seconds a minimum pressure should course the light go out. If this pressure **DOES NOT** indicated whithin 10-15 seconds, **STOP** the engine and check the oil lubricating system.

3. When the nessesary engine oil pressure has been obtained, gradually increse engine speed observing the **"OK"** monitor system to be sure all systems are normal.

   Work up to maximum engine speed in manner.

4. Perform all machine motions in order to get movement of oil through all working units.

5. In cold weather, it may be nessesary to heat the hydraulic oil by going over relief. To accomplish this, set engine speed at one-half to three-quaters throttle. Actuate dump lower function to direct pump flows over relief.

6. Repeat this over relief procedure in short 5 second attempts with 10-15 second pauses in between. Occasionally, go through all the hydraulic motions to move warmed oil to cylinders and cold oil buck to reservoir.

   Depending on the ambient temperature, the above procedure should warm hydraulic oil to within its specified temperature range for full load operation in 15-30 minutes.

   Be sure to perform the pre-operation warm - up procedure whenever the hydraulic oil temperature is lower than 20°C at start-up

2 - 7 "BREAK-IN" OPERATION

In case of the new machine, as the severe operation from the beginning will have a bad influence upon the machine life, perform the enough break-in operation as described the right table.

Hour meter	Load
Up to 10 hours	About 60% load
Up to 50 hours	About 80% load
After 50 hours	Full load

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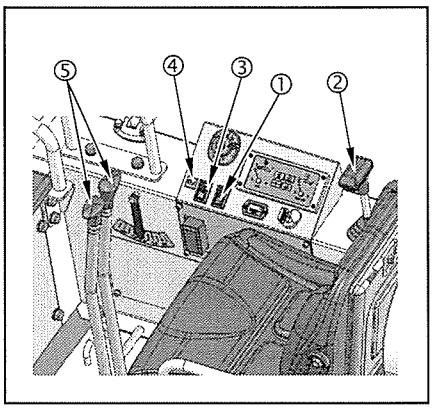
Up to 10 hours	About 60% load
Up to 50 hours	About 80% load
After 50 hours	Full load

2 - 8 TRAVELING THE MACHINE

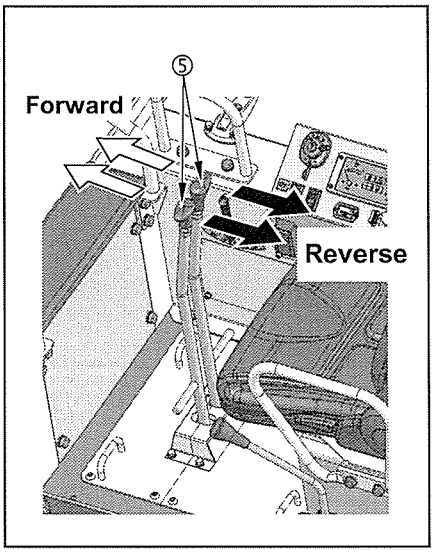
STRAIGHT TRAVEL

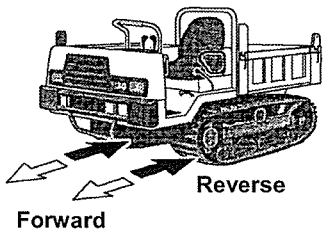
⚠ WARNING

* Before attempting any travel operations, **BE SURE** all personnel are standing clear of the machine.
* Keep the machine under control at all times to prevent injury.
* Travel the carrier only after body has been completely lowered.
* Make sure the rear gate and left & right side gates are securely locked.
* When sitting in the front second seat, the seat and the instrument panel will face in different directions.
* Do not use the front second seat in locations where the carrier will have a large tilt or when travelling on slopes.
* Use the horn as a warning signal.



1. Set the travel speed select switch ① to match the speed range you need.
2. Move engine throttle lever ② best method of speed control.
3. Press the "no mark" side of the parking brake switch ③ to release the parking brake.
   Check that the parking brake lamp ④ is now off.
4. Control right and left travel levers ⑤ as follows.
   - Forward Direction Travel
     Push the both travel levers ⑤ forward to move the machine forward.
   - Reverse Direction Travel
     Pull the both travel levers ⑤ rear to move the machine reverse.
5. Stop
   Move the travel levers to neutral, which engages the hydraulic brake automatically and stops travel.

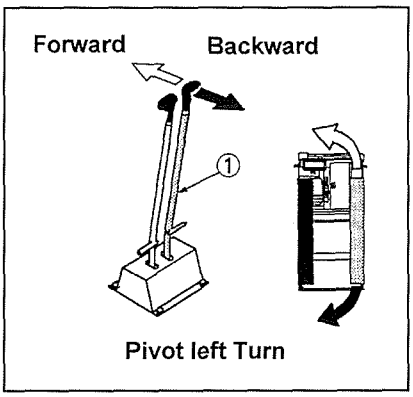




STEERING CONTROL

Pivot Left Turn

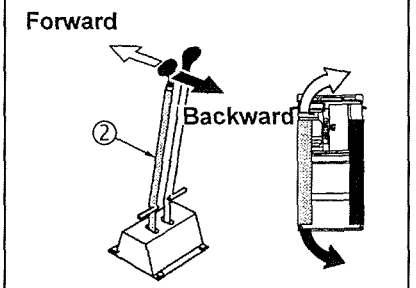
Move the right travel lever ① forward , allowing the machine to turn to the left, pivoting on the left track.



Pivot left Turn

Pivot right Turn

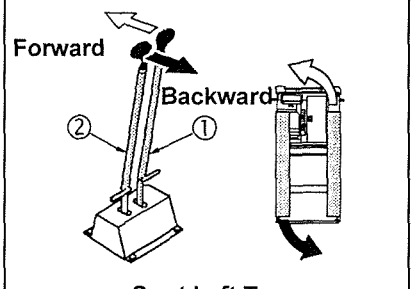
Move the left travel lever ② forward , allowing the machine to turn to the right, pivoting on the right track.



Pivot Right Turn

Pivot Left Turn

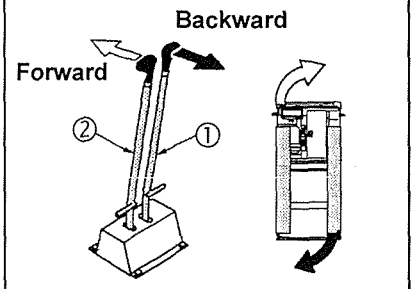
Move the right travel lever ① forward and move the left travel lever ② backward at the same time. This allows a quick left turn(counter track rotation).



Spot Left Turn

Spot Right Turn

Move the right side travel lever ① backward and move the left side travel lever ② forward at the same time.
This allows a quick right turn (counter track rotation).



Spot Right Turn

NOTE:

If the engine stall when changing directions while the engine speed (rpm) is low or the travel select switch is set to high. Restart the engine, increase the engine speed (rpm) and set the travel select switch is set to low. Control the travel levers stroke while traveling.

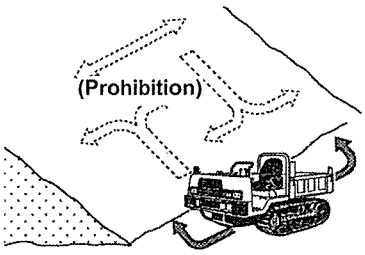
CAUTION ON TRAVEL ON THE GRADE

⚠ WARNING

- Be sure no one is working on or near the machine to prevent injury, keep the machine under control at all times to prevent injury.
- Reduce engine speed when maneuvering in tight quarters or when breaking over a rise.
- Select the travel speed range necessary before starting downgrade. Do not change travel speed ranges while going downhill.
- A good practice is to use the same travel speed range going downgrade that would be used to go up the grade.

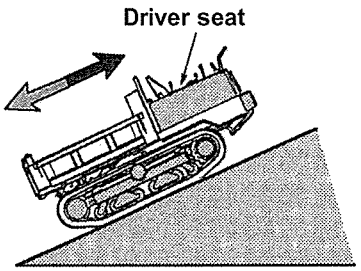
1. Traveling on slopes with an unloaded Vehicle.
   - Set the travel speed select switch to the LOW range.
   - Travel so the operator's seat faces up to the slope. The center of gravity of the machine is under the operator's seat so this will maintain stability.
2. Traveling on slopes with unloaded Vehicle.
   - Set the travel speed select switch to the LOW range.
   - Travel so the body with the load faces up to the slope. The center of gravity of the machine is now under the body so this will maintain stability.
3. Braking on slopes
   - When braking on slopes, move the travel lever to neutral and braking will take place

Do not change the direction or traverse on a slope.

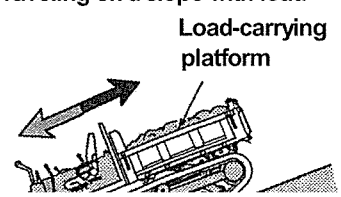


Detour on a plane ground.

Traveling on a slope without load



Traveling on a slope with load

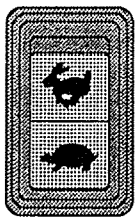


CHANGE SPEEDS

Change the travel speed range as needed.

NOTE: 1. Switch the range as needed according to the carrier load or the current road surface.

2. Switch the speed range while the carrier is stopped.



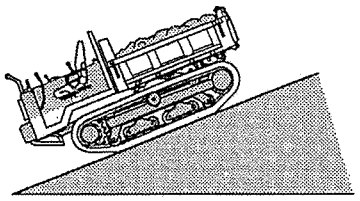
Travel speed selector switch

■ Changing speed range to match travelling conditions

• Low speed ( ) range :

1. Use low speed range when going up and down slopes or uneven terrain where lots of travel power is needed.
2. Low speed range should also be used when travelling down slopes as well as when climbing slopes.

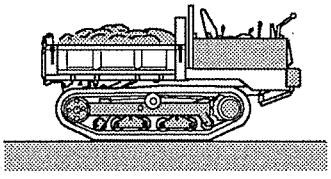
Low speed



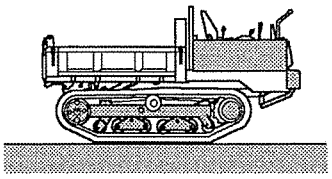
• High speed ( ) range :

1. Use high speed when travelling on fiat terrain while carrying a load. Switch the speed range as needed according to load and the current road surface.
2. Use high speed when travelling on flat terrain with no load.

Low speed



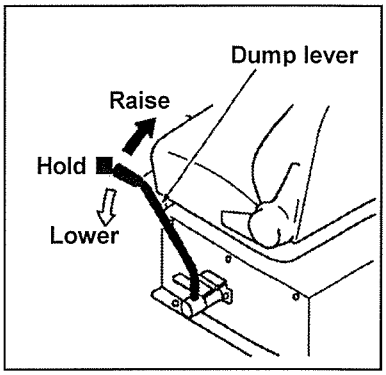
High speed



2 - 9 DUMP OPERATION

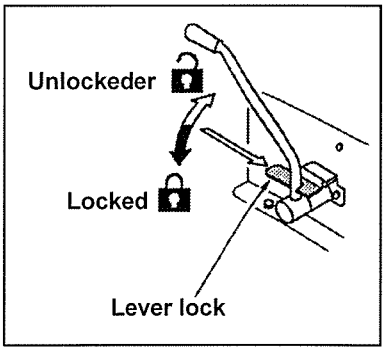
■Dump operation

1. Stop the carrier and confirm safety of a dumping place.
2. Move the dump lever to raise or lower the body.
   - **Dump** —Pull the lever back, to raise the body.
   - **Lower** —Push the lever lower, to lower the body.
   - **Hold** — When released, the lever will return to hold (center position)
3. Run the engine at a higher speed to increase the dumping speed, and at a lower speed to decrease it.
4. The rear gate of body automatically opens or closes as the body rises or lowers.



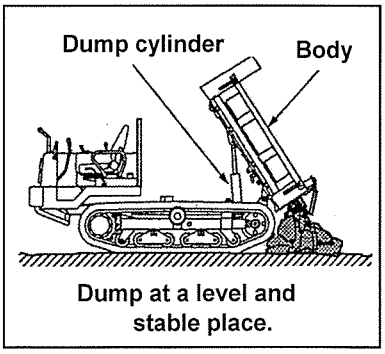
⚠ CAUTION

1. When dumping the load, use the lever to gradually raise the body. Do not try to dump the load quickly.
2. Reduce the engine speed When lowering the body and let it down slowly.
3. Place the lever lock in lock position when no dumping is needed.



■Precautions on dump operation

1. Dumping on sloping, rough, or soft ground may overturn the machine when the center of gravity moves. Perform dump operation on even and stable ground where the machine is kept as level as possible.
2. Avoid dumping to a place such as cliff or ditch, which may cause downfall. If not avoidable, set chocks or place a signal person and obey his/her signals.
3. When dumping bigger stones, operate dumping slowly. If there is a too big object to be dumped through the rear gate, remove the gate in advance.
4. Confirm that the body is completely lowered before starting travel.
5. Do not travel while the body is raised. ALWAYS travel keeping the body lowered.



Dump at a level and stable place.

■ Lowering Boom With engine Stopped

⚠ CAUTION

- Only lowr the body using the stop valve when trouble occurs.
- Releasing the stop valve applies the parking brake an the carrier stops.
- Be sure to always completely close the stop valve once the trouble has been repaired.
  If the stop valve is not completely closed, the parking brake will not fully release, causing lower travel power and early brake wear due to constant application of the brake.
  This is also related to pump damage.

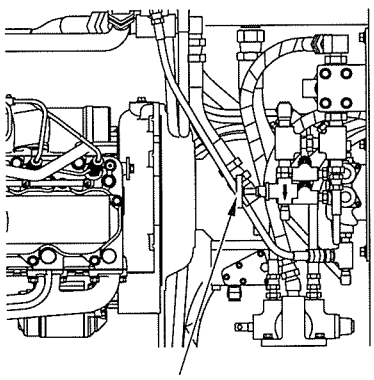
⚠ WARNING

Lowering the body with the engine stopped could cause personal injury or death.

