

Operation & Maintenance Manual

SEAM034800

PC28UU-2

HYDRAULIC EXCAVATOR

SERIAL NUMBERS PC28UU-11295 and up

WARNING

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

NOTICE

Komatsu has Operation & Maintenance Manuals written in some other languages. If a foreign language manual is necessary, contact your local distributor for availability.

KOMATSU

1. FOREWORD

This manual provides rules and guidelines which will help you use this machine safely and effectively. Keep this manual handy and have all personnel read it periodically. If this manual has been lost or has become dirty and can not be read, request a replacement manual from Komatsu or your Komatsu distributor.

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

Continuing improvements in the design of this machine can lead to changes in detail which may not be reflected in this manual. Consult Komatsu or your Komatsu distributor for the latest available information of your machine or for questions regarding information in this manual.

This manual may contain attachments and optional equipment that are not available in your area. Consult Komatsu or your Komatsu distributor for those items you may require.

WARNING

- **Improper operation and maintenance of this machine can be hazardous and could result in serious injury or death.**
- **Operators and maintenance personnel should read this manual thoroughly before beginning operation or maintenance.**
- **Some actions involved in operation and maintenance of the machine can cause a serious accident, if they are not done in a manner described in this manual.**
- **The procedures and precautions given in this manual apply only to intended uses of the machine. If you use your machine for any unintended uses that are not specifically prohibited, you must be sure that it is safe for you and others. In no event should you or others engage in prohibited uses or actions as described in this manual.**
- **Komatsu delivers machines that comply with all applicable regulations and standards of the country to which it has been shipped. If this machine has been purchased in another country or purchased from someone in another country, it may lack certain safety devices and specifications that are necessary for use in your country. If there is any question about whether your product complies with the applicable standards and regulations of your country, consult Komatsu or your Komatsu distributor before operating the machine.**
- **The description of safety is given in SAFETY INFORMATION on page 0-2 and in SAFETY from page 1-1.**

CALIFORNIA


Proposition 65 Warning


Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.


2. SAFETY INFORMATION

Most accidents are caused by the failure to follow fundamental safety rules for the operation and maintenance of machines. To avoid accidents, read, understand and follow all precautions and warnings in this manual and on the machine before performing operation and maintenance.

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

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

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

-  **CAUTION** – This word is used on safety messages and safety labels for hazards which could result in minor or moderate injury if the hazard is not avoided. This word might also be word for hazards where the only result could be damage to the machine.

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

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

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

3. INTRODUCTION

3.1 INTENDED USE

This Komatsu HYDRAULIC EXCAVATOR is designed to be used mainly for the following work:

- Back hoe work
- Smoothing work
- Ditching work
- Side ditching work
- Loading work

See the section "12.11 WORK POSSIBLE USING HYDRAULIC EXCAVATOR" for further details.

3.2 FEATURES

In addition to the functions generally found on small hydraulic excavators with boom offset, this machine also has the following mechatronics equipment.

- Interference prevention device
If the bucket comes close to the cab, this device functions to stop the work equipment and to sound an alarm. Please read the instructions on the method of operation and the precautions in the safety section, and be sure to use this device correctly.
- Auto-stop device for work equipment (if equipped)
This device automatically controls the display of the digging depth, the setting for the amount that the boom can be raised or lowered, and the positioning of the left offset. For details of the method of the operation, see "12.19 HANDLING 4-SYSTEM".

3.3 BREAKING IN THE MACHINE

Your Komatsu machine has been thoroughly adjusted and tested before shipment. However, operating the machine under severe conditions at the beginning can adversely affect the performance and shorten the machine life.

Be sure to break in the machine for the initial 100 hours (as indicated by the service meter.)

During breaking in:

- Idle the engine for 5 minutes after starting it up.
- Avoid operation with heavy loads or at high speeds.
- Avoid sudden starts, sudden acceleration, sudden steering and sudden stops except in cases of emergency.

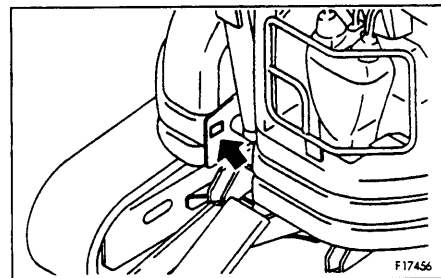
The precautions given in this manual for operating, maintenance, and safety procedures are only those that apply when this product is used for the specified purpose. If the machine is used for a purpose that is not listed in this manual, Komatsu cannot bear any responsibility for safety. All consideration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

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

4. LOCATION OF PLATES, TABLE TO ENTER SERIAL NO. AND DISTRIBUTOR

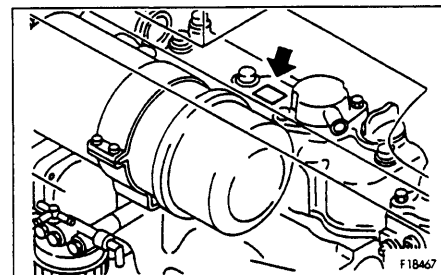
4.1 MACHINE SERIAL NO. PLATE POSITION

On the bottom right of the cab.



4.2 ENGINE SERIAL NO. PLATE POSITION

On the upper side of the engine cylinder head cover.



4.3 TABLE TO ENTER SERIAL NO. AND DISTRIBUTOR

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

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SAFETY

 **WARNING**

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

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

6. GENERAL PRECAUTIONS

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

SAFETY RULES

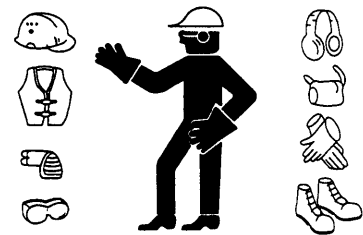
- ONLY trained and authorized personnel can operate and maintain the machine.
- Follow all safety rules, precautions and instructions when operating or performing maintenance on the machine.
- When working with another operator or a person on worksite traffic duty, be sure all personnel understand all hand signals that are to be used.

SAFETY FEATURES

- Be sure all guards and covers are in their proper position. Have guards and covers repaired if damaged.
- Use safety features such as safety lock properly.
- NEVER remove any safety features. ALWAYS keep them in good operating condition.
Safety lever → See "12.12 PARKING MACHINE".
- Improper use of safety features could result in serious bodily injury or death.

CLOTHING AND PERSONAL PROTECTIVE ITEMS

- Avoid loose clothing, jewelry, and loose long hair. They can catch on controls or in moving parts and cause serious injury or death. Also, do not wear oily clothes because they are flammable.
- Wear a hard hat, safety glasses, safety shoes, mask or gloves when operating or maintaining the machine. Always wear safety goggles, hard hat and heavy gloves if your job involves scattering metal chips or minute materials - this is so particularly when driving pins with a hammer and when cleaning the air cleaner element with compressed air.
Check also that there is no one near the machine.
Driving in pins → See "12.18 REPLACEMENT OF BUCKET".
Cleaning of air cleaner element → See "24.2 WHEN REQUIRED" in service procedure.

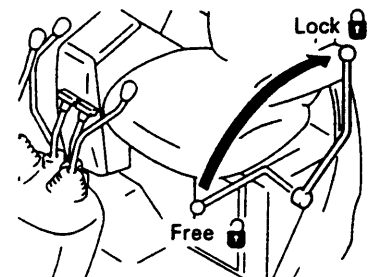


UNAUTHORIZED MODIFICATION

- Any modification made without authorization from Komatsu can create hazards.
- Before making a modification, consult your Komatsu distributor. Komatsu will not be responsible for any injury or damage caused by any unauthorized modification.

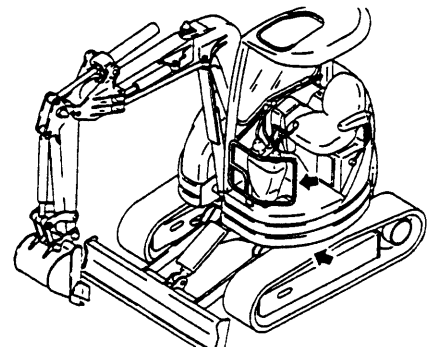
ALWAYS APPLY LOCK WHEN LEAVING OPERATOR'S SEAT

- When standing up from the operator's seat, always place the safety lock lever securely in the LOCK position. If you accidentally touch the travel or swing lever when they are not locked, the work equipment may suddenly move and cause serious injury or damage.
- When leaving the machine, lower the work equipment completely to the ground, set the safety lock lever to the LOCK position, then stop the engine and use the key to lock all the equipment. Always take the key with you.
Work equipment posture → See 12.12 PARKING MACHINE.



MOUNTING AND DISMOUNTING

- NEVER jump on or off the machine. NEVER get on or off a moving machine.
- When mounting and dismounting, face the machine and use the handholds and truck shoes.
- Do not hold any control levers when getting on or off the machine.
- Ensure safety by always maintaining at least three-point contact of hands and feet with the handrails or track shoes.
- Repair any damaged handhold or step, and tighten any loose bolts. Handholds and steps must be free of oil, grease and excessive dirt.
- Always remove any oil or mud from the handrails and track shoes. If they are damaged, repair them and tighten any loose bolts.



FIRE PREVENTION FOR FUEL AND OIL

Fuel, oil, and antifreeze can be ignited by a flame. Fuel is particularly **FLAMMABLE** and can be **HAZARDOUS**.

- Keep a flame away from flammable fluids.
- Stop the engine and do not smoke when refueling.
- Tighten all fuel and oil caps securely.
- Refueling and oiling should be made in well ventilated areas.
- Keep oil and fuel in the determined place and do not allow unauthorized persons to enter.

**PRECAUTIONS WHEN HANDLING AT HIGH TEMPERATURES**

- Immediately after operations are stopped, the engine coolant, engine oil, and hydraulic oil are at high temperatures, and are still under pressure. Attempting to remove the cap, drain the oil or water, or replace the filters may lead to serious burns. Always wait for the temperature to go down, and follow the specified procedures when carrying out these operations.
- To prevent hot water from spurting out:
 - 1) Turn engine off.
 - 2) Allow water to cool.
 - 3) Slowly loosen cap to relieve pressure before removing.
- To prevent hot oil from spurting out:
 - 1) Turn engine off.
 - 2) Allow oil to cool.
 - 3) Slowly loosen cap to relieve pressure before removing.



ASBESTOS DUST HAZARD PREVENTION

Asbestos dust can be HAZARDOUS to your health if it is inhaled.

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

- NEVER use compressed air for cleaning.
- Use water for cleaning to keep down the dust.
- Operate the machine with the wind to your back, whenever possible.
- Use an approved respirator if necessary.



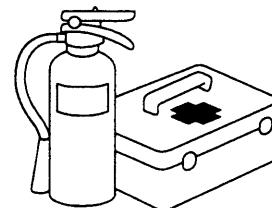
CRUSHING OR CUTTING PREVENTION

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



FIRE EXTINGUISHER AND FIRST AID KIT

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



PRECAUTIONS FOR ATTACHMENTS

- When installing and using an optional attachment, read the instruction manual for the attachment and the information related to attachments in this manual.
- Do not use attachments that are not authorized by Komatsu or your Komatsu distributor. Use of unauthorized attachments could create a safety problem and adversely affect the proper operation and useful life of the machine.
- Any injuries, accidents, product failures resulting from the use of unauthorized attachments will not be the responsibility of Komatsu.