Keep all personnel away from the body drop area when lowering the body with the engine stopped.

If trouble occurs in the engine or pump while the body is still raised and the engine stalls, you will be unable to lower the body. In such cases, open the stop valve which is located at the inside the engine cover at the rear. With the stop lever open, the body can now be lowered.

1. Keep all personnel away from the body drop area.
2. Open the engine cover.
3. Turn the stop valve handle counter- clockwise to open the valve.
4. Lower the dump lever down to lower the body.
5. Once the body is completely lowered, turn the stop valve clockwise and tighten it securely.



Stop valve

Engine cover interior

2 - 10 TOWING

⚠WARNING

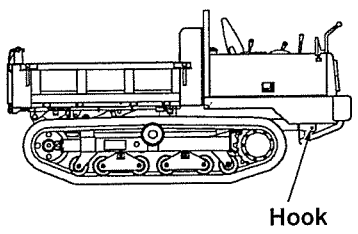
* Personal injury or death could result when towing a disabled machine incorrectly.
* Follow the recommendations below, to properly perform the towing procedure.
* During towing operation, **NEVER** allow anyone between the towing machine and the towed machine.
* Quick machine movement could overload the tow line or bar and cause it to break. Gradual and smooth machine movement will work better.
* Keep the tow line angle to a minimum. Do not exceed a 30° angle from the straight ahead position.

■ Towing the carrier

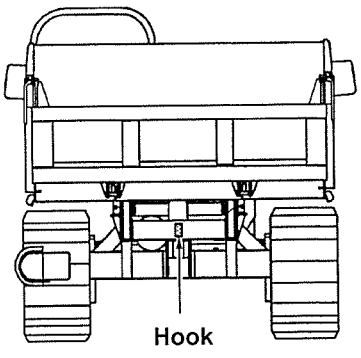
When the carrier gets stuck for instance in mud and cannot escape under its own power it must be towed by another vehicle. In such cases attach a shackle to a wire rope and attach this to the front or rear hook. The carrier can now be towed.

1. Start the engine.
2. Press the unmarked side of the parking brake switch to release the parking brake.
3. Steer the travel lever in the direction you are being towed in.

NOTE : When the engine is broken and will not start, the parking brake will not release. The parking brake will prevent the crawler belt from rotating so the carrier cannot be towed.



Front towing hook



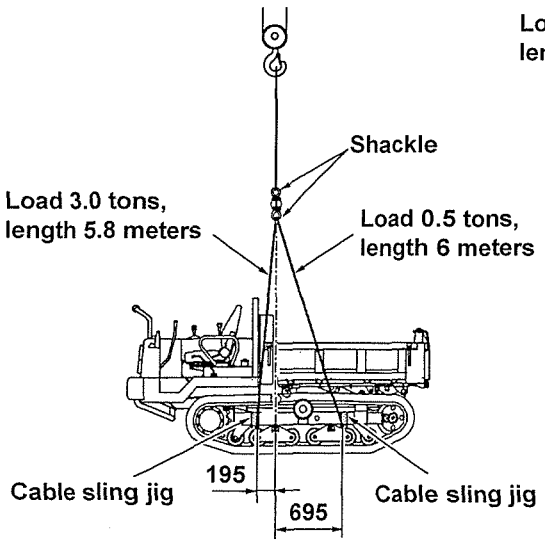
Rear towing hook

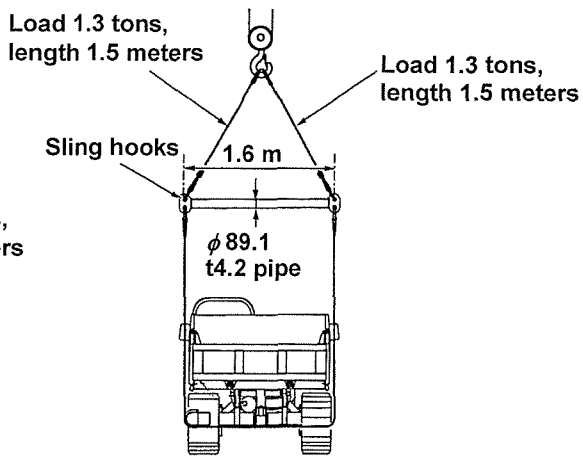
2 - 11 LIFTING THE MACHINE

⚠ WARNING

Personal injury or death can result, if the following is not observed.

* **ALWAYS** lift the machine on the level ground.
* **NEVER** lift the machine loaded with any personnel.
* Make sure the lifting cables and other lifting devices are strong enough to support the machine.
* Use a crane whose lifting capacity meets the weight of the machine.
* Use guide or tag lines to prevent the machine from swinging or turning.





1. Prepare a wire rope, shackle and sling hooks of sufficient strength to handle the loads shown in the above figure.
2. Lower the body completely and stop the engine.
3. Install the wire rope to the crawler frame as shown in the figure.
4. Install the wire rope to the sling hooks with the shackle.
5. Install the wire rope to the crane hooks and lift upward so the crawler is a little bit above the ground, then stop lifting. Check the machine balance.
6. If the balance is good continue slowing lifting the machine.

Total operation weight (kg)	2,250

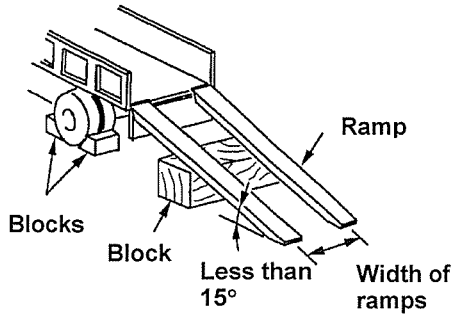
2 - 12 LOADING AND UNLOADING THE MACHINE

⚠WARNING

* Use a ramp that has sufficient strength, width, length, and thickness.
* Load and unload the machine the machine on a level and firm ground. Keep a distance from a distance from a shoulder.
* Remove mud from the shoe so that the machine will not skid down. Clean the truck deck and ramp by getting rid of grease, oil, or ice.
* Perform warm-up before loading and unloading under cold weather.
* **NEVER** make a turn on a ramp. To make a turn, get off the machine from the ramp first.

ALWAYS use the ramps for loading and unloading the machine by following the next procedures.

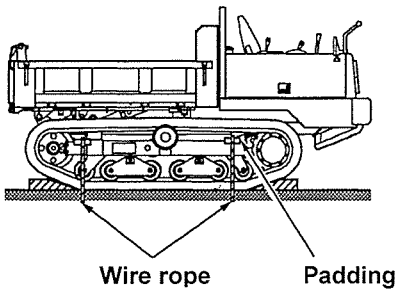
1. Block the truck wheels before loading the machine.
2. Fix ramps to the truck securely. Set the ramps angle less than 15° . Set the width between ramps according to the width of crawlers.
3. Lower the engine speed by the engine throttle lever.
4. Set the travel speed selector switch to low speed ( ) range.
5. Lower the body completely and set so that the operator's seat is facing towards the truck.
6. Place the machine in such a manner that the center of the machine and the truck body aligns with that of the shoe and the ramps.
7. Travel as slowly as possible.
8. Properly set the machine on a designated place.



FIXATION AT TRANSPORTATION

Securely fix the machine to the truck body with wire.

1. Stop the engine.
2. Engage the stop block in front and back of the crawler.
3. Fix the crawler to the truck chain or wire rope.



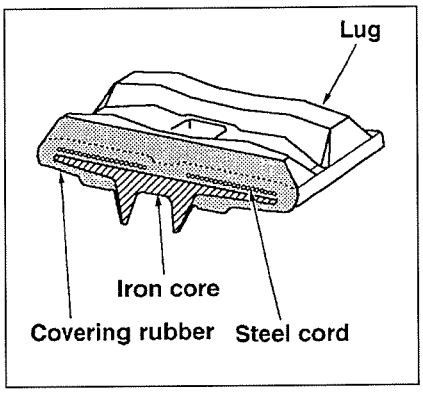
2 - 13 PRECAUTION ON USE OF RUBBER CRAWLER SHOE

⚠ CAUTION

The rubber crawler shoe may be damaged or worn faster depending on working conditions. Perform working operation properly according to working site conditions and machine operation.

■ Structure of Rubber Crawler Shoe

The structure of rubber crawler shoe. It consists of steel cord to sustain tension, iron core to support it, and covering rubber to them.

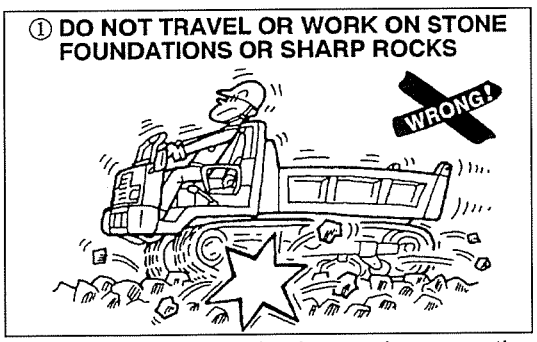


NOTE : If a crack reaches the steel cord, it may be rusted and cut off by moisture. When any crack is detected, immediate repair is essential. Please contact your local IHI distributor.

■ Cautions while working and travelling

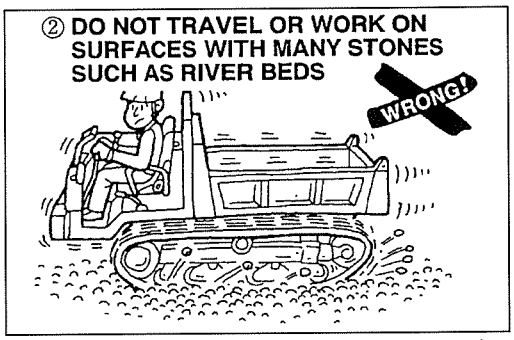
Avoid the following while travelling.

① **DO NOT TRAVEL OR WORK ON STONE FOUNDATIONS OR SHARP ROCKS**



This wears down the lug and causes the steel cord to break.

② **DO NOT TRAVEL OR WORK ON SURFACES WITH MANY STONES SUCH AS RIVER BEDS**

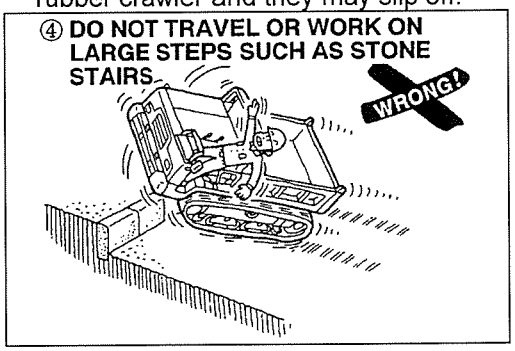


This causes damage or wear on the rubber crawler and they may slip off.

③ **DO NOT TRAVEL OR WORK ON STEEL OR SCRAP MATERIAL**

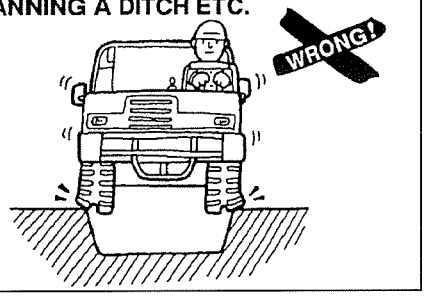
This wears down the lug and causes the steel cord to break.

④ **DO NOT TRAVEL OR WORK ON LARGE STEPS SUCH AS STONE STAIRS**



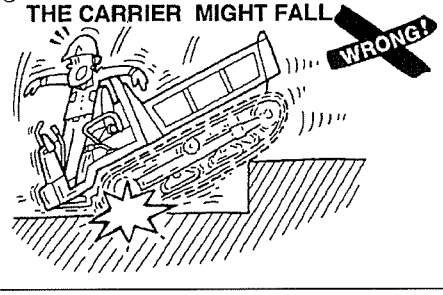
- Move slowly directly up steps.
- While moving up the steps avoid places where the road surface changes.

⑤ DO NOT TRAVEL OR WORK WHILE SPANNING A DITCH ETC.



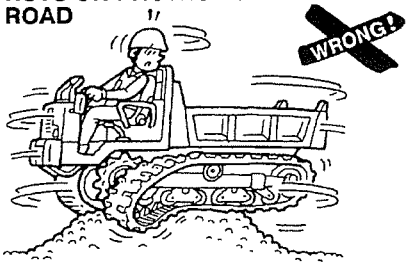
- This wears down the lug and breaks the iron core.
- The carrier might fall or topple over.

⑥ AVOID LOCATIONS WHERE THE CARRIER MIGHT FALL



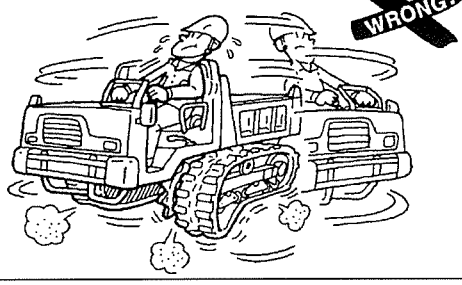
Do not let the carrier fall from locations like large stone steps.
This might damage or break the iron core.

⑦ AVOID TRAVELLING OVER LARGE RUTS OR PROTRUSIONS ON THE ROAD



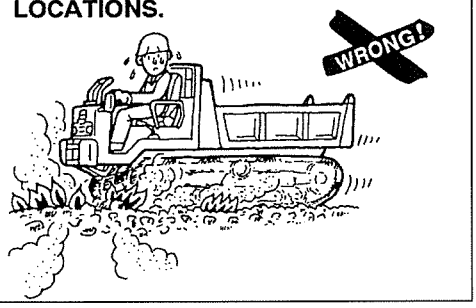
- Travel slowly and take care not to let the crawlers come off the rollers.
- Do not change directions when the crawlers may have lost tension at the high and low parts of ruts and protrusions. This may cause the crawlers to come off.

⑧ AVOID SUDDEN CHANGES IN DIRECTION WHEN STEERING



- Make direction changes in several smaller steering movements.
- Avoid sudden changes in direction. This causes early wear on the lug and may cause the crawlers to slip off.

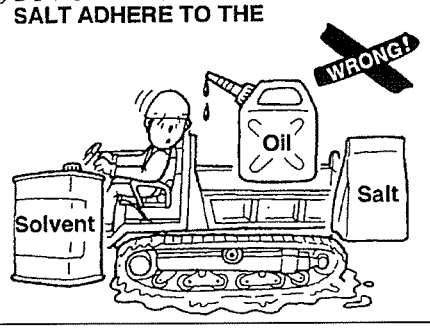
⑨ DO NOT TRAVEL OVER HIGH HEAT LOCATIONS.



Do not try to travel over place subjected to high heat such as steel plate that was placed in bonfires or under scorching heat, asphalt or floorboards etc.
This causes serious abrasion or damage and breakage of the lug.

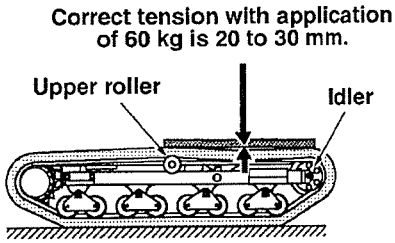
■ OTHER ITEMS FOR CAUTION

① DO NOT LET OIL – SOLVENTS OR SALT ADHERE TO THE



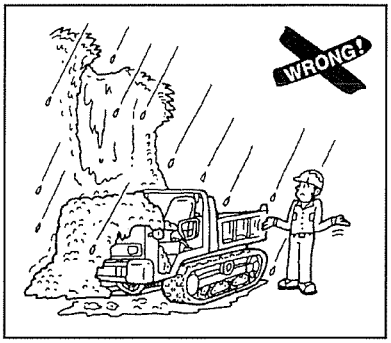
- If fuel, transmission fluid or paint should adhere to the rubber crawlers wipe it away quickly
- Wash away with water after working in locations with a large salt content. Salt can cause the iron core to rust or peel.

② ALWAYS USE CORRECT TENSION ON THE SHOE



Attempting to change directions on terrain with different levels or steps while the rubber crawler is still slack may damage the rubber crawlers or cause them to come off the rollers.

2 - 14 PARKING THE MACHINE



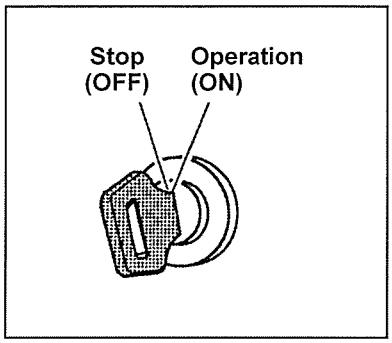
At the end of a day's work, following steps should be observed as the established machine shut-down procedure:

Stopping the Machine

Move the machine to a safe location on level ground. **ALWAYS** lower the body.

Freezing Conditions

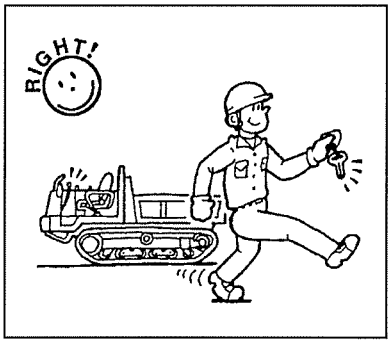
If freezing temperature are expected, each crawler frame should be cleaned of mud and dirt and the machine parked on wood planks.



Engine Stopping

1. Operate the engine at **LOW IDLE** for five minutes. This gives the engine a chance to cool off gradually before they are stopped.
2. Turn the start switch counterclockwise to **OFF** position. Stopping the engine.

Leaving the Machine

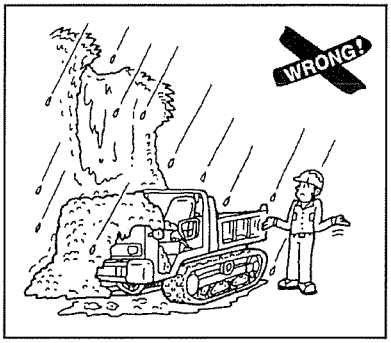


1. **REMOVE THE START SWITCH KEY.**
2. **INSPECT THE ENTIRE MACHINE** for leaks, loose connections, signs of wear, crack etc. Report any signs of trouble discovered during this inspection.
3. Lock the cab door.
4. Close and lock the upper structure access doors.

2 - 15 EMARGENCY ENGINE STOP

To stop the engine in emergency, turn the starter switch to "OFF" position.

2 - 14 PARKING THE MACHINE



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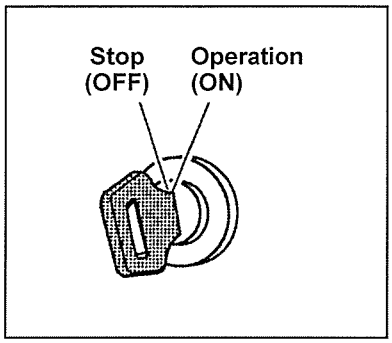
Freezing Conditions

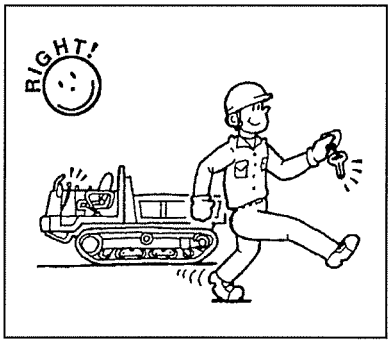
If freezing temperature are expected, each crawler frame should be cleaned of mud and dirt and the machine parked on wood planks.



Engine Stopping

1. Operate the engine at **LOW IDLE** for five minutes. This gives the engine a chance to cool off gradually before they are stopped.
2. Turn the start switch counterclockwise to **OFF** position. Stopping the engine.

Leaving the Machine



1. **REMOVE THE START SWITCH KEY.**
2. **INSPECT THE ENTIRE MACHINE** for leaks, loose connections, signs of wear, crack etc. Report any signs of trouble discovered during this inspection.
3. Lock the cab door.
4. Close and lock the upper structure access doors.

2 - 15 EMARGENCY ENGINE STOP

To stop the engine in emergency, turn the starter switch to "OFF" position.

3 MAINTENANCE

MAINTENANCE INTERVALS

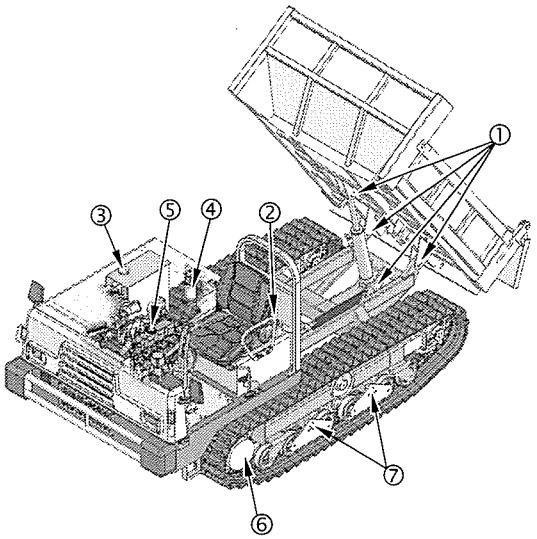
Check Point	Item	Page
When Required		
Tracks	Check and Adjust Tension	3 – 5
Battery	Inspect and Topping Up	3 – 6
Fuses	Replace	3 – 7
Fusible Link	Replace	3 – 7
Rubber Shoes	Check Rubber Shoes	3 – 8
Daily Check (8 Service hours)		
Engine Oil	Check Oil Level	3 – 9
Hydraulic Tank	Check Hydraulic Oil Level	3 – 9
Engine Coolant	Check Coolant Level	3 – 10
Air Cleaner	Check Filter Dust Indicator	3 – 10
Every 50 Service Hours (First perform previous service hour items)		
Pins	Lubricate Fitting with Grease	3 – 11
Full Tank	Drain Water and Sediment	3 – 11
Engine	Change Oil and Filter *	3 – 12
Hydraulic System	Change Line Filter *	3 – 17
Every 250 Service Hours (First perform previous service hour items)		
Engine Oil and Filter	Change Oil and Filter	3 – 12
Air Cleaner	Service Air Cleaner Element	3 – 13
Fan and Alternator Belt	Inspect / Adjust	3 – 15
Engine Coolant	Change Coolant (When not used L.L.C)	3 – 23
Every 500 Service Hours (First perform previous service hour items)		
Tighten Bolts	Retighening Bolt	3 – 16
Line Filter	Change Line Filter Element	3 – 17
Fuel Filter	Change Filter	3 – 18
Travel Reduction	Check Oil Level	3 – 19
Air Cleaner	Change Filter Element	3 – 20
Every 1000 Service Hours (First perform previous service hour items)		
Travel Reduction	Change Gear Case Oil	3 – 21
Hydraulic Tank	Change Hydraulic Oil / Clean Strainer	3 – 22
Every 2 years Service Hours		
Engine Coolant	Change Coolant (When used L.L.C)	3 – 23

* Interval given applies only to initial period of use (Break-in).

3 MAINTENANCE

3 - 1 LUBRICATION CHART MAINTENANCE AND CHECKS

The interval of lubrication, maintenance and check is the maximum interval indicated by the service hour meter. Of course it should be shortened in service operating conditions.



Check points		Check items	Check intervals					
			Initial period of use After 50 hours	Daily	Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours
①	Body and cylinders Pins	Lubricate the Fittings "G"			○			
②	Fuel Tank	Drain the Water and			○			
③	Hydraulic Tank	Check Level and Change Oil "H"		○				●
		Drain the Water			○			
		Clean the Suction Strainer						○
④	Line Filter	Change the Filter	●				●	
⑤	Engine	Check and Change the Oil "E"	●	○		●		
		Change the Oil Filter Element	●			●	●	
		Change the Air Filter Element				○ Clean	●	
		Check the Coolant Level "W"		○				
⑥	Travel Reductions	Check and Change the Oil "L"					○	●
⑦	Link Pins	Lubricate the Fittings "G"			○			

Symbol	G	L	H	E	W	○	●
Remarks	Grease	Gear oil	Hydraulic fluid	Engine oil	Coolant	Inspection/ Maintenance /Supply	Replacement
	EP- 2 Lithium grease	API・GL- 4, ISO-VG320 (SAE90)	Wear-proof hydraulic fluid ISO-VG46	API•CC or CD SAE 10W30			

3 - 2 RECOMMENDED LUBRICATION TABLE

LOCATION	REFILL CAPACITIEAS	REPLACING INTERVAL	USE	SPECIFICATION
Diesel Engine	Max. 9.7 L Min. 7.0 L	250 Hrs. Initial 50 hours	Cold Regions	API, Class CD SAE20
			General	API, Class CD SAE30
			Tropical Regions	API, Class CD SAE40
Hydraulic oil	Total Amount 30 L Tank level Capacity 25 L	1,000 Hrs.	Ambient Temp. Above -5°C	Wear Proof Hydraulic Fuluid ISO - VG 46
			Ambient Temp. Below -5°C	Wear Proof Hydraulic Fuluid ISO - VG 32
Lower Roller	120 cc	1,000 Hrs.	General	API, GL-4 ISO-VG320 (SAE90) Gear Oil
Travel Reduction Drive	0.6 L	1,000 Hrs.	General	
Upper Roller	40 cc	1,000 Hrs.	General	API, Class CD SAE30
Idler	100 cc			
General Greasing Points	Body pin, Link pin for rotary roller		General	EP2 Lithium Grease

Note:

1. Oils in the hydraulic fluid columns marked with *should be use above 0°C.
2. If the oil becomes dirty or deterioration of the oil's properties are excessive, replace more frequently than described above.
3. Disassemble lower and upper rollers when replacing oil.

3 - 3 PRECAUTION ON MAINTENANCE

You must read and understand the warnings and instructions contained in the Safety section of this manual, before performing any operation or maintenance procedures.

■ **Using the safety bar**

Using the safety bar when operating underneath the body which has been raised.

⚠ DANGER

ALWAYS use the safety bar for maintenance under the body since the body may lower if removing dump cylinder or hose without the bar.

1. Set the safety bar

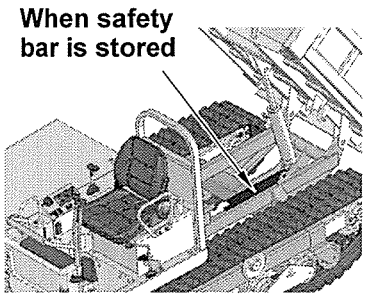
(1) Raise the body completely.
(2) Raise the safety bar and set it to the bracket under the body.
(3) Stop the engine.
(4) Open the stop valve and push down the dump lever to lower the body.
Confirm the safety bar comes in contact with the bracket.
(5) Close the stop valve.