7. PRECAUTION DURING OPERATION

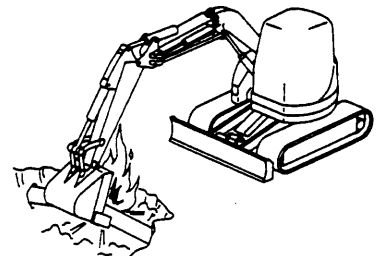
⚠ WARNING: Failure to follow these safety precautions may lead to a serious accident.

7.1 BEFORE STARTING ENGINE

SAFETY AT WORKSITE

- Before starting the engine, thoroughly check the area for any unusual conditions that could be dangerous.
- Before starting the engine, examine the terrain and soil conditions of the worksite. Determine the best and safest method of operation.
- Make the slope as horizontal as possible before continuing operations.
- If you need to operate on a street, protect pedestrians and cars by designating a person for worksite traffic duty or by installing fences around the worksite.
- If water lines, gas lines, and high-voltage electrical lines may be buried under the worksite, contact each utility and identify their locations. Be careful not to sever or cut any of these lines.
- Check the depth and flow of water before operating in water or crossing a river. NEVER be in water which is in excess of the permissible water depth.

Permissible water depth → See "12.9 PRECAUTIONS FOR OPERATION".



FIRE PREVENTION

- Thoroughly remove wood chips, leaves, paper and other flammable things accumulated on the engine compartment. They could cause a fire.
- Check fuel, lubrication, and hydraulic systems for leaks. Have any leaks repaired. Wipe up any excess oil, fuel or other flammable fluids.
Check point → See "12.1.1 WALK-AROUND CHECK".
- Be sure a fire extinguisher is present and working.



IN OPERATOR'S CAB

- Do not leave tools or spare parts lying around in the operator's compartment. They may damage or break the control levers or switches. Always put them in the tool box.
- Keep the cab floor, controls, steps and handholds free of oil, grease, snow, and excess dirt.

VENTILATION FOR ENCLOSED AREAS

- If it is necessary to start the engine within an enclosed area, provide adequate ventilation. Exhaust fumes from the engine can KILL.



PRECAUTIONS FOR MIRRORS, WINDOWS AND LIGHTS

- Remove all dirt from the surface of the windows and lights to ensure that you can see well.
- Check that the head lamps and working lamps are installed to match the operating conditions. Check also that they light up properly.

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

7. PRECAUTIONS DURING OPERATION

7.2 OPERATING MACHINE

WHEN STARTING ENGINE

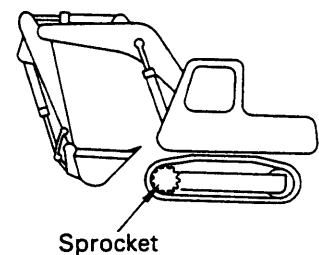
- Walk around your machine again just before mounting it, checking for people and objects that might be in the way.
- NEVER start the engine if a warning tag has been attached to the control.
- When starting the engine, sound the horn as an alert.
- Start and operate the machine only while seated.
- Do not allow anyone other than the operator to ride in the cab or on the machine body.

CHECK DIRECTION BEFORE STARTING MACHINE

Before operating the travel lever, check the direction of the track frame. If the sprocket is at the front, the travel lever must be operated in the opposite direction.

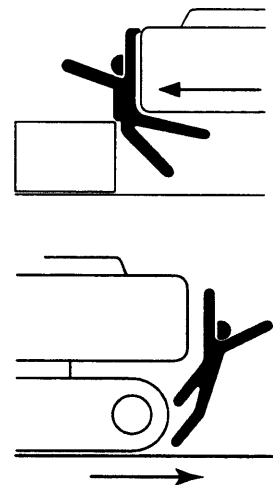
Travel operations → See "12.4 MOVING MACHINE OFF".

Travel in reverse direction



CHECK THAT NO ONE IS IN AREA BEFORE SWINGING OR TRAVELING IN REVERSE

- Always position a signalman in places in dangerous places or places where the view is not clear.
- Make sure that no one comes inside the swing radius or direction of travel.
- Before starting to move, sound the horn or give a signal to warn people not to come close to the machine.
- There are blind spots behind the machine, so if necessary, swing the upper structure to check that there is no one behind the machine before traveling in reverse.

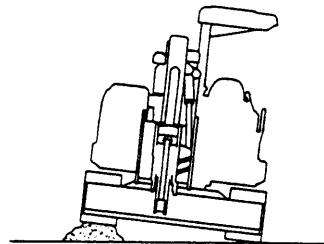
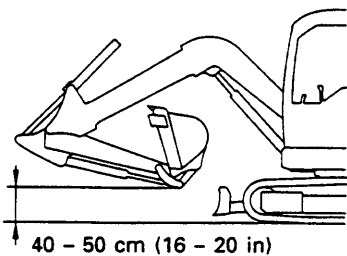


PRECAUTIONS WHEN TRAVELING

- Fold in the work equipment as shown in the diagram below, and keep it at a height of 40 – 50 cm from the ground level before starting to travel.
- When traveling, do not operate the work equipment levers. If the work equipment levers have to be operated, never operate them suddenly.
- When traveling on rough ground, travel at low speed, and avoid sudden changes in direction.
- Avoid traveling over obstacles as far as possible. If the machine has to travel over an obstacle, keep the work equipment as close to the ground as possible and travel at low speed. Never travel over obstacles which make the machine tilt strongly (10° or more).

Travel posture

INCORRECT



TRAVELING ON SLOPES

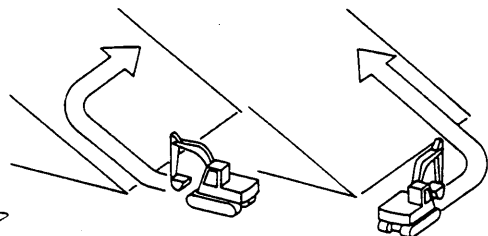
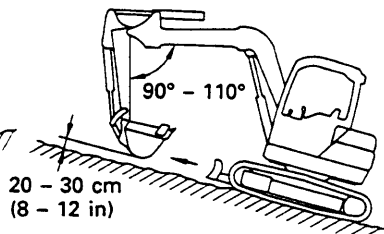
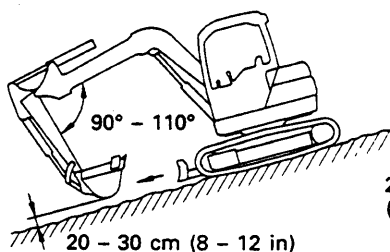
- Traveling on hills, banks or slopes that are steep could result in the machine tipping over or slipping.
- On hills, banks or slopes, carry the bucket closer to the ground, approximately 20 to 30 cm (8 to 12 in) above the ground. In case of emergency, quickly lower the bucket to the ground to help the machine stop and prevent it from tipping over.
- Do not turn on slopes or travel across slopes. Always go down to a flat place to perform these operations.
Method of traveling on slopes → See “12.9 PRECAUTIONS FOR OPERATION”.
- Do not travel up and down on grass, fallen leaves, and wet steel plates. These materials may allow the machine to slip, if it is traveling sideways. Keep travel speed very low.

Downhill

Uphill

INCORRECT

CORRECT



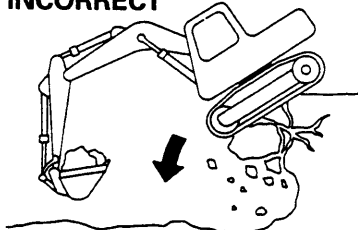
⚠ WARNING: Failure to follow these safety precautions may lead to a serious accident.

7. PRECAUTIONS DURING OPERATION

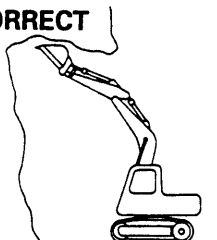
PROHIBITED OPERATIONS

- Do not dig the work face under an overhang. This may cause the overhang to collapse and fall on top of the machine.
- Do not carry out deep digging under the front of the machine. The ground under the machine may collapse and cause the machine to fall.

INCORRECT



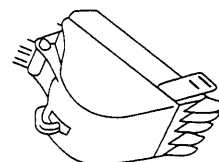
INCORRECT



IT IS PROHIBITED TO LIFT LOADS

- It is prohibited to use this machine for lifting loads.
- It is permitted to use this machine only for pulling out steel plates, but this work requires the use of a special device.

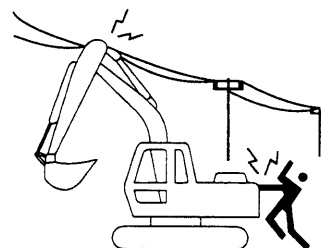
Lifting loads → See "12.8 PROHIBITIONS FOR OPERATION".



DO NOT GO CLOSE TO HIGH-VOLTAGE CABLES

- Going close to high-voltage cables can cause electric shock. Always maintain the safe distance given below between the machine and the electric cable.
- The following actions are effective in preventing accidents.
 - 1) Wear shoes with rubber or leather soles.
 - 2) Use a signalman to give warning if the machine approaches too close to the electric cable.
- If the work equipment should touch the electric cable, the operator should not leave the operator's compartment.
- When carrying out operations near high voltage cables, do not let anyone come close to the machine.
- Check with the electricity company about the voltage of the cables before starting operations.

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



DO NOT HIT WORK EQUIPMENT

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

ENSURE GOOD VISIBILITY

- When working in dark places, install working lamps and head lamps, and set up lighting in the work area if necessary.
- Stop operations if the visibility is poor, such as in mist, snow, or rain, and wait for the weather to improve to a condition that allows the operation to be carried out safely.

OPERATE CAREFULLY ON SNOW

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

WORKING ON LOOSE GROUND

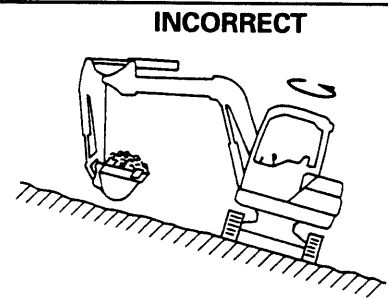
- Avoid operating your machine too close to the edge of cliffs, overhangs, and deep ditches. If these areas collapse, your machine could fall or tip over and result in serious injury or death. Remember that the soil after heavy rain or blasting is weakened in these areas.
- Earth laid on the ground and the soil near ditches are loose. They can collapse under the weight or vibration of your machine.
- Install the HEAD GUARD if working in areas where there is danger of falling rocks and dirt.

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

7. PRECAUTIONS DURING OPERATION

OPERATIONS ON SLOPES

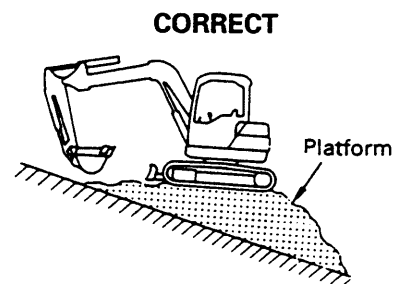
- When working on slopes, there is danger that the machine may lose its balance and turn over when the swing or work equipment are operated. Always carry out these operations carefully.
- Do not swing the work equipment from the uphill side to the downhill side when the bucket is loaded. This operation is dangerous.
(See the upper diagram on the right.)