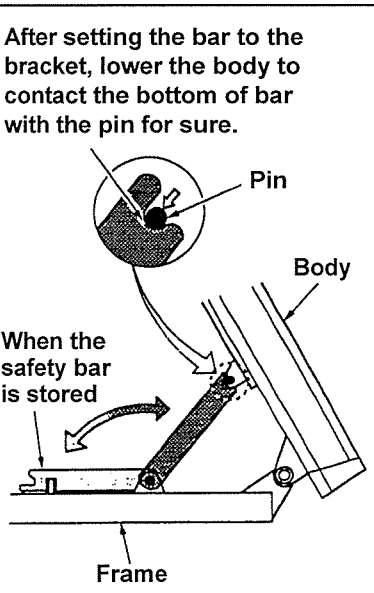
⚠ CAUTION

Do not start the engine and lower the body while using the safety bar. This may cause damage to the bar or body.

2. Remove the safety bar

(1) Start the engine and pull up the dump lever to raise the body completely.
(2) Remove the safety bar from the bracket and store the bar onto the frame.





Setting and storing the safety

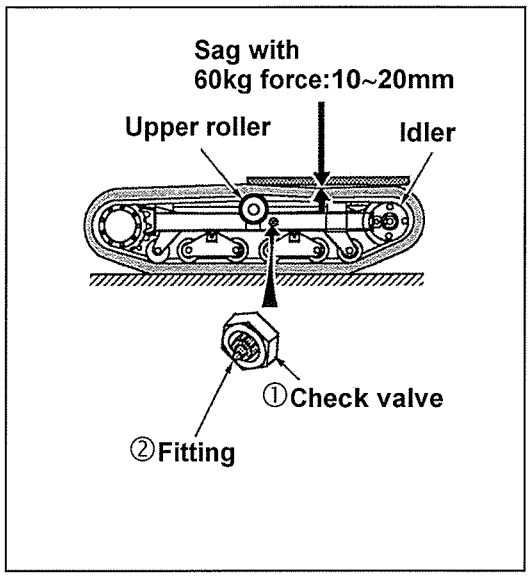
3 - 4 WHEN REQUIRED MAINTENANCE AND CHECKS

TRACK ADJUSTMENT

■ Check Track Tension

Repeat the procedure on the opposite track after completion of the first track.

1. Place the carrier on a firm and level ground.
2. Completely raise the body. Set the safety bar.
3. Have a person (60kg) on the center of the upper roller and the idler.
4. Place a straightedge on the tracks. Measure the distance from the bottom of the straightedge to the top of the lowest grouser tip.
5. Correct adjustment allows 20 to 30mm of sag midway between the upper roller and the idler.



■ To Tighten Track

1. Add grease through the check valve fitting until the adjustment is correct.
2. Operate the machine back and forth to equalize pressure.
3 Recheck the adjustment.

■ To Loosen Track

1. Remove soil deposited on idler bearing.
2. Loosen the check valve ② 3 turns only to allow grease to escape.
3. Tighten the check valve seat when the adjustment is correct.
   NEVER over tighten the check valve, The torque requirement for check valve is 59 to 69 N·m (6 to 7 kgf•m)
4. Operate the machine back and forth to equalize pressure. Remeasure the adjustment.

If the correct adjustment cannot be obtained, contact your IHI dealer.

⚠WARNING

Grease is under high pressure.

Do not remove grease fitting ②.

Grease coming out of the relief valve under pressure can penetrate the body causing injury or death.

Do not watch the relief valve to see if grease is escaping. Watch the track or track adjustment cylinder to see if the track is being loosened.

Loosen the check valve ① 3 turns only.

BATTERY MAINTENANCE

⚠ WARNING

Batteries give off flammable fumes that can explode.

Do not smoke when observing the battery electrolyte levels.

Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.

If the battery electrolyte comes in contact with eyes, wash it away with water and call for emergency medical cure.

Always wear protective glasses when working with batteries.

1. **Cleanliness**
   Any acid that may have been spilled should be mopped and battery then should be cleaned with a rag and water and allowed to dry. Terminals must not be allowed to corrode; this can be prevented by keeping them coated with a good quality grease.

2. **Battery Recharge**
   Battery should not be allowed to stand in a fully discharged condition, but should be recharged as soon as possible. If battery is out of use for a long time, it must not be allowed to run down completely. The battery should be given a small recharge, sufficient to bring it back to fully charged state about every one or two months. Trickle charging is not recommend and during charging as before, care must be taken that temperature of electrolyte does not rise above 40°C for temperate climates and 52°C for battery using lower gravity acids specified for tropical use.

3. **Inspection**
   For close inspection of cells, use a flashlight and not a naked light as gases evolved from a battery may, in certain circumstances, be highly explosive. To avoid risk of sparks giving rise to explosion, do not rest flashlight or other metal object on top of battery.

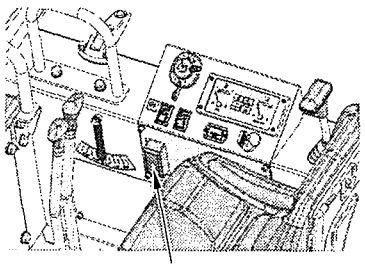
4. **Topping Up**
   Maintain level of electrolyte in cells at correct height by adding distilled water when required. If any electrolyte is spilled, replace it with fresh sulfuric acid of same specific gravity as that of remaining in cell. Level of electrolyte must never fall below tops of plates.

FUSES

The fuse box is located on the front of the instrument panel.

Fuses protect the electrical system from damage caused by overloaded circuits.

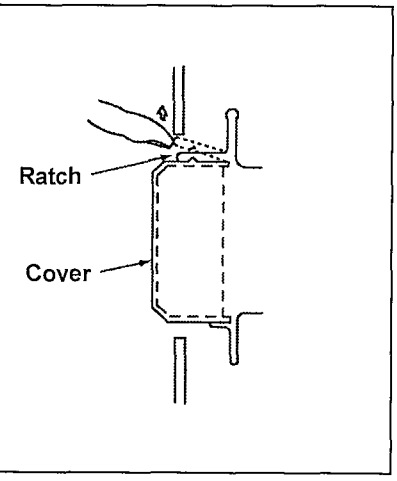
Replace fuses with the same type and size only. Otherwise, electrical damage can result. Change a fuse, have the circuit checked and repaired.



Fuse box

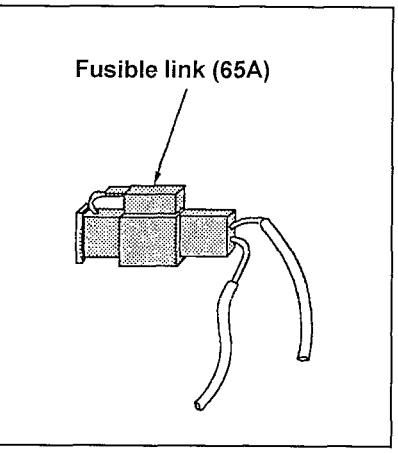
■ Replace

1. Pull the ratch and remove the cover for fuse access.
2. Change the damaged fuse to new one.
   Fuse amperage: 20A



FUSIBLE LINK

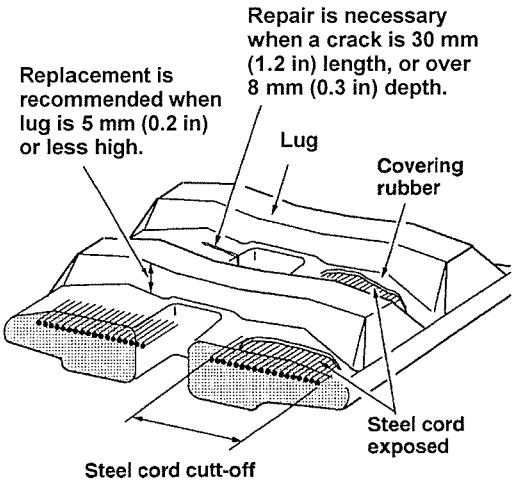
The fusible link is provided between the positive terminal of the battery and the starter switch to prevent electrical circuit wires from being burnded because of short circuit. When the power is turned off by short circuit, check the fusible link.
When it is blown out, replace it with new one after repairing the electrical wires.



RUBBER CRAWLER SHOE MAINTENANCE

⚠ CAUTION

Rubber crawler shoe should be repaired or replaced under the next conditions.
If is necessary to repair or replace it, contact your **IHI** dealer.



1. **Height of lugs**
   The rubber crawler can be used even if it is worn, however, if it is excessively worn, the crawler shoe is likely to be slippery and more travel force is required. If the remaining lug is less than 5 mm (approx. 0.2 in.) high, replace it with brand-new one.

2. **Exposure of Steel Cords**
   If steel cord is exposed because of weary rubber or damage, replace it with brand-new one.

3. **Cutting of Steel Cords of Rubber Crawler Shoes**
   When cutting of steel cord is detected, replace it immediately. If you leave it as it is, the rubber crawler shoes can be cut off without expectation, which causes a serious accident.

4. **Crack of Covering Rubber**
   If a crack is 30mm (1.2 in.) or more long and 8 mm (0.3 in.) or more deep, repair the cover immediately. If Steel cord appears even if a crack is small, repair it immediately. Otherwise, water may come into a crack, which rusts steel cords and cuts off the rubber crawler shoe.

3 - 5 DAILY MAINTENANCE AND CHECKS

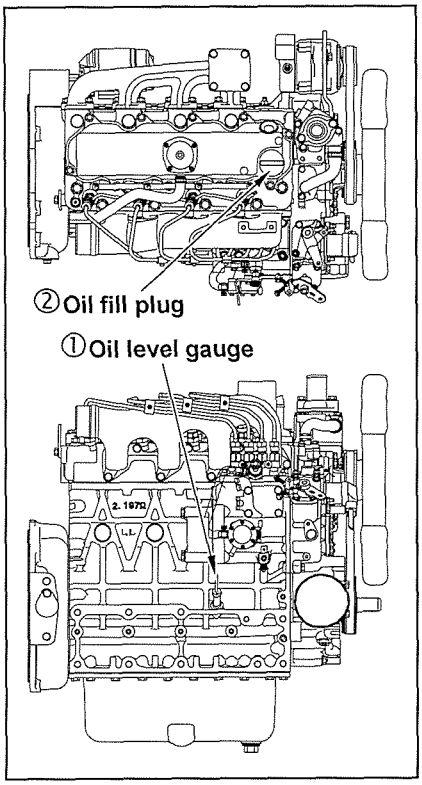
■ Check the Engine Oil Level

Check the oil level with the engine stopped. DO NOT check the oil level with the engine running.

⚠ CAUTION

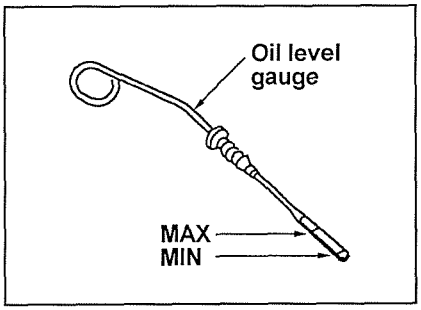
* Do not overfill the crankcase. Engine damaged can result.
* Never operate the engine when oil level is above **FULL** mark or **ADD** marks.

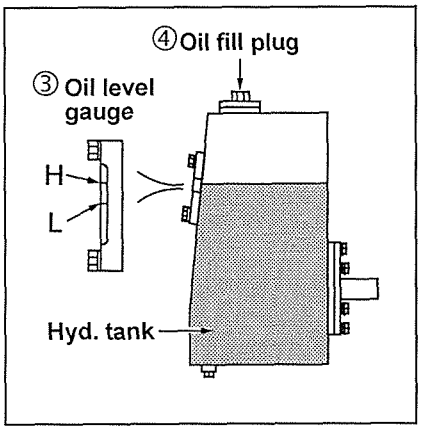
1. Open the access cover on the engine.
2. Remove dipstick ① and wipe it clean. insert dipstick ①, then move it again to read actual oil level. Insert dipstick ①.
3. Maintain the oil level to the FULL mark on dipstick ①. Add oil if necessary.
4. Remove the oil fill plug ② and Add oil.
5. Check oil level.
6. Clean and install the fill plug ②.
7. Close the access cover.



■ Check the Hidraulic Oil Level

1. Place the machine on the level ground, and the engine stoped.
2. Check the oil level with the oil colded.
3. Mainten oil level between the FULL and ADD marks on the sight gauge ③.
4. Remove the oil fill plug ④.
5. Fill the hygraulic tank with hydraulic oil.
6. Clean and install the oil fill plug ④.

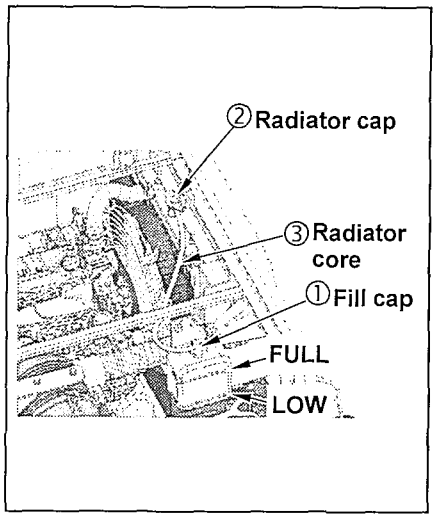




■ Check Coolant Level

⚠ WARNING

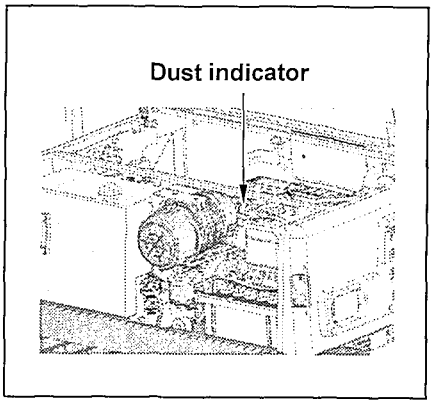
* Steam generated by hot fluid under pressure in radiator can cause personal injury.
* Remove filler cap only when cool enough to touch with bare hand.



1. Open the access door at the right of the machine.
2. Always check the coolant level in the reserve tank. Coolant level should be between the marks on the coolant reserve tank.
3. If additinal coolant is needed, remove the coolant fill cap ① of the reserve tank and add appropriate coolant / water mixture as necessary.
4. If the reserve tank is empty, remove the cover on the engine.
   Add coolant to the radiator. Slowly loosen fill cap ② of the radiator to release pressure.
5. Inspect the condition of the cap gascket. Replace the cap if necessary.
6. Install the radiator cap ②.
7. Inspect the radiator core ③ for debiris and clean if necessary.
8. Close and latch the access door and install the engine cover.

■ Check the Dust Indicator

The air filter is equipped with a "Service Signal" indicator located on the outlet side of the air cleaner. If red signal is in the service level, clean filter element or replace if necessary. Inspect filter gaskets for damage and replace if necessary. After servicing, push the reset button to reset ithe dust indicator.



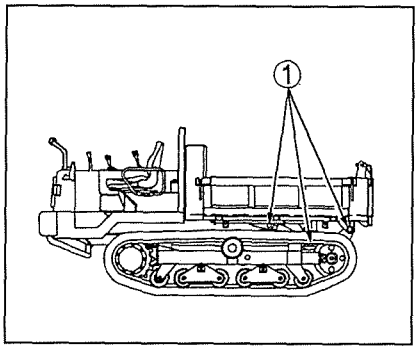
3 - 6 50 HOURS MAINTENANCE AND CHECKS

First Perform Previous Service Hour Items.

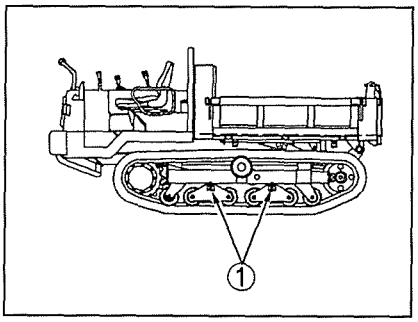
■ Lubrication

⚠ WARNING

ALWAYS set a safety bar in place under the body when lubricating the vehicle with the body raised.



1. Stop the engine.
2. Use a grease can and apply lubricant to all the grease fillings ① on the machine.
3. After finished with lubrication, remove all the old grease squeezed out of the fittings.



■ Lubricating the lower roller link pins

Apply grease to the grease nipple ① of the link pin.

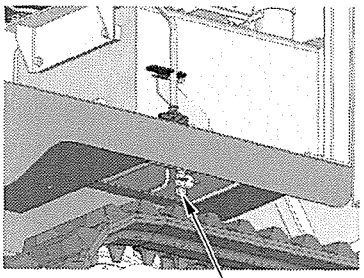
NOTE: Perform this lubricating job everyday before starting work in swamps or muddy locations.

■ Drain Sediment From Fuel Tank

Drain valve located under the fuel tank.

1. Open the drain valve ① and allow the moisture and sediment to drain.
2. Close the drain valve ①.

If the air temperature is expected to be lower than 0°C the draining must be done at the end of work.



①Drain valve

3 - 7 250 HOURS MAINTENANCE AND CHECKS

First Perform Previous Service Hour Items.

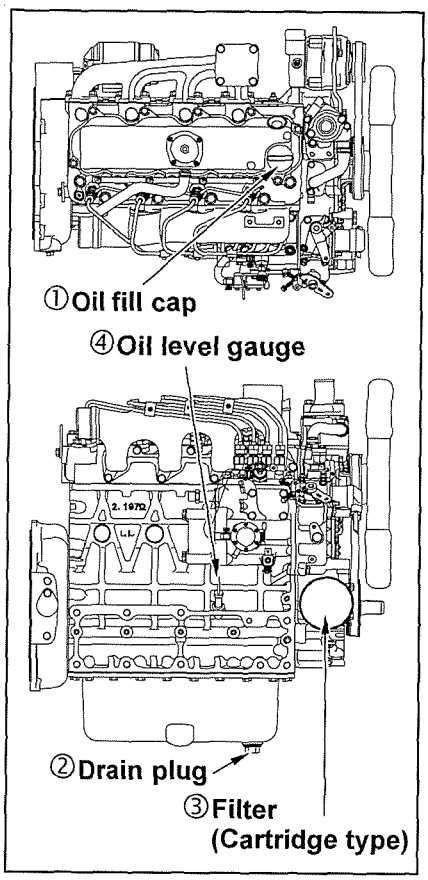
ENGINE CRANKCASE

■ **Change Oil and Filter**

⚠ WARNING

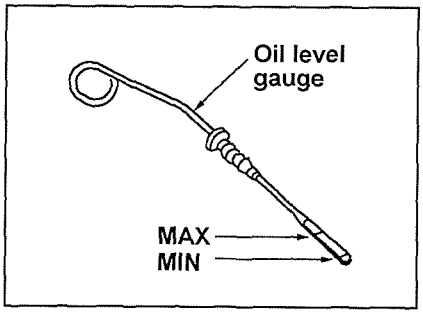
Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.

1. Stop the engine.
2. Remove the crankcase oil drain plug ②. Allow the oil to drain.
   Use a container to catch the drained oil so that the engine and the machine will not be fouled by the drained oil.
3. Remove the used cartridge type filter ③ by the filter wrench. Clean the filter base.
4. Coat the seal of a new filter with clean engine oil.
5. Install the new filter by hand. When the seal contacts the base, tighten an additional 5/8 turn by filter wrench.
6. Install the crankcase drain plug ②.
7. Remove the oil fill plug ①. Fill the crankcase with oil.
   See "Refill Capacities".
8. Start and operate the engine to fill the filter. Check for leak.
9. Stop the engine. Maintain the oil level between the ADD and FULL limit marks on the dipstick ④.



⚠ CAUTION

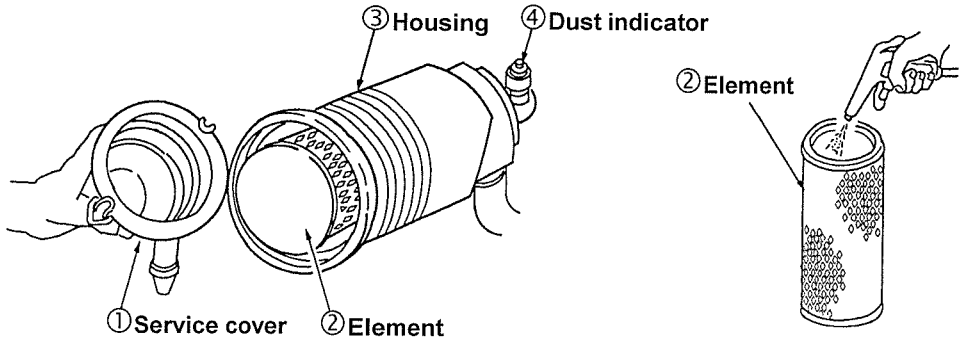
* Keep oil level close to full mark.
  DO NOT OVERFILL!
* NEVER operate the engine when oil level is above full mark or add marks.



■ Service the Filter Elements

⚠ CAUTION

* Service the air cleaner only with the engine stopped to prevent engine damage.
* Do not clean the filter elements by bumping or tapping them.
  Do not use filter element with the damaged pleats, gaskets or seals.
  Engine damage could result.
* When using pressure air for cleaning, wear a protective face shield or protective grasses.



1. Stop the engine.
2. Release the two latches and remove the service cover ①.
3. Remove the element ② from the air cleaner housing ③.

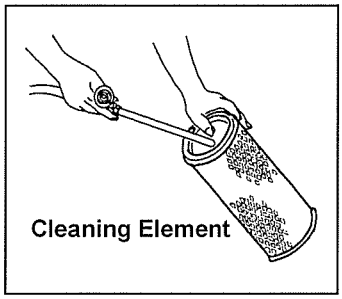
NOTE: Remove the seal unit of element gently. The element is radially sealed by the element seal unit and seal tube. To loose the seal unit, move the outer of element gently up and down or right and left or turn the element to remove it.
Take out the element not to scatter dust.

4. Clean the inside of the cleaner housing ③ and service cover ①.

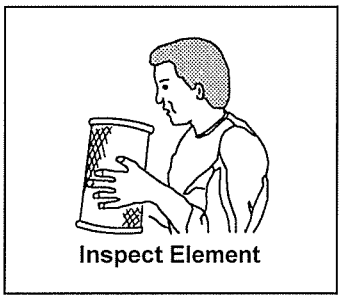
NOTE: Clean the seal tube in the cleaner housing. Dust on the seal tube causes dust leak.

5. Element ② can be cleaned with compressed air 200 kPa (2 kgf/cm^2) maximum.
   Direct air along pleats inside of filter element.

6. Inspect the filter element after cleaning. Do not use a filter element with damaged pleats, gasket or seats.

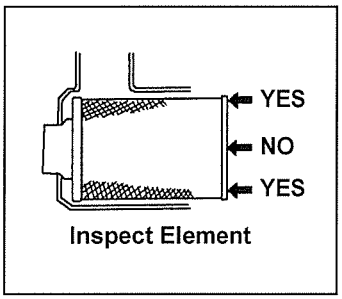


NOTE: The used element may be useful to find a foreign substance on the seal surface of the filter element, which can cause leak. If the striped dust is seen on the seal surface, it is a symptom of dust leak. If such dust seen, inspect if there are foreign substances, on the inside and outside of the housing seal tube.



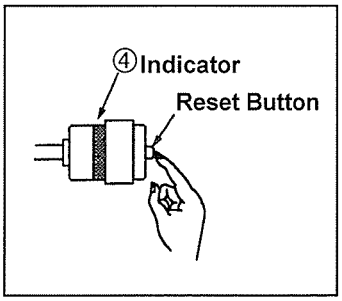
7. Install a clean element ② Install and secure the service cover ①.

NOTE: Insert a new element correctly. When the element seal unit is inserted into the seal tube, its seal surface is extended uniformly to seal the element. To seal the element more accurately, push securely not the center but the outer of the element end surface.



8. Reset the dust indicator ④ by pushing in the reset button.

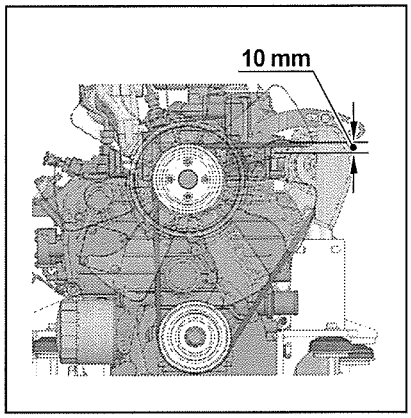
9. If the dust indicator indicated the red signal after starting the engine, change to new element.



NOTE: Normally a filter can be cleaned up to five times. Replace after five cleanings maximum.

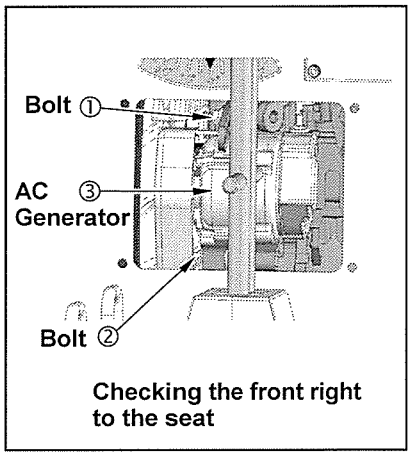
■ Fan and Alternator Belts

1. Stop the engine.
2. Open the access door on the rear of the machine.
3. Inspect the condition and adjustment of the belts. If the belt are damaged, replace them.
4. To check the belt tension, apply a 98N (10kgf) force, on belt, midway between the pulleys. Belt should deflect 10 to 15 mm.



To Adjust

1. Loosen bolts ① and ②.
2. Move alternator ③ so that belt tension will a deflection of approximately 10 mm (10 kg).
3. Tighten bolts ① and ②
4. If the belt is elongated and has no adjusting margin, replace the belt.



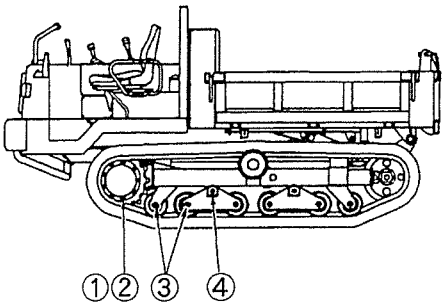
Checking the front right to the seat

3 - 8 500 HOURS MAINTENANCE AND CHECKS

First Perform Previous Service Hour Items.

■ Check the Fixed Bolt Torque

When loosened bolt or nut is found at daily check, tighten it with torque specifications table.



1. Special torque specifications

Special tighten is applied for main bolts as illustrated below.

When replacing bolts, apply molybdenum grease to bolts, nuts, and bearing surface of nuts. Then, tighten them with specified torque.

Items	Tighten point	Wrench Size (mm)	Thread Size metrie	Q'ty	Tighten torque N•m
①	Travel drive	22	M14	18	157
②	Sprocket	22	M14	18	157
③	Lower roller	24	M16	12	245
④	Rotary link	30	M20	4	392

Newton meter (N•m) is approximately the same as 0.1 kg•m

2. General torque specifications

Other than above-mentioned, refer the next table for torques.