- If the machine has to be used on a slope, pile the soil to make a platform that will keep the machine as horizontal as possible.

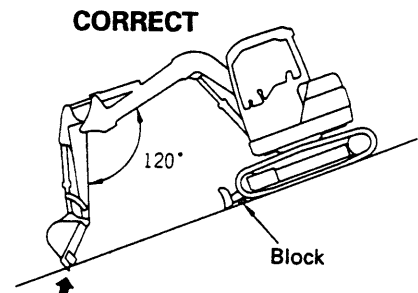
(See the lower diagram on the right.)

Piled soil on slope → See "12.10 PRECAUTIONS WHEN TRAVELING UP OR DOWN HILL".



PARKING THE MACHINE

- Park on level ground whenever possible. If not possible, block the tracks, lower the bucket to the ground and thrust the bucket in the ground.

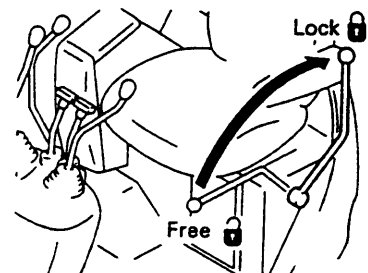


- When parking on public roads, provide fences and signs, such as flags or lights, on the machine to warn passersby to be careful. Be sure that the machine, flags or lights do not obstruct traffic.
Parking procedure → See "12.12 PARKING MACHINE".

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

Work equipment posture → See "12.12 PARKING MACHINE".

Places to lock → See "12.16 LOCKING".



7.3 TRANSPORTATION

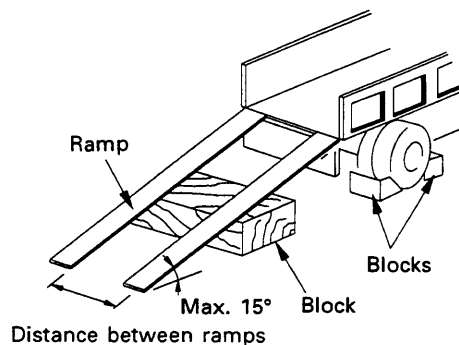
LOADING AND UNLOADING

- Loading and unloading the machine always involves potential hazards. **EXTREME CAUTION SHOULD BE USED.**
- Perform loading and unloading on firm, level ground only. Maintain a safe distance from the edge of a road.
- **ALWAYS** block the wheels of the hauling vehicle and place blocks under both ramps before loading and unloading.
- **ALWAYS** use ramps of adequate strength. Be sure the ramps are wide and long enough to provide a safe loading slope.
- Be sure that the ramps are securely positioned and fastened, and that the two sides are at the same level as one another.
- Be sure the ramp surface is clean and free of grease, oil, ice and loose materials. Remove dirt from the machine tracks.
- **NEVER** correct your steering on the ramps. If necessary, drive away from the ramps and climb again.
- After loading, block the machine tracks and secure the machine with tie-downs.

Loading and unloading → See "13. TRANSPORTATION".

Tie-downs → See "13. TRANSPORTATION".

CORRECT



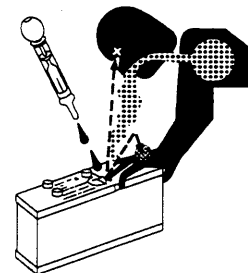
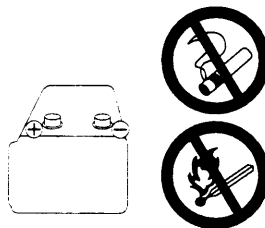
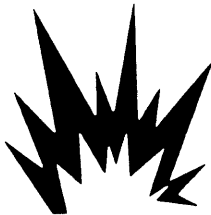
SHIPPING

- When shipping the machine on a hauling vehicle, obey all state and local laws governing the weight, width, and length of a load. Also obey all applicable traffic regulations.
- Determine the shipping route while taking into account the width, height and weight of the load.

7.4 BATTERY

BATTERY HAZARD PREVENTION

- Battery electrolyte contains sulfuric acid and can quickly burn the skin and eat holes in clothing. If you spill acid on yourself, immediately flush the area with water.
- Battery acid could cause blindness if splashed into the eyes. If acid gets into the eyes, flush them immediately with large quantities of water and see a doctor at once.
- If you accidentally drink acid, drink a large quantity of water or milk, beaten egg or vegetable oil. Call a doctor or poison prevention center immediately.
- When working with batteries. ALWAYS wear safety glasses or goggles.
- Batteries generate hydrogen gas. Hydrogen gas is very EXPLOSIVE, and is easily ignited with a small spark or flame.
- Before working with batteries, stop the engine and turn the starting switch to the OFF position.
- Avoid short-circuiting the battery terminals through accidental contact with metallic objects, such as tools, across the terminals.
- Tighten the battery terminals securely. Loosened terminals can generate sparks and lead to an explosion.

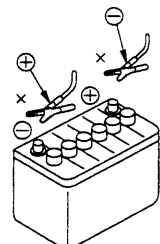


STARTING WITH BOOSTER CABLES

- ALWAYS wear safety glasses or goggles when starting the machine with booster cables.
- When starting from another machine, do not allow the two machines to touch.
- Be sure to connect the positive (+) cable first when installing the booster cables. Disconnect the ground or negative (-) cable first when removing them.
- If any tool touches between the positive (+) terminal and the chassis, it will cause sparks. This is dangerous, so be sure to work carefully.
- Connect the batteries in parallel: positive to positive and negative to negative.
- When connecting the ground cable to the frame of the machine to be started, be sure to connect it as far as possible from the battery.

Starting with booster cables → See "16.4 IF BATTERY IS DISCHARGED".

INCORRECT

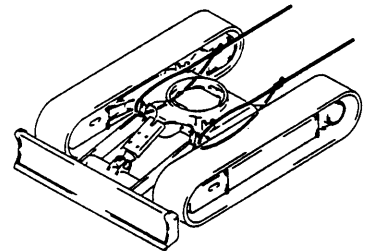


7.5 TOWING

WHEN TOWING, ATTACH WIRE TO FRAME

- Injury or death could result if a disabled machine is towed incorrectly.
- If your machine is towed by another machine, ALWAYS use a wire rope with a sufficient towing capacity.
- NEVER allow a disabled machine to be towed on a slope.
- Do not use a kinked or frayed wire rope.
- Do not straddle the towing cable or wire rope.
- When connecting up a towing machine, do not let anyone enter the area between the towing machine and the equipment being towed.
- Set the towing machine and the towing connection of the equipment being towed in a straight line when connecting it.

Towing method → See "16. TROUBLESHOOTING".



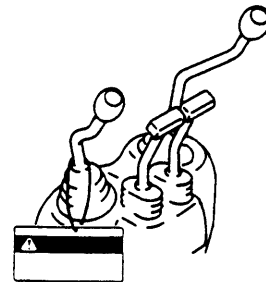
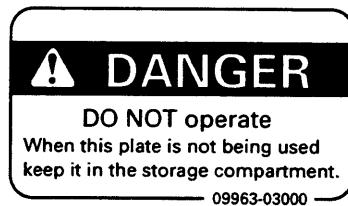
8. PRECAUTIONS FOR MAINTENANCE

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

8.1 BEFORE CARRYING OUT MAINTENANCE

WARNING TAG

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



PROPER TOOLS

- Use only tools suited to the task. Using damaged, low quality, faulty, or makeshift tools could cause personal injury.
Tools → See "21.1 INTRODUCTION OF NECESSARY TOOLS".

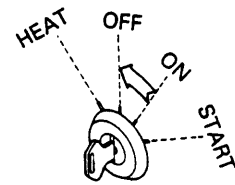


PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

- Replace the following fire-related components periodically:
Fuel system: Fuel hose, spilling hose, and fuel tube cap
Hydraulic system: Pump outlet hose, and front and rear pump branch hoses
- Replace these components periodically with new ones, regardless of whether or not they appear to be defective. These components deteriorate over time.
- Replace or repair any such components if any defect is found, even though they have not reached the time specified.
Replacement of safety critical components → See "22. PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS".

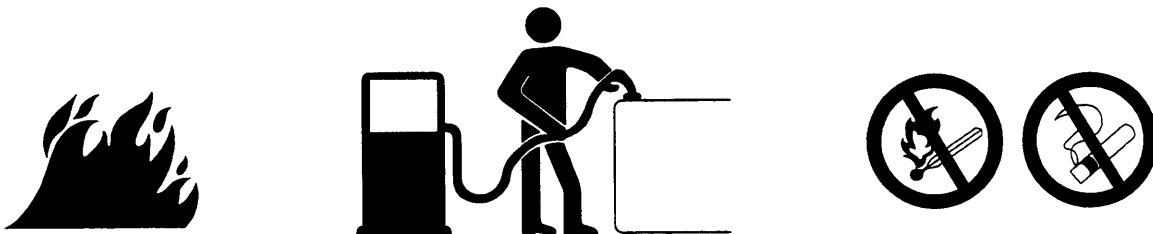
STOP THE ENGINE BEFORE CARRYING OUT INSPECTION AND MAINTENANCE

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



RULES TO FOLLOW WHEN ADDING FUEL OR OIL

- Keep away from flame when filling with fuel or oil.
- Spilled fuel and oil may cause you to slip, so always wipe it up immediately.
- Always tighten the cap of the fuel and oil fillers securely.
- Never use fuel for washing any parts.
- Always add fuel and oil in a well-ventilated place.

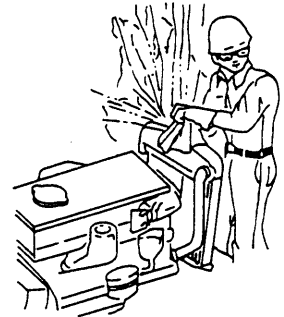


⚠ WARNING: Failure to follow these safety precautions may lead to a serious accident.

8. PRECAUTIONS FOR MAINTENANCE

RADIATOR WATER LEVEL

- If it is necessary to add water to the radiator, stop the engine and allow the engine and radiator to cool down before adding the water.
- Slowly loosen the caps to relieve pressure before removing the caps.



USE OF LIGHTING

- When checking fuel, oil, coolant, or battery electrolyte, always use lighting with anti-explosion specifications. If such lighting equipment is not used, there is danger of explosion.



8.2 DURING MAINTENANCE

PERSONNEL

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

ATTACHMENTS

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



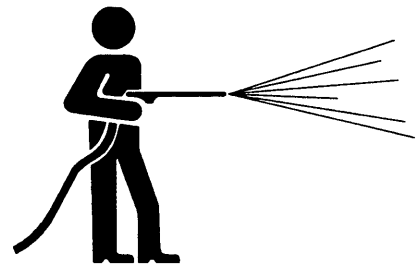
WORK UNDER THE MACHINE

- Always lower all movable work equipment to the ground or to their lowest position before performing service or repairs under the machine.
- Always block the tracks of the machine securely.
- Never work under the machine if the machine is poorly supported.



KEEP THE MACHINE CLEAN

- Spilled oil or grease, or scattered tools or broken pieces are dangerous because they may cause you to slip or trip.
Always keep your machine clean and tidy.
- If water gets into the electrical system, there is danger that the machine may not move or may move unexpectedly.
Do not use water or steam to clean the sensors, connectors, or the inside of the operator's compartment.



PRECAUTIONS WITH BATTERY

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

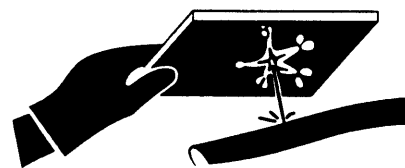


HANDLING HIGH-PRESSURE HOSES

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

PRECAUTIONS WITH HIGH PRESSURE OIL

- Do not forget that the work equipment circuits are always under pressure.
- Do not add oil, drain oil, or carry out maintenance or inspection before completely releasing the internal pressure.
- If oil is leaking under high pressure from small holes, it is dangerous if the jet of high-pressure oil hits your skin or enters your eyes. Always wear safety glasses and thick gloves, and use a piece of cardboard or a sheet of wood to check for oil leakage.
- If you are hit by a jet of high-pressure oil, consult a doctor immediately for medical attention.



PRECAUTIONS WHEN CARRYING OUT MAINTENANCE AT HIGH TEMPERATURE OR HIGH PRESSURE

- Immediately after stopping operations, the engine cooling water and oil at all parts is at high temperature and under high pressure. In this condition, if the cap is removed, or the oil or water are drained, or the filters are replaced, this may result in burns or other injury. Wait for the temperature to go down, then carry out the inspection and maintenance in accordance with the procedures given in this manual.

Cleaning inside or cooling system → see “24.2 WHEN REQUIRED”.

Checking cooling water level, oil level in hydraulic tank → see “24.3 CHECK BEFORE STARTING”.

Checking lubricating oil level → see “24.3 CHECK BEFORE STARTING”.

Changing oil, replacing filters → see “24.5 - 8 PERIODIC MAINTENANCE”.



PRECAUTIONS WHEN USING HIGH PRESSURE GREASE TO ADJUST TRACK TENSION

Grease is pumped into the track tension adjustment system under high pressure. If the specified procedure for maintenance is not followed when making adjustments, the plug or grease fitting may fly out and cause damage or personal injury.

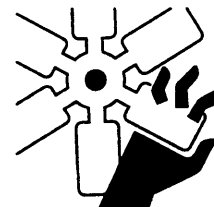
- When loosening the grease drain plug, never loosen it more than one turn.
- Never put your face, hands, feet, or any other part of your body directly in front of any grease drain plug or valve.

Adjusting track tension → see “24.2 WHEN REQUIRED”.



ROTATING FAN AND BELT

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

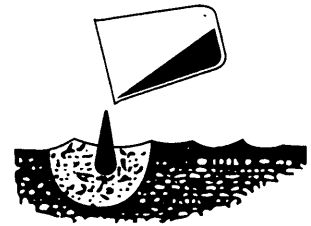


⚠ WARNING: Failure to follow these safety precautions may lead to a serious accident.

WASTE MATERIALS

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

INCORRECT



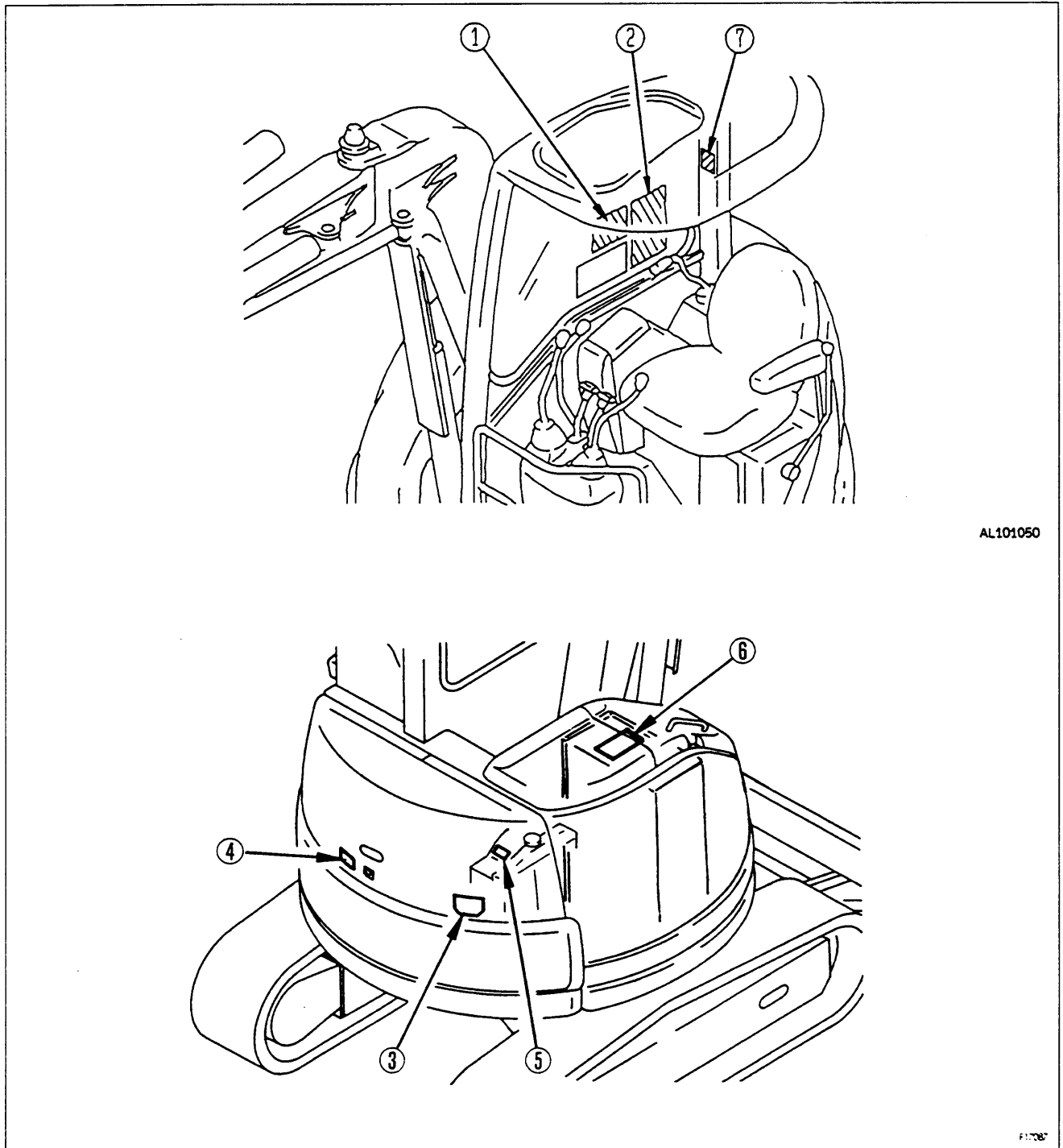
9. POSITION FOR ATTACHING SAFETY LABELS

Always keep these labels clean. If they are lost or damaged, attach them again or replace them with a new label.

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

Safety labels may be available in languages other than English. To find out what labels are available, contact your Komatsu distributor.


9.1 POSITION FOR ATTACHING SAFETY LABELS



The position for sticking these labels is shown for reference.
Confirm the machine for the actual position to stick the labels.

These labels are samples. Confirm the machine for the actual labels.

1. Warnings for leaving operator's seat (203-00-61270)
Warnings for operation, inspection and maintenance (14X-98-11580)




WARNING

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

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

203-00-61270



WARNING

Improper operation and maintenane can cause serious injury or death.

Read manual and labels before operation and maintenance.

Follow instructions and warnings in manual and in labels on machine.

Keep manual in machine cab near operator.

Contact komatsu distributor for a replacement manual.

14X-98-11580

2. Cautions for handling interference prevention device (21W-98-21420)

HANDLING INTERFERENCE PREVENTION DEVICE

CHECKS BEFORE STARTING

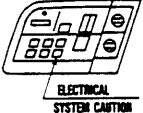
TO MAINTAIN THE INTERFERENCE PREVENTION DEVICE IN CORRECT WORKING ORDER, CARRY OUT THE FOLLOWING CHECKS BEFORE STARTING. IF ANY ABNORMALITY IS FOUND, HAVE IT CHECKED IMMEDIATELY.

1. CHECK THE FOLLOWING WHEN STARTING THE ENGINE.

WHEN KEY IS ON	CAUTION	BUZZER
WHEN STARTING ENGINE	LIGHTS UP FOR 3 SEC	SOUNDS FOR 1 SEC
	OFF	DOES NOT SOUND

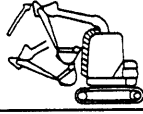
2. MAKE THE LEFT CONTROL BOX SPRING UP AND CHECK THAT IT IS IMPOSSIBLE TO OPERATE THE WORK EQUIPMENT.

3. OPERATE THE BOOM, ARM, AND OFFSET INDIVIDUALLY, AND CHECK THAT THE BUCKET ALWAYS STOPS AUTOMATICALLY WHEN IT COMES NEAR THE CAB (CANOPY).




ELECTRICAL SYSTEM CAUTION

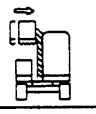
BOOM OPERATION
FRONT FACE OF CAB



ARM OPERATION
FRONT FACE OF CAB



OFFSET OPERATION
SIDE FACE OF CAB




4. IN COLD AREAS, ALWAYS DO THE FOLLOWING BEFORE STARTING THE OPERATIONS.

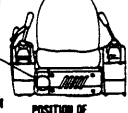
1. WARM UP THE ENGINE FOR 5 MINUTES. (RUN THE ENGINE AT A MIDRANGE SPEED.)
2. PUSH THE BUCKET OUT OR KEEP IT PULLED IN AND WARM UP THE HYDRAULIC OIL FOR A FURTHER 5 MINUTES.

PRECAUTIONS FOR USE

1. IF THE ELECTRICAL SYSTEM CAUTION LAMP FLASHES OR THE BUZZER SOUNDS DURING OPERATIONS, OR IF IT BECOMES IMPOSSIBLE TO CARRY OUT OPERATIONS, STOP OPERATIONS IMMEDIATELY AND HAVE THE MACHINE CHECKED. IF IT IS NECESSARY TO MOVE THE MACHINE TO A SAFE PLACE, TURN ON THE CANCEL SWITCH BEFORE MOVING THE MACHINE. (DO NOT USE THE CANCEL SWITCH EXCEPT IN EMERGENCIES.)
2. DO NOT DISASSEMBLE THE SENSORS ATTACHED TO THE WORK EQUIPMENT, AND BE CAREFUL NOT TO HIT THEM AGAINST ANY EXTERNAL OBJECT. IF THE SENSOR IS DAMAGED, THE INTERFERENCE PREVENTION DEVICE MAY NOT WORK NORMALLY.
3. WHEN REPLACING THE WORK EQUIPMENT WITH THE SLIDE ARM OR LONG ARM SPECIFIED BY KOMATSU, ALWAYS CARRY OUT THE REPLACEMENT OPERATION AT THE WORK SHOP SPECIFIED BY KOMATSU. WHEN INSTALLING ANY ATTACHMENT NOT RECOMMENDED BY KOMATSU, THE INTERFERENCE PREVENTION DEVICE AND WORK EQUIPMENT AUTOMATIC CONTROL DEVICE WILL NOT WORK PROPERLY, SO BE EXTREMELY CAREFUL DURING OPERATIONS.