Thread size metric	Wrench size (mm)	Tighten torque	
		Metric coarse H.T.	Metric fine H.T. bolt
		N•m	N•m
M8	13	23	25
M10	17	47	50
M12	19	83	91
M14	22	134	135
M16	24	206	220
M20	30	412	450
M24	36	715	813

High pressure-hose union nut	
Hose size (inch)	Tighten torque N•m
1/4"	25
3/8"	49
1/2"	59
3/4"	118
1"	137
1-1/4"	167

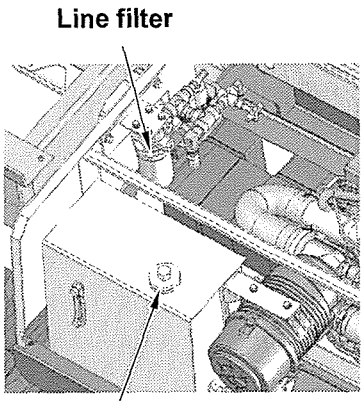
■ Change Line Fitter

⚠WARNING

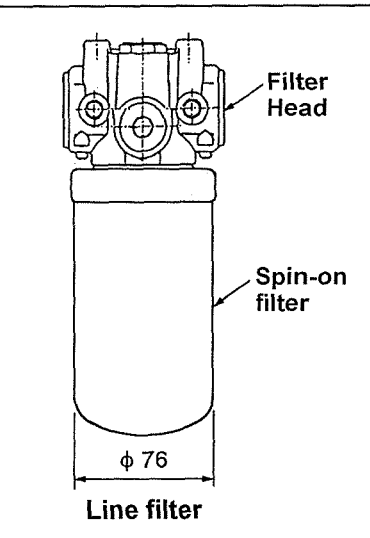
Hot oil can cause burns.

At operating temperature, the hydraulic tank is hot and under pressure.

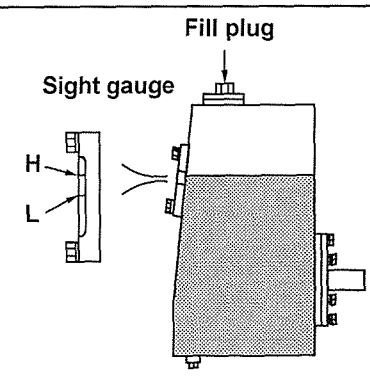
Remove the fill plug only when the engine is stopped, and the cap is cool enough to touch with your bare hand. Remove the fill plug slowly to relieve pressure.



1. Stop the engine.
2. Remove hydraulic tank oil fill plug slowly to relieve air pressure.
3. Remove the used spin-on type filter by filter wrench. Cean the filter head.
4. Coat the seal of new filter with clean hydraulic oil.
5. Install the new filter by filter wrench 2 kg-m tightnig torque.
6. Start and operate the engine to fill the filter. Maintain the oil level between ADD and FULL marks on the level gauge.
7. Check for leaks on the line filter.



☆ Replace it after 50-hours use at initial period.



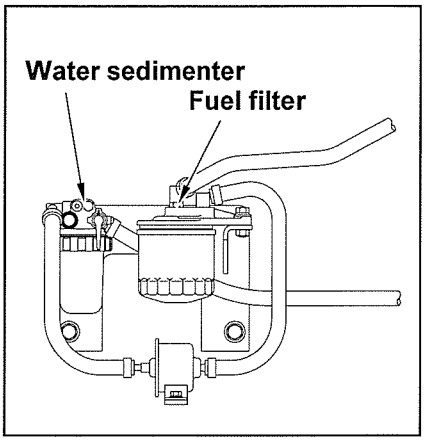
■ Replacing fuel filter elements

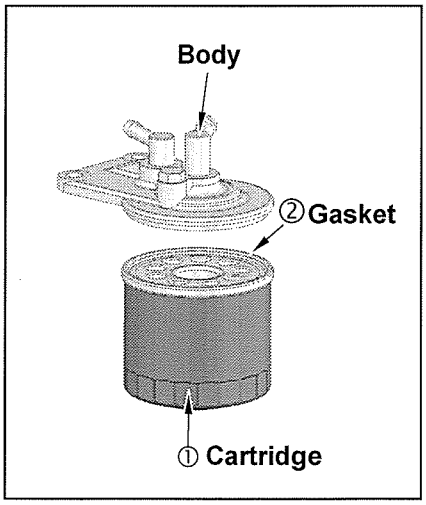
⚠ CAUTION

- Start replacement after each part of engine is cooled down.
- Do not put fire closely.
- Since spilt light oil may cause fire disasters, remove it by wiping off carefully.

IMPORTANT Do not over-tighten element assembly ①. Over-tightening may result in damages of the element.

1. Stop the engine.
2. With a filter wrench, turn element assembly ① counterlockwise to remove it.
3. Before mounting, coat engine oil thinly on the gasket of element assembly ①. After gasket ② contacts the seal surface, tighten by 3/4 to 1 turn.
4. After mounting, perform air purge.
5. Priming the system. There should be enough fuel in the system to allow the engine to start. Keep the engine start switch key at ON for a period of 20 seconds, which operates the fuel pump and priming automatically.

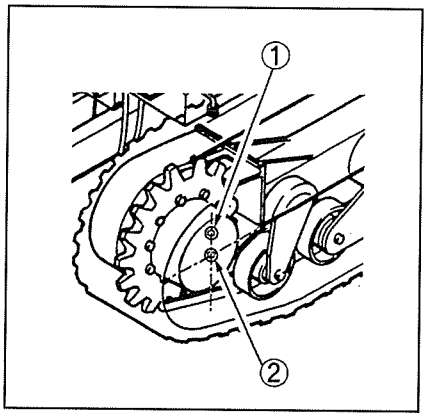




■ Check the Travel Drives Oil Level

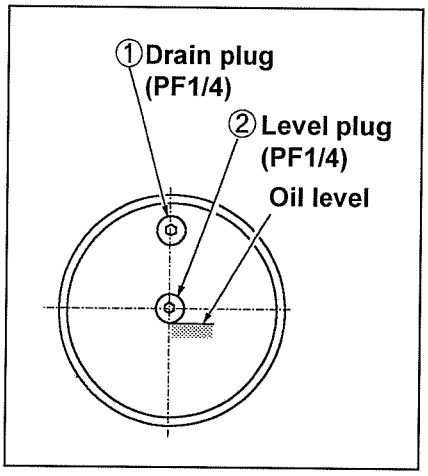
⚠ CAUTION

When the quantity of oil is found to have increased abnormaly, it is necessary to check the oil seal of the travel motor.
If the seal is leaking, contact a IHI dealer.



1. Remove the oil level/fill plug ②. Oil should be to the bottom of the level plug opening.
2. Add oil through the opening of oil level/fill plug ② if necessary.
3. Clean the plug ②. Install the plug ②.
4. Perform procedure on the other travel drive.

NOTE: Overfilling the travel reduction will case the travel motor seals to allow hydraulic oil or water to enter and contaminate the drive.

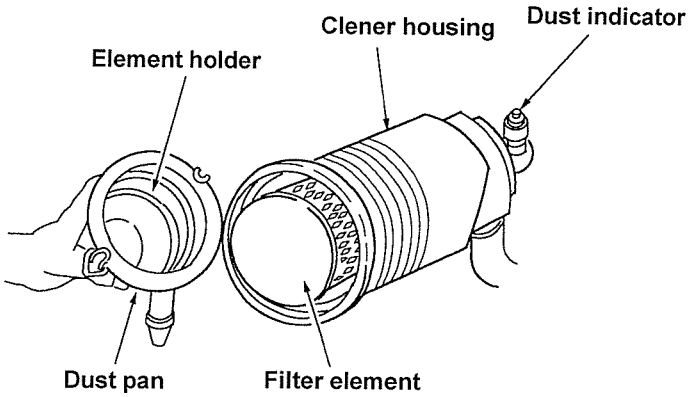


Recommended oil
IS0-VG320 API GI-4 (SAE 90)

■ Change the Air Filter Element

The air cleaner is equipped with a "Service-Signal" indicator located on the outlet side of the air cleaner. With the engine running, check indicator each day.

If red signal is in the service level, clean filter element or replace if necessary. Inspect filter gaskets for damage and replace if necessary.



1. Stop the engine.
2. Release the two latches and remove the dust pan.
3. Remove the filter element from the air cleaner housing.
4. Clean the inside of the air cleaner housing.
5. Remove the element holder from the dust pan and clean the element holder.
6. Install a new filter element. Install and secure the dust pan with arrow point upward.
7. Reset the dust indicator by pushing in the reset button.

⚠ CAUTION

- Service the air cleaner only with the engine stopped. Engine damage could result.

3 - 9 1000 HOURS MAINTENANCE AND CHECK

■ Change the Travel Drive Oil

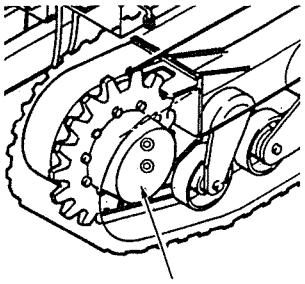
1. Position one travel drive with oil drain plug ① at the bottom.
2. Remove drain plug ① and oil level/plug ②. Allow the drain into a container.

NOTE: Dispose drained material according to local regulation.

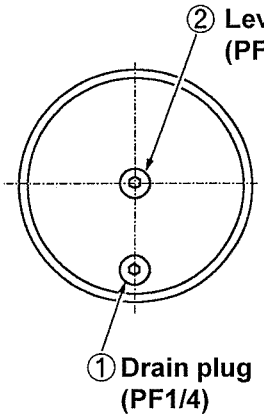
3. Clean the plugs.
4. Install drain plug ①.
5. Fill the travel drive to bottom of level plug opening.

Recommended oil	Refill capacities
ISO-VG320 API GL-4 (SAE 90)	0.6 L

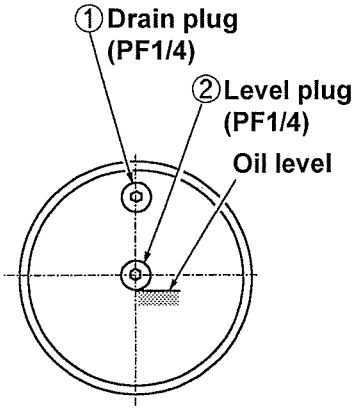
6. Install level/fill plug ②.
7. Perform procedure on the other travel reduction.
8. Start the engine and allow the travel drive to turn through several cycles.
9. Stop the engine, Check the oil level.
10. Check the drain oil for metal chips or particles. If there are any, consult your IHI dealer.



Travel reduction



Plug position upon oil drain



Plug position upon oil supply

■ Change hydraulic Oil and Clean the Strainer

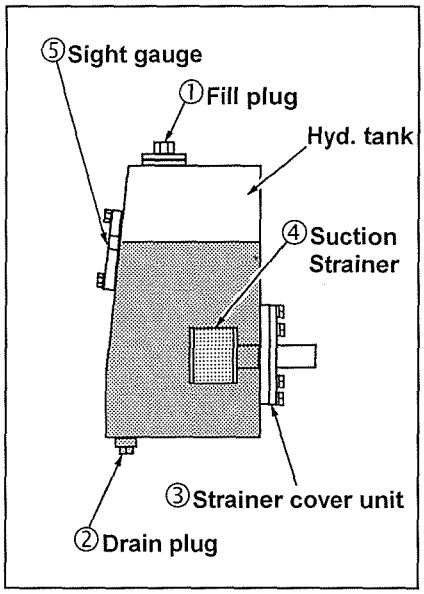
⚠ WARNING

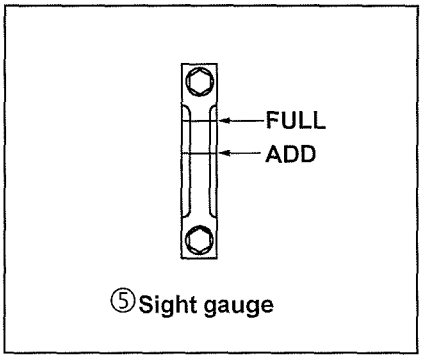
Hot oil can cause burns.

At operating temperature, the hydraulic tank is hot and under pressure.

Remove the fill plug only when the engine Is stopped, and the cap is cool enough to touch with your bare hand. Remove the fill plug slowly to relieve pressure.

1. Lower the body and stop the engine.
2. Remove hydraulic oil tank fill plug ① to relieve air pressure in the tank.
3. The hydraulic tank oil drain plug ② is located on the right side of the machine under the upper structure.
4. Remove the oil drain plug ②. Drain oil into a container.
   Drain oil in all parts of the hydraulic system thereafter.
5. Remove the strainer cover unit ③ from the hydraulic tank and clean the strainer ④.
6. Clean the inside of the tank with the clean oil.
7. Install the strainer cover unit ③, and drain plug.
8. Fill the hydraulic tank with oil.
   See "Recommended lubrication table."
   Clean and install the fill plug ①.
9. Start the engine and operate it at **LOW IDLE**, to fill hydraulic system. Check for leaks. Cycle all hydraulic motors and cylinder.
10. Lower the body. Stop the engine. Check the hydraulic oil level.
11. Maintain the oil level between **FULL** and **ADD** marks on the sight gauge.





3 - 10 2 YEARS MAINTENANCE AND CHECKS

COOLING SYSTEM COOLANT

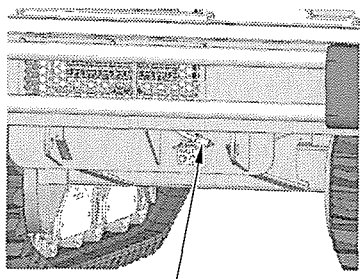
■ **Change the Coolant**

⚠ CAUTION

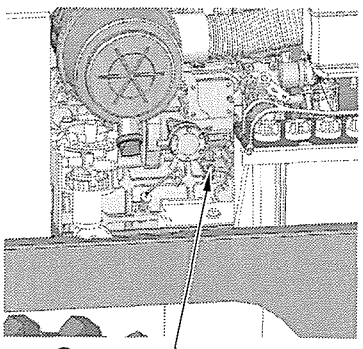
At operating temperature, the engine coolant is hot and under pressure.

Stem can cause personal injury.