NORMAL POSITION



POSITION FOR EMERGENCIES

POSITION OF CANCEL SWITCH

21W-98-21420

3. Keeping out of turning area (20Y-00-21270)



DANGER

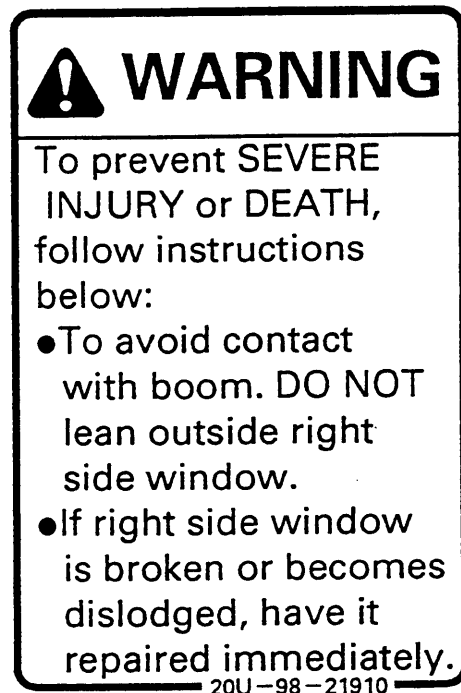
Keep off swing area

9. POSITION FOR ATTACHING SAFETY LABELS

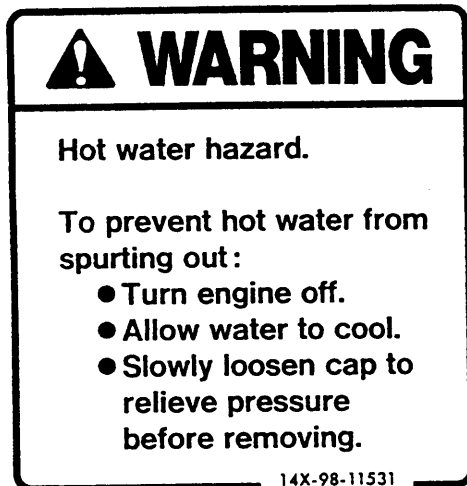
4. Warnings for opening engine hood
(21W-98-21480)



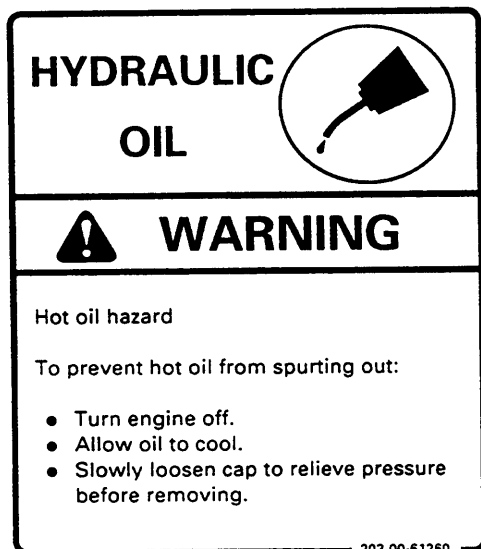
7. Warning for removing window
(20U-98-21910)