Change the coolant only after the engine has been stopped and the fill cap is cool enough to touch with your bare hand.
Remove the fill cap slowly to relieve pressure.



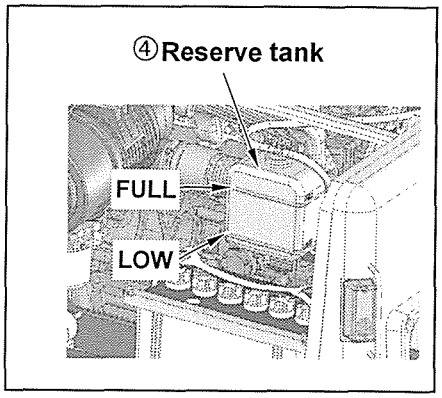
②**Drain cock (Radiator)**



③**Drain cock (Engine)**

Coolant should be drain+. However, when adding "Long-Life-Coolant" the drain period can be extended to 2 years.
Drain the coolant earlier whenever the coolant is dirty or foaming is observed.

1. Place the machine on firm and level ground. Stop the engine.
2. Remove the fill cap slowly to relieve pressure. (Do not handle while the coolant in hot!)
3. Open the drain valves and allow the coolant to drain into a conteiner. Drain valves located under the radiator and the cylinder block left side.
4. Close the drain valves. Fill the system with cleaning solution.
5. Start and operate the engine for 1/2 hour. Stop the engine and drain the cleaning solution.
6. Flush the system with water, with the engine stopped, until the draining water becomes clear.
7. Close the drain valves. Fill the system with clean water and run the engine for five minutes. Stop the engine and drain the water.
8. Repeat step 6 several times, if necessary, until the drained water becomes clear.
9. Add the coolant solution. See next page.
10. Operate the engine for five minutes with the fill cap off.
11. Maintain the coolant level to the fill port neck.
12. Replace the cap if the gasket is damaged. Install the cap.
13. Maintain the coolant level between the **FULL** and **LOW** marks on the reservoir.



■ Radiator exterior cleaning

When the radiator core is clogged, the cooling air flow is interrupted lowering the cooling efficiency.

Clean the radiator with a steam or a pressurized water at 500 hours interval. Whenever the radiator is found to be closed, clean it at any time.

■ Selection of coolant

Long-Life-Coolant (LLC) is supplied to this machine before shipment.

This is a coolant provided with properties of antifreeze, corrosion-proof and fouling-proof.

Its long lasting effects will maintain the machine free from coolant exchange for 2 years through summer and winter seasons.

The Long-Life-Coolant is therefore recommended for use with this machine when exchanging its coolant.

■ Mixing Rate of Long-Life-Coolant

The mixing ratio of Long-Life-Coolant with water determines the freezing point.

Select the mixing ratio for a freezing point lower by 5°C than the expected lowest atmospheric temperature.

Normally, the Long-Life-Coolant is used under a mixing ratio of 30 to 50%.

If the mixing ratio is less than 30%, occurrence of rust is feared and when it is over 50%, overheating is feared and sealing components may be deteriorated quicker than usual.

Meanwhile, use city water to mix with Long-Life-Coolant

Freezing point (°C)	–15	–25	–35
Mixing ration (%)	30	40	50
Quantity of LLC (L)	2.3	3.1	3.9
Quantity of water (L)	5.5	4.7	3.9
Coolant Total amount: 7.8 L	Engine proper: 3.7 L Radiator and other proper : 3.0 L Reserve tank : 1.1 L		

3 - 11 UNUSUAL OPERATING CONDITIONS

Special problems in maintenance and operation are caused by unusual conditions such as extremes in heat, cold and humidity, high altitude, salt water, and dusty or sandy work sites. When operating under such conditions, special precautions must be taken to prevent machine damage, minimize wear, and avoid component deterioration.

■ Extreme Cold

In periods of extreme cold, the problems of freeze damage, inadequate lubrication and battery failure may become particularly troublesome. With the onset of very cold weather, it is advisable to "winterize" the machine by servicing the cooling system and switching to the lubricants recommended for cold weather usage. Follow the recommendations below when the machine must be operated in very cold conditions.

1. To prevent freeze damage to the cooling system and cracking of the engine block or head, drain and flush the cooling system.
   Clean the radiator exterior, making certain the air passages through the core and the cooling fins are free of foreign matter.

   Refill the cooling system, adding an antifreeze solution recommended by the engine manufacturer in an amount and strength appropriate to the anticipated temperatures. A corrosion inhibitor is recommended.

   Never use a chromatic base corrosion inhibitor when the coolant contains ethylene glycol. Use only non-chromatic base inhibitors.

   Inspect the thermostat, clamps, radiator hoses and radiator core for proper condition.
   Replace or repair any cooling system component found to be defective.

2. Condensation in the fuel tank contaminates the fuel supply with water, which can freeze in the fuel lines and block the fuel flow to the engine. To minimize this possibility, keep the tank as full as is practical during cold weather.
   This may entail refilling the tank more frequently than usual, but the inconvenience is small compared to clearing a blocked fuel line.
   If water should be noticed in the fuel supply, drain the tank and refill it with uncontaminated fuel

3. Lubricate the machine with the lubricants recommended for cold weather operation in the Lubrication Section, If necessary, change the engine oil and other lubricants in order to conform to the recommendations.

4. The battery is more likely to sustain freeze damage if not kept fully charged because its electrolyte will freeze at a higher temperature than that in a fully charged battery. Be certain the battery is charging when the engine is running and use an external charger to restore full charge when the machine is not being operated.
   The battery can discharge if snow or ice short circuits the terminals. Keep the battery posts and cable connectors clean and dry.
   Remove any corrosion with a solution of soda and water.
   During extremely cold weather, it is advisable to remove and store the battery in a heated area when the machine is to remain idle overnight or for any extended period.

⚠ CAUTION

Water added to the battery can freeze before it mixes with the electrolyte.
During very cold weather, add water to the battery just prior to, or during operation of the machine. If the machine is not to be run, water may be added if an external charger is connected to the battery.

5. Special attention must be given to the hydraulic oil during very cold weather.

> **⚠ CAUTION**
>
> **BEFORE** attempting any working operations, warm up the hydraulic oil as described in "Pre-Operation Warm-Up on page 45".

6. At the end of the work period, or whenever the machine is to be left idle for extended periods, prevent it from being frozen to the ground by parking it on wood, concrete, asphalt or mat surface.

■ Extreme Heat

Like extreme cold, extreme heat requires that precautions be taken with respect to the cooling system, the battery and lubrication. Protect the machine by performing the following recommended procedures:

1. High temperatures necessitate the use of lubricants which are both more viscous and which resist deterioration at higher operating temperatures. Refer to the Lubrication Section and lubricate the machine using the lubricants recommended for the expected temperatures.
   Crankcase oil is particularly important because it helps dissipate heat. Check the oil level frequently and add oil as required to maintain required level. Too little oil will hinder heat dissipation.

2. To ensure proper coolant circulation, drain and flush the cooling system, clean any foreign matter from the radiator cooling fins and through-core air passages, replace defective hoses, tighten hose clamps, tension the water pump drive belt properly, eliminate any leaks detected and fill the system with a 50% solution of ethylene glycol.
   A corrosion inhibitor is recommended.
   Engine overheating due to loss of coolant will most often be corrected by **SLOWLY** adding coolant while the engine is running at **FAST IDLE**. Should this fail to correct the problem, drain and flush the system and refill with fresh coolant (50% solution of ethylene glycol) and a corrosion inhibitor.

   Allow the engine to cool before draining and flushing the cooling system.
   Water containing more than small concentrations of salt or minerals should not be used in the cooling system. Salt facilitates corrosion and minerals deposit on the coolant passage walls.
   Both processes inhibit proper cooling.

3. Increased evaporation rates will cause the battery electrolyte level to fall more rapidly during very hot weather. Check the level frequently and add distilled water as required to maintain the proper level.

4. Air circulation around the engine and battery must not be restricted. Keep air intake and exhaust openings clear of leaves, paper or other foreign matter which may restrict air flow.

5. Keep the engine clean of dirt, grease and other substances which inhibit heat dissipation.

6. Operate engine at full throttle when digging or tracking machine.
   Run the engine only when engaged in work operations or when traveling the machine.
   Avoid prolonged periods at idle and shut the engine down if operations are interrupted.

■ Sandy or Dusty Work Sites

The presence of large amounts of sand or dust at the work site can contribute to accelerated component weather. Either substance will act as an abrasive when deposited on moving parts of the machine.

This problem can be alleviated by increasing the schedule of lubrication and by servicing breathers and filters at more frequent intervals.
Follow the recommendations below when operating in sand or dust on a regular bases.

1. Keep sand and dust out of the hydraulic system by keeping the reservoir filler cap tight and servicing the hydraulic system filters frequently.

2. The fuel system should be kept free of sand and dust by keeping the tank filler cap tight and servicing the fuel filters frequently.

3. The engine breathers and air cleaner should also be serviced frequently to prevent sand and dust from entering the engine. The engine oil and oil filter should be changed at shorter than normal intervals to ensure a clean oil supply to the engine's moving parts.

4. When lubricating the machine, thoroughly clean each grease fitting before attaching the grease gun. Pump generous amounts of grease into all lubrication points, using the fresh grease to pump out old.

5. Adequate ground bearing support may be required for the tracks when operating in soft sand. Be alert for signs of track digging into sand during operations. It may be necessary to back off and fill in area where tracks dig in.
   The increased frequency of lubrication and service discussed above should be determined by observations made at the work site. Inspection will determine how long it takes for lubricants, breathers and filters to accumulate unacceptable amounts of sand or dust. The frequency of lubrication and service should be adjusted accordingly.

■ High Humidity or Saltwater

In some locations, such as coastal areas, the machine may be exposed to the deteriorating effects of salt, moisture, or both. To protect exposed metallic surfaces, wiring, paint and other items, keep them dry and well lubricated where salt or high humidity are encountered. Follow the recommendations below when operating in these conditions.

1. Make frequent inspections for rust and corrosions and remove them as soon as they are detected. Dry and paint exposed surfaces after rust and corrosion have been removed.

2. Where paint may not be applied, such as on polished or machined surfaces, coat the area with grease or lubricant to repel water.

3. Keep bearings and their surrounding surfaces well lubricated to prevent the entry of water.

4. Never use saltwater in the cooling system. Internal corrosion will occur and all parts will have to be replaced.

5. Hose down the machine periodically when working in saltwater. If necessary, use an oil soaked cloth to clean moving parts.

6. If the machine is submerged, be sure it is never submerged in water deeper than upper crawler belt.

If the machine exceeds this limit, disassemble, clean and lubricate the lower.

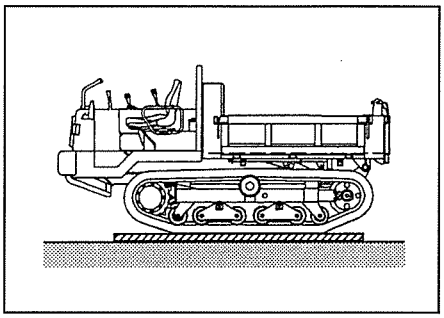
■ High Altitudes

Variations in altitude alter the fuel-air mixture burned in the engine and affect the engine's performance. At high altitudes, atmospheric pressures are lower and less oxygen is available for combustion of the fuel. Above 1500 meter, the engine fuel setting may have to be changed to ensure proper performance.
Consult engine manufacturer should this problem anse.
Keeping the air cleaner clean and free of obstructions will help alleviate high altitude problems.
At high altitudes, closely monitor the engine temperature for overheating.

3 - 12 LONG TERM STORAQE

If the machine is to be stored for more than one month, observe the following precautions so that its function will not be impaired during storage.

■ Before Storage



To protect the cylinder rods, set the machine position in the right illustration. (To prevent the cylinder rods from being rusted)

To store the machine from long term, follow the next procedures.

- Clean parts of the machine and store indoors.
  If you have to place the machine outdoors, choose a flat place and cover the machine.
- Be sure to perform fill the fuel , lubrication, and oil change.
- Store the battery after remove the negative terminal and covering it or dismounting the battery from the machine.
- Lock the dump lever with the lock lever.

■ During Storage

During storage, operate the machine once a month to maintain films of oil at the lubrication section and charge the battery at the same time.

■ After Storage

After long term storage, follow the next procedures before operating the machine.

- Be sure to perform fill the fuel and lubrication.