5. Warnings for high temperature coolant
(14X-98-11531)



6. Warnings for high temperature hydraulic oil
(203-00-61260)

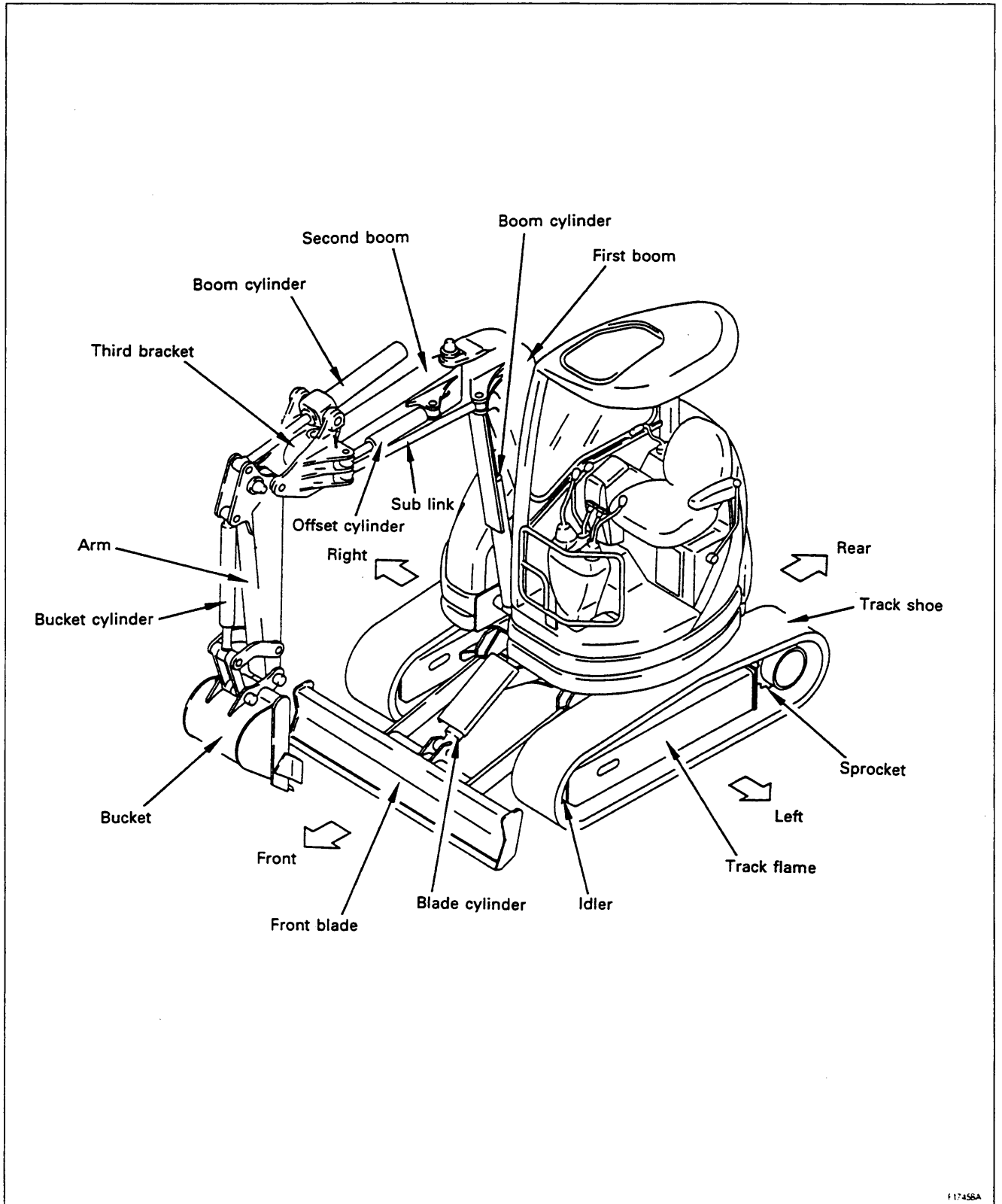


OPERATION

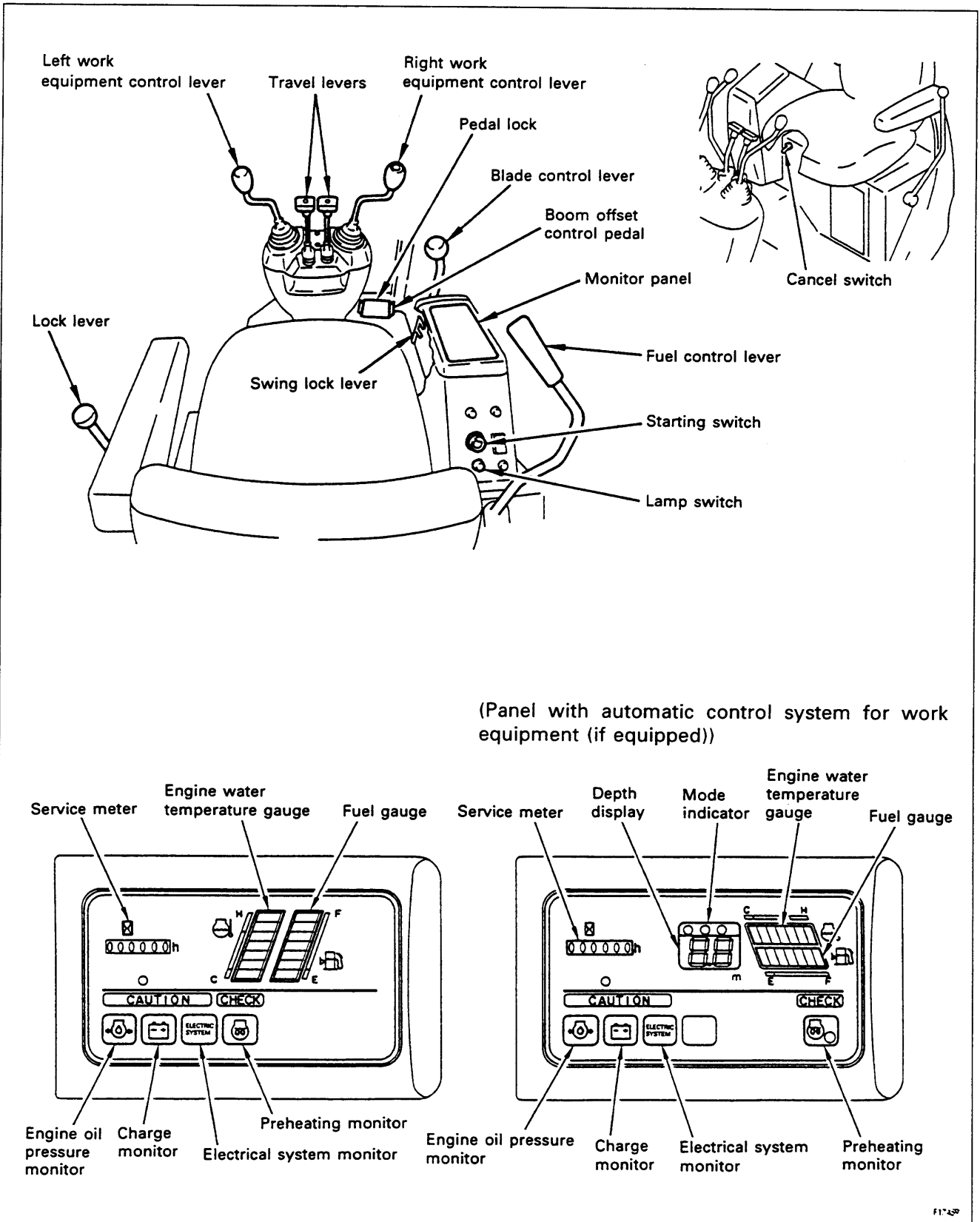
10. GENERAL VIEW

10.1 GENERAL VIEW OF MACHINE

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



10.2 GENERAL VIEW OF CONTROLS AND GAUGES



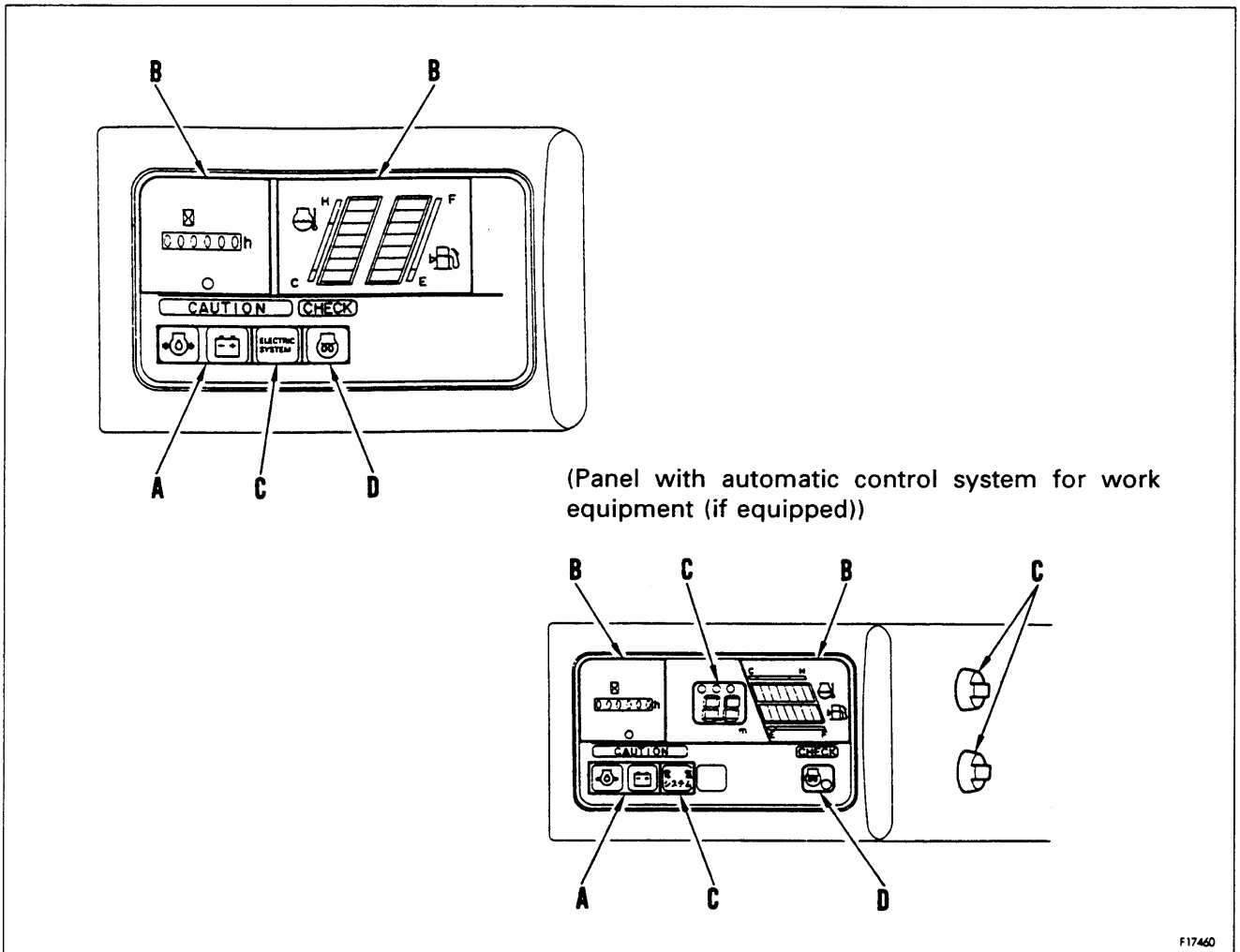
11. EXPLANATION OF COMPONENTS

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

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

Before reading the explanation of components, please read the table below to check what equipment is installed to your machine.

11.1 MACHINE MONITOR



F17460

A. EMERGENCY STOP ITEMS (11.1.1)

These are items which need to be observed while the engine is running. If any abnormality occurs, items which need to be repaired immediately are displayed.

If there is any abnormality, the appropriate monitor lamp will flash and the buzzer will sound to indicate the location of the abnormality.

CAUTION

If any monitor lamp flashes, stop the work, and repair it immediately.

B. METERS (11.1.2)

This shows the engine water temperature and fuel level.

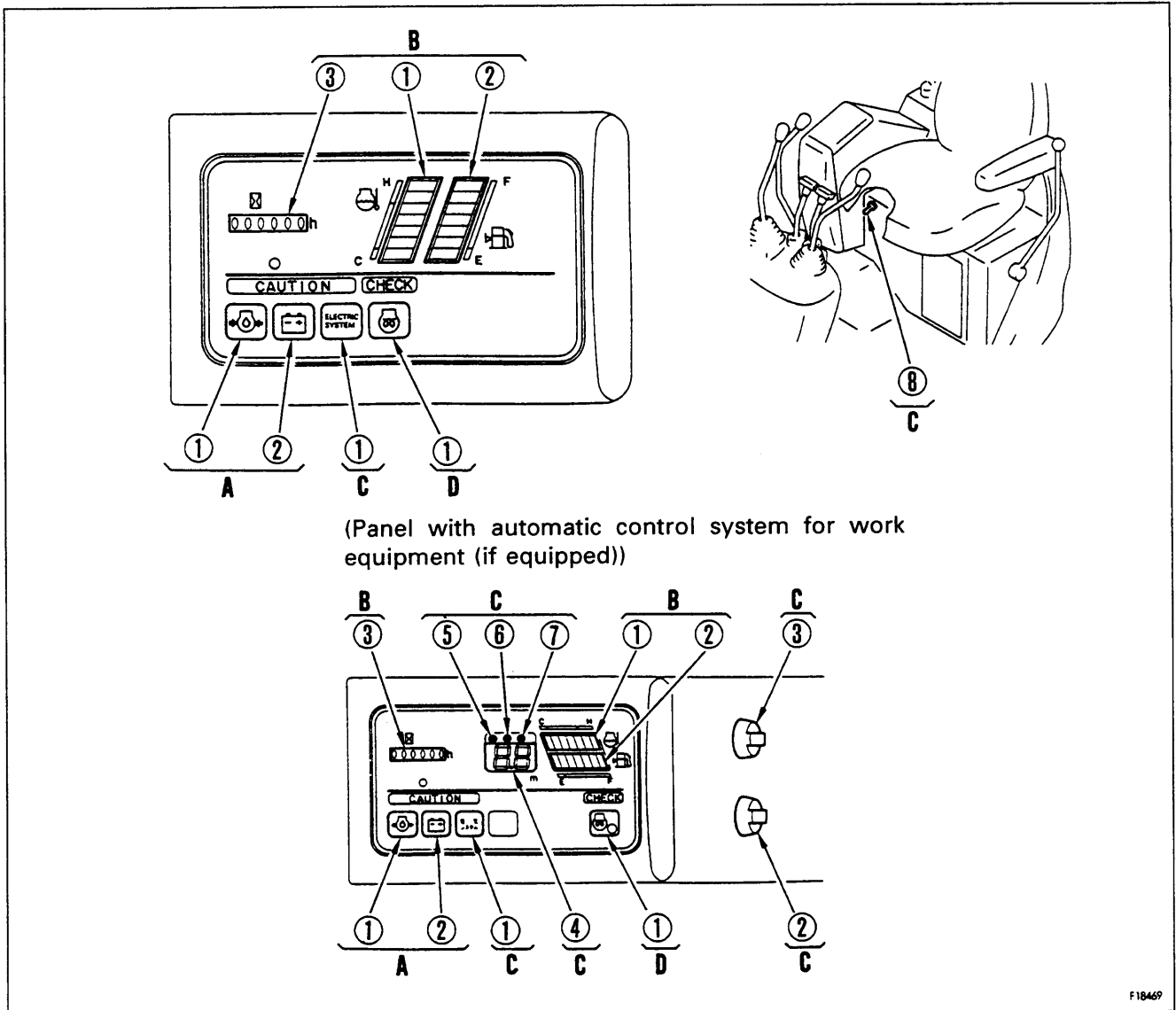
C. 4-SYSTEM (11.1.3)

This carries out the display and setting for the automatic work equipment control system (if equipped) and interference prevention system for the bucket and cab.

D. PILOT LAMP (11.1.4)

This shows the condition of preheating.

11. EXPLANATION OF COMPONENTS



11.1.1 A EMERGENCY STOP ITEM

⚠ CAUTION

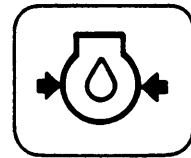
If the monitor flashes, stop the engine immediately and carry out the following action.

1. ENGINE OIL PRESSURE

This lamp flashes if the engine lubricating oil pressure drops below the normal value. If it flashes, stop the engine and check the condition. For details, see "16.5 OTHER TROUBLE".

REMARK

When the engine is stopped, and the starting switch is turned to the ON position, this lamp lights up, but it does not indicate an abnormality.



F17462

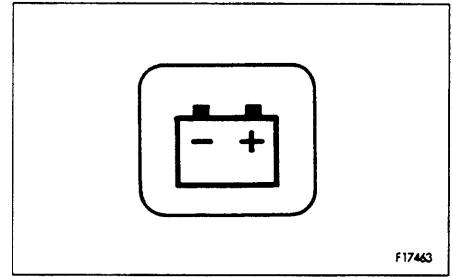
2. CHARGE LEVEL

This monitor indicates an abnormality in the charging system while the engine is running.

If the monitor lamp flashes, stop the engine and check the V-belt tension. If any abnormality is found, see "16. TROUBLESHOOTING".

REMARK

When the engine is stopped, and the starting switch is turned to the ON position, this lamp lights up, but it does not indicate an abnormality.



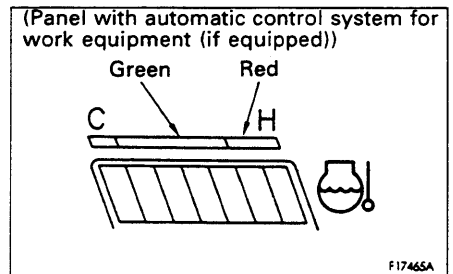
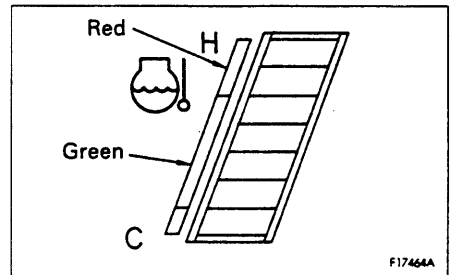
11.1.2 B METERS

1. ENGINE WATER TEMPERATURE GAUGE

This displays the engine cooling water temperature. During normal operation, the lamp should light up in the green range.

If the lamp in the red range lights up during operation, run the engine at low idling and wait for the temperature to go down to the green range.

After starting the engine, warm up it until the green range lights up.

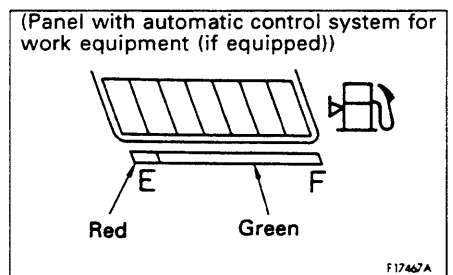
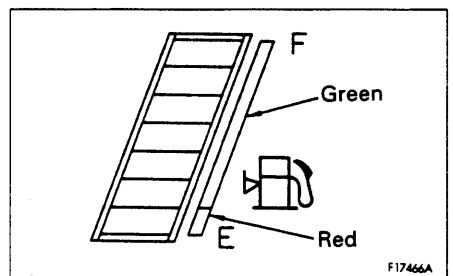


2. FUEL GAUGE

This shows the fuel level in the fuel tank. During normal operation, the lamp should light up in the green range.

If the lamp in the red range flashes during operation, there is less than 5 liters (1.32 US gal, 1.10 UK gal) of fuel remaining, so check and add fuel.

The correct level may not be displayed for a short time after the starting switch is turned to the ON position, but this is not an abnormality.



11. EXPLANATION OF COMPONENTS

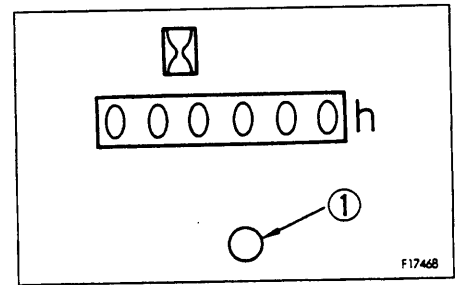
3. SERVICE METER

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

Set the periodic maintenance intervals using this display.

While the engine is running, operation display ① at the lower of the meter will light to show that the meter is advancing.

Meter will advance by 1 for each hour of operation regardless of the engine speed.

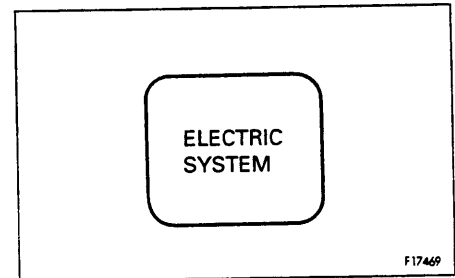


11.1.3 C 4-SYSTEM

1. ELECTRIC SYSTEM

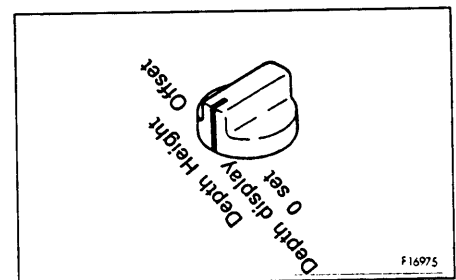
If there is any abnormality in the 4-system line (interference prevention system and automatic work equipment control system), a warning signal is emitted, so stop the engine. The cause of the abnormality is displayed as an error code on the depth display, so check the condition. For details of the method of checking, see "16.5 OTHER TROUBLE".

When the engine is started or stopped with the starting switch at the ON position, the buzzer may sound and this lamp may light up momentarily, but this does not indicate any abnormality.



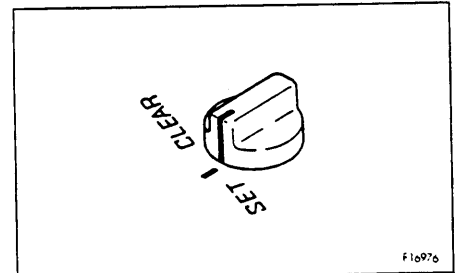
2. MODE SELECTOR SWITCH (if equipped)

This switch is used to select the depth display 0 set mode, depth mode, height mode, or offset mode.



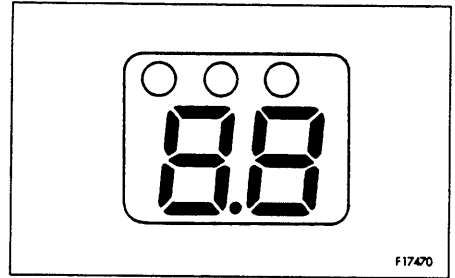
3. SETTING SWITCH (if equipped)

This switch is used to set or clear the mode selected by the mode selector switch.



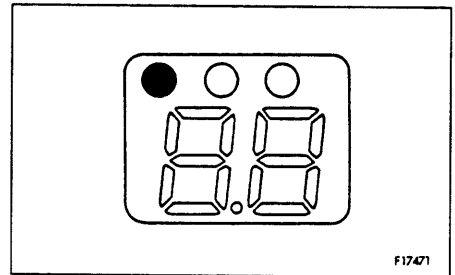
4. DEPTH DISPLAY (if equipped)

This shows the depth of the bucket from the ground level. When the bucket is above the ground level, UP is always displayed. If a height lower than the ground surface is set as the standard surface (when in the depth display 0 set mode), the depth from the standard surface is displayed.



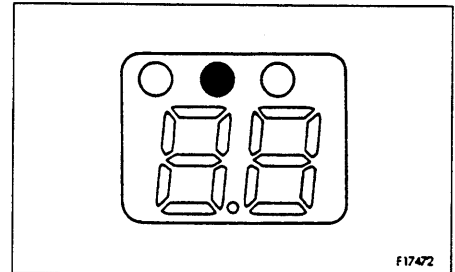
5. DEPTH MODE INDICATOR (if equipped)

This lights up when the amount the boom can be lowered is set. It lights up when the mode selector switch is set to DEPTH, and shows that the boom lower amount is set.



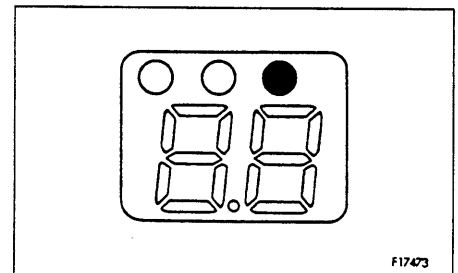
6. HEIGHT MODE INDICATOR (if equipped)

This lights up when the amount the boom can be raised is set. It lights up when the mode selector switch is set to HEIGHT, and shows that the boom raise amount is set.



7. OFFSET MODE INDICATOR (if equipped)

This lights up when the left offset amount is set.



8. CANCEL SWITCH

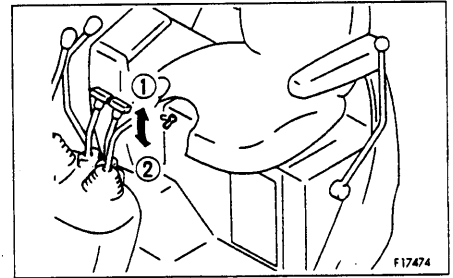
WARNING

Never carry out operations with the CANCEL switch ON. The 4-system is not actuated and the work equipment does not stop automatically, so there is danger that it will hit the chassis.

Use this switch to move the work equipment only in cases where an abnormality occurs in the 4-system and the work equipment stops.

- ① ON: Auto-stop cancel
- ② OFF: Normal operating condition

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

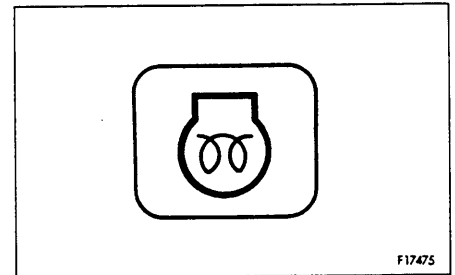


11.1.4 D PILOT LAMP

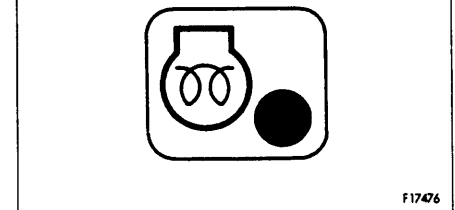
1. PRE-HEATING MONITOR

This monitor lamp indicates the pre-heating time required when starting the engine at an ambient temperature below 0°C.

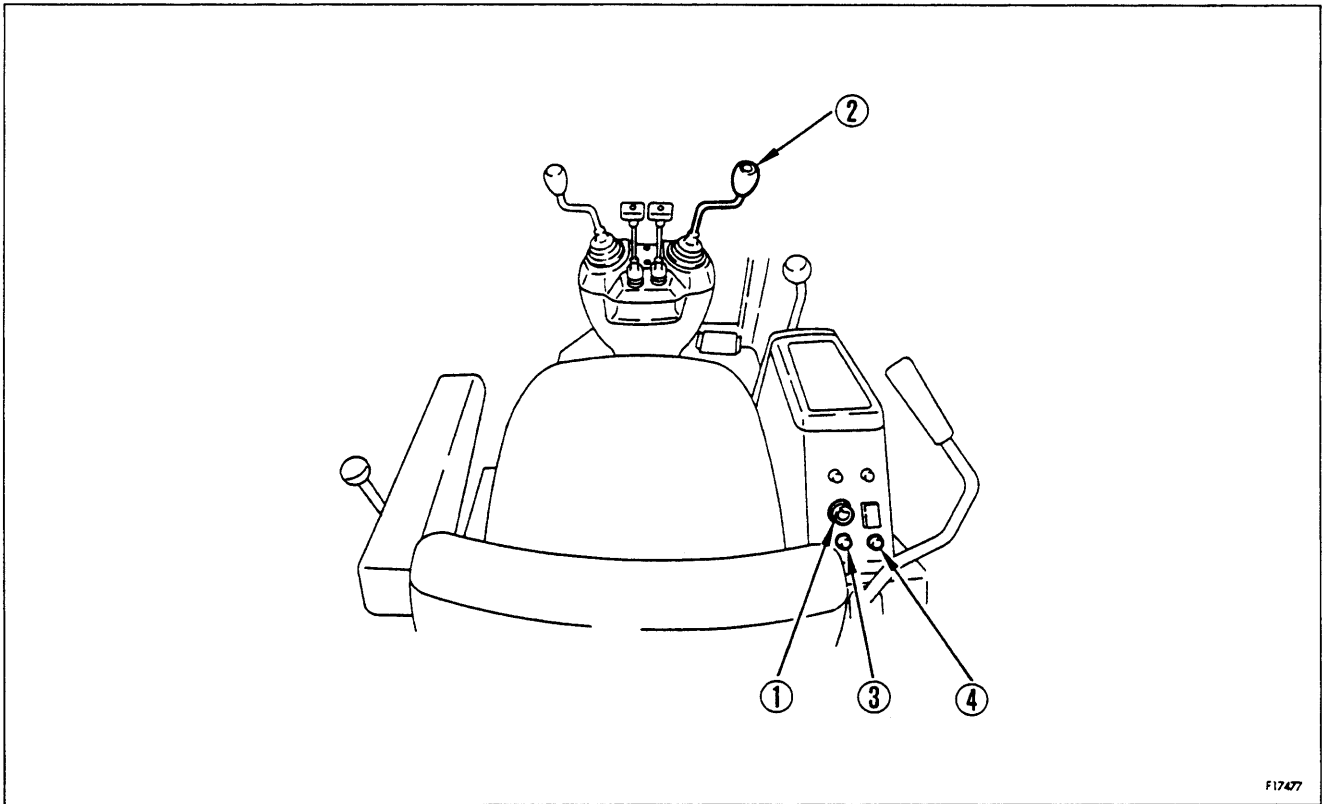
The monitor lamp lights when the starting switch is turned to the HEAT position and goes off after approx. 18 seconds to show that the pre-heating is completed.