4 TROUBLE SHOOTING

4 - 1 TROUBLE AND REMEDY

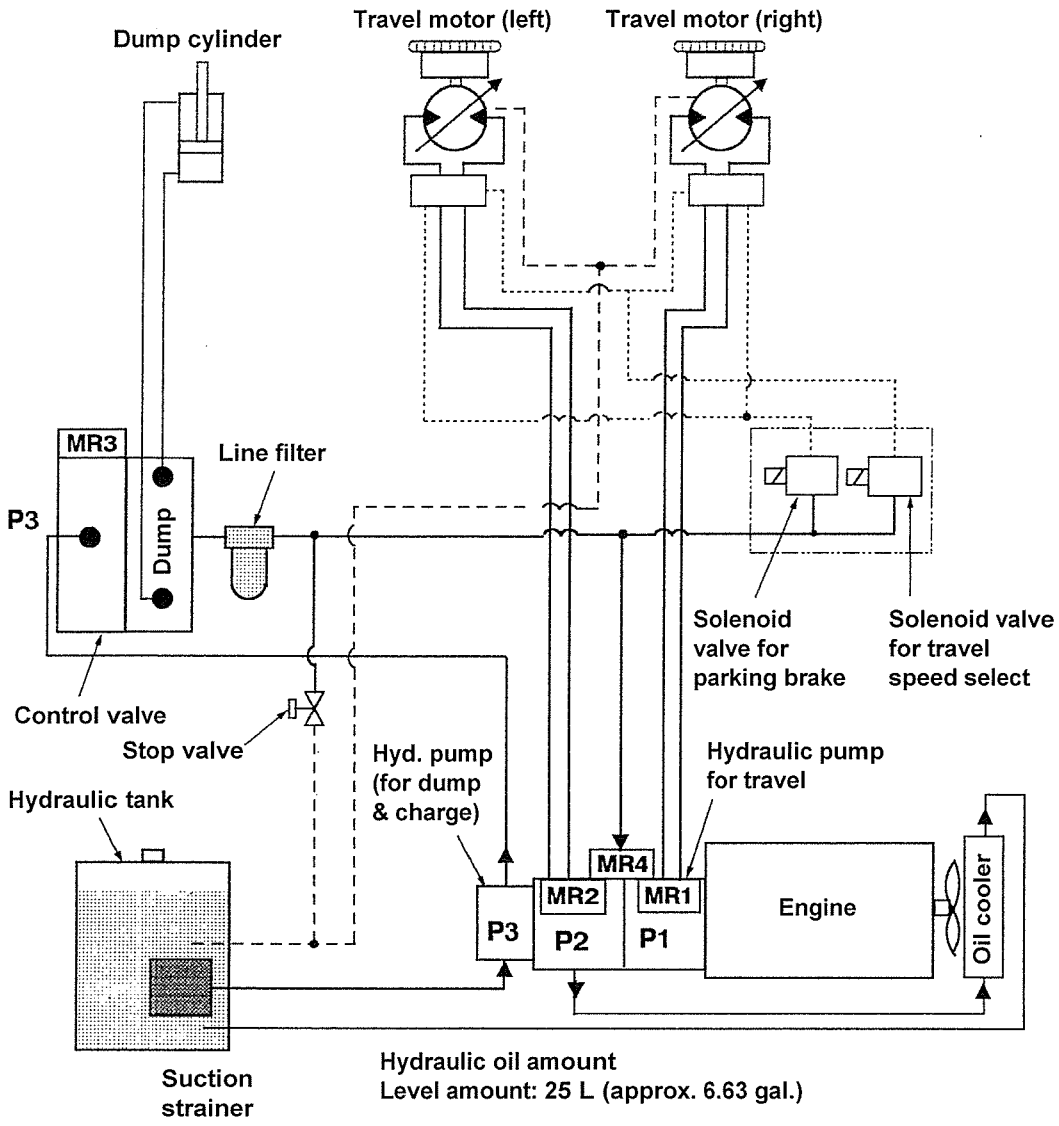
It is essential to detect any abnormality at early stage and prevent trouble in advance by fully understanding normal performance and conditions of the machine during daily operation. If any abnormality is detected, immediately investigate cause and take necessary action such as adjustment, repair, and so on. Keeping operation with detected abnormality may cause more serious trouble.
Regarding to procedures marked with ★ , contact the distributor or service personnel.

■ Engine

SYMPTOM	PROBABLE CAUSE	REMEDY
Engine does not start.	• Shot of fuel • Clogged fuel filter • Mixed water in fuel system • Stopped fuel pump • Burned fuse • Insufficiently charged battery • Defect of wiring • Defect of injection pump or nozzle • Insufficient compressed pressure	• Supply fuel and bleed air. • Clean the fuel filter. • Drain mixed water. • Replace the fuel pump. • Check and replace fuse. • Charge the battery. ★ Check and repair wires. ★ Repair and replace pump or nozzle. ★ Repair parts.
Engine oil pressure warning lamp lights.	• Short of oil in oil pan • Clogged oil filter • Defect of oil pressure switch • Defect of monitor	• Supply oil. • Replace element. ★ Replace parts. ★ Replace parts.
Engine water temperature gauge	• Short or leakage of coolant • Slack of fan belt • Damage or stain inside the cooling system • Clogged radiator fin or fall of fin • Defect of thermostat • Defect of thermosensor or water temperature gauge	• Supply coolant or fix water leakage. • Adjust tension of fan belt. • Replace coolant and clean cooling system. • Clean or repair fin. ★ Replace thermostat. ★ Replace water temperature gauge or sensor.
Engine water thermometer gauge points white zone even after long operation	• Defect of thermostat	★ Replace thermostat.
Exhaust of the engine is white or blue.	• Excessive oil of oil pan • Mixed water in fuel	• Drain oil up to the specified level. • Drain mixed water.
Exhaust of engine is black of dark gray.	• Oil of poor quality • Clogged air cleaner • Defect of nozzle • Insufficiently compressed	• Replace with specified fuel. • Clean or replace Cleaner. ★ Replace nozzle. ★ Disassemble to repair or replace

5 HYDRAULIC SYSTEM DIAGRAM

5 - 1 HYDRAULIC SYSTEM DIAGRAM

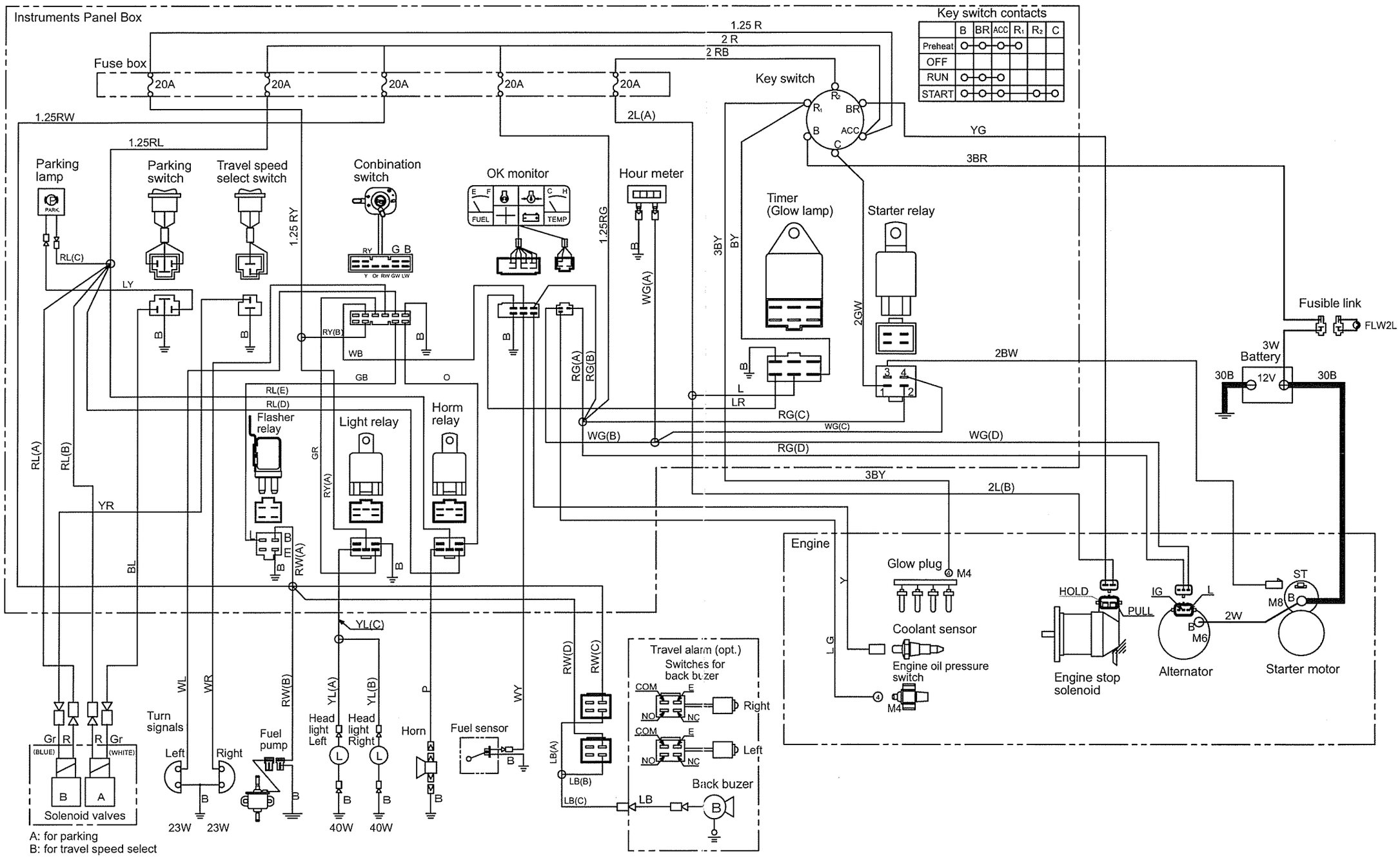


Relief valve set pressure;

Code	Item	Pressure	
		MPa	kgf/cm^2
MR1	Main relief valve for right travel motor	30.9	315
MR2	Main relief valve for left travel motor	30.9	315
MR3	Main relief valve for P3 dump pump	18.6	190
MR4	Charge relief valve	1.5	15

6 ELECTRIC SYSTEM DIAGRAM

6 - 1 ELECRIC SYSTEM DIAGRAM



Notes :

AVS=0.85 is applied for a thickness of wire without remark.

All figures of coupler are illustrated from the connected side.

Terminal marking —□ CB104

—▷ CA104

7 SPECIFICATIONS

7 - 1 GENERAL SPECIFICATIONS

■ BASE MACHINE PERFORMANCE

Travel speed	km/h	Low : 6.0 High : 11.0
Gradability	% (deg.)	58 (30)

■ ENGINE

Engine model	–	KUBOTA V2203-M
Engine type		4cycle, water cooled, diesel
No. of cyl. – bore × stroke	mm	4 – 87 × 92.4
Total piston displacement	L	2.197
Rated output (SAE J1349)	kW (PS)/rpm	34.6 (47.0) ± 5%/2800
Max. torque (SAE J1349)	N•m (kgf•m)/rpm	143.2 (14.6) ± 5%/1700

■ WEIGHT

Unloaden vehicle weight		kg	2250
Maximum payload		kg	2500
Average ground bearing pressure	With unloaden	kPa(kgf/cm^2)	25.1 (0.26)
	With load		53.0 (0.54)

■ CAPACITY

Body capacity	Struck	m^3	0.8
	Heaped		1.2

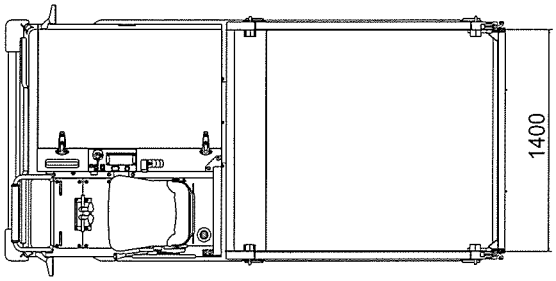
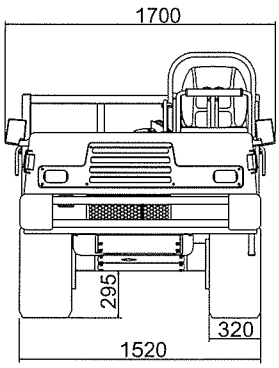
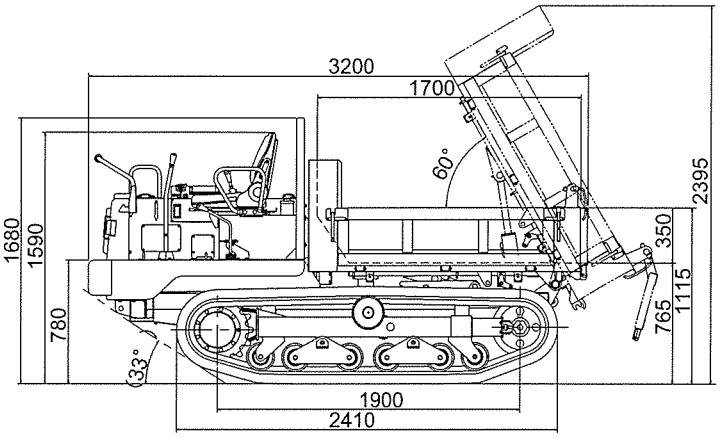
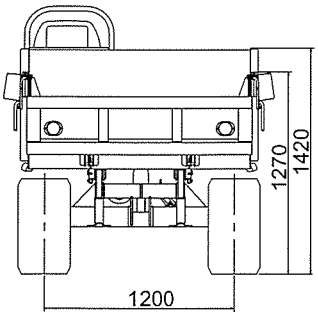
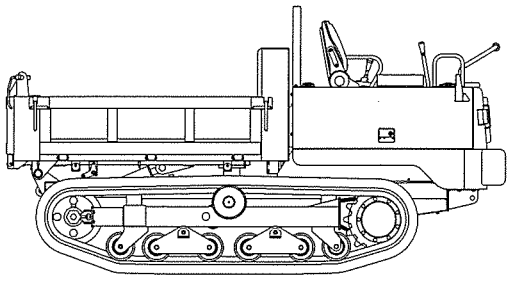
7 SPECIFICATIONS

7 - 1 GENERAL SPECIFICATIONS

■ AMOUNT OF FUEL, LUBRICATING OIL AND COOLANT

Fuel		L	52
Hydraulic fluid	Oil level	L	25
	Total amount in system	L	30
Engine oil	Max. level	L	9.7
	Min. level	L	7.0
Coolant	Engine proper	L	3.7
	Total amount	L	7.8

■ TRAVEL DRIVE SYSTEMS

Travel drive system	–	Hydraulic Static Transmission (H.S.T)
Transmission system	–	2 speed motor and pump flow control
Transmission stage		2 stage (Low, High)
Brake system	–	H.S.T hydraulic brake and mechanical parking brake
H.S.T set pressure	MPa (kgf/cm^2)	30.9 (315)

7 - 2 OVERALL DIMENSIONS