(Panel with automatic control system for work equipment (if equipped))



11.2 SWITCHES



1. STARTING SWITCH

This switch is used to start or stop the engine.

OFF position:

At this position, the starting switch key can be inserted or removed. When the switch is turned to this position, the electrical circuits are switched off and the engine stops.

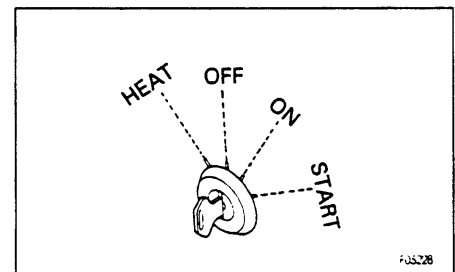
ON position:

In this position, electric current flows in the charging and lamp circuits.

Keep the starting switch key at the ON position while the engine is running.

START position:

This is the position to start the engine. Hold the key at this position while cranking. Release the key immediately after the engine has been started. The key will return to ON position when released.



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11. EXPLANATION OF COMPONENTS

HEAT position:

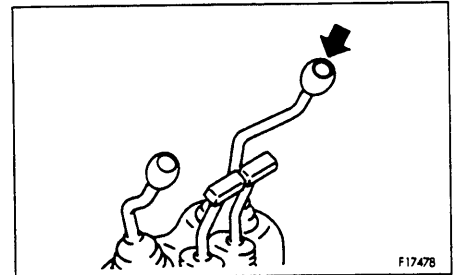
Turn the starting switch key to the HEAT position when starting in cold weather.

When the key is turned to the HEAT position, the preheating monitor lights up. Keep the key at this position until the preheating monitor goes out. When the preheating monitor goes out, release the key immediately.

When the key is released, it will return to OFF, so turn it immediately to the START position to start the engine.

2. HORN BUTTON

When the switch in the center of the knob of the right work equipment control lever is pressed, the horn will sound.



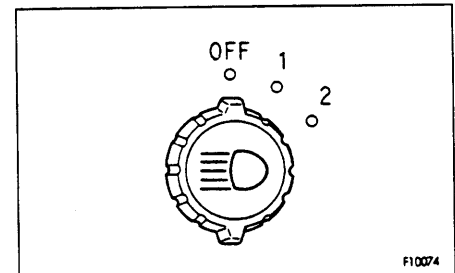
3. LAMP SWITCH

This lights up the head lamps and the panel lamp.

Position 1: Panel lamp lights up.

Position 2: Head lamps and panel lamp light up.

Position OFF: Lamps go off.



4. CAB HEATER SWITCH (if equipped)

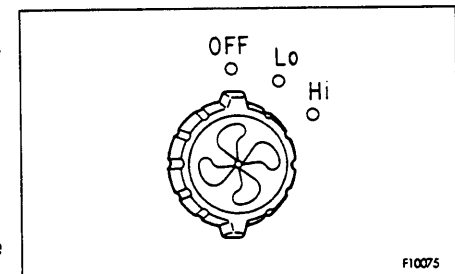
This switch is used to heat the operator's compartment. The flow rate of the hot air can be set to two levels.

Hi position: Strong

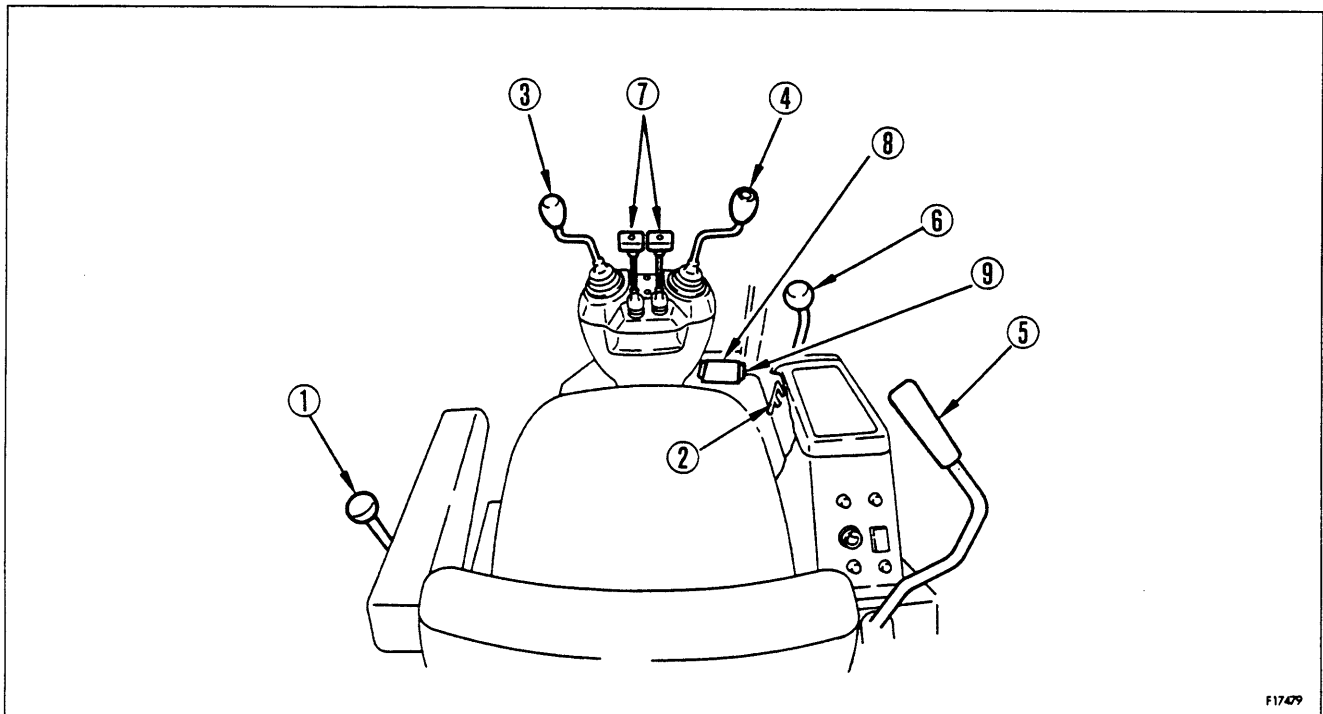
Lo position: Weak

OFF position: Cab heater is stopped.

The cab is heated by hot water from the engine, so if the engine cooling water temperature is low, the cab will not heat up.



11.3 CONTROL LEVERS AND PEDALS

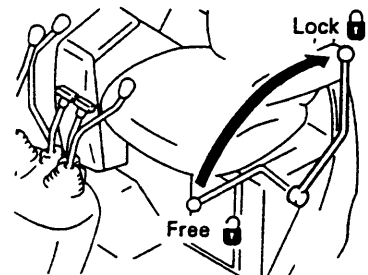


F1749

1. LOCK LEVER (FOR LEFT AND RIGHT WORK EQUIPMENT LEVERS)

⚠ WARNING

- When leaving the operator's compartment, set the safety lever securely to the LOCK position. If the gear shift lever is not locked, and it is touched by mistake, this may lead to a serious accident.
- If the safety lever is not placed securely in the LOCK position, the control lever may not be properly locked. Check that the situation is as shown in the diagram.



⚠ WARNING

- Even when the lock lever is in the lock position, it does not lock the blade.
- When pulling the lock lever up, be careful not to touch the work equipment control lever. If the lock lever is not pulled up fully, there is danger that the work equipment or swing may move.

⚠ WARNING

Be careful not to touch the work equipment lever when pushing down the lock lever from the lock position to the free position.

This is a device to lock the work equipment and swing. When the lever is pulled, the lever stand springs up and is locked.

This lock lever is a hydraulic lock type, so it is possible to move the work equipment control levers even when it is in the lock position, but the work equipment and swing motors will not move.

2. SWING LOCK LEVER

⚠ WARNING

When the machine is traveling under its own power, or when the swing is not being operated, always set the swing lock lever to the LOCK position.

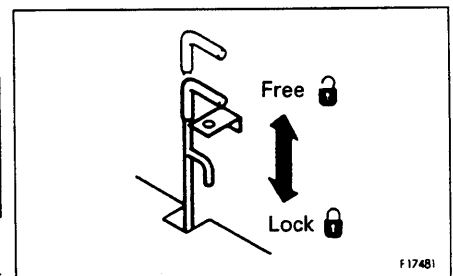
NOTICE

Do not attempt to rotate the upper works, when the swing lock lever is in the lock position.

This lever is used to lock the upper structure so that it cannot swing.

When the lever is pulled up, the lock is released.

When setting the lever to the LOCK position, always set the upper structure and track frame parallel and push the lever down fully. If the upper structure and track frame are not parallel, the lock is not applied even if the lever is set to the LOCK position.



3. LEFT WORK EQUIPMENT LEVER

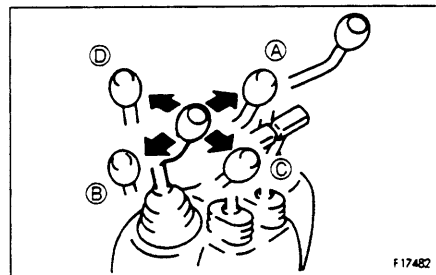
This lever is used to operate the arm and upper works.

Swing operation

- Ⓐ Swing to right
- Ⓑ Swings to left

Arm operation

- Ⓒ Arm IN
- Ⓓ Arm OUT



4. RIGHT WORK EQUIPMENT LEVER

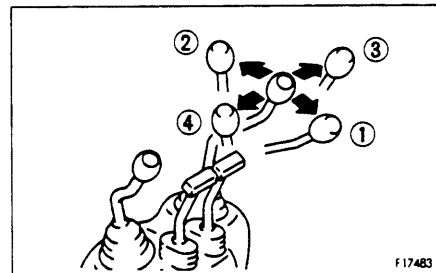
This lever is used to operate the boom and bucket.

Boom operation

- ① RAISE
- ② LOWER

Bucket operation

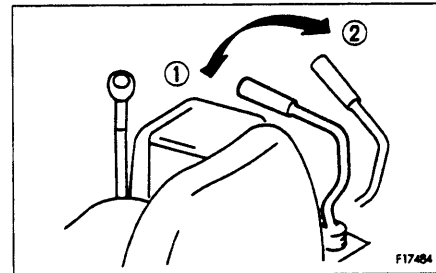
- ③ DUMP
- ④ CURL



5. FUEL CONTROL LEVER

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

- ① Low idling position: Push the lever fully.
- ② High idling position: Pull the lever fully.



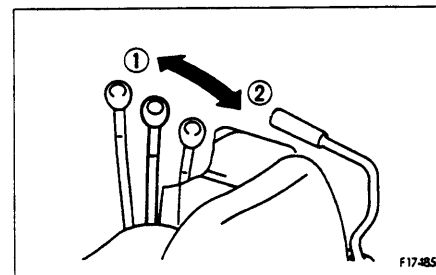
6. BLADE CONTROL LEVER

NOTICE

- This lever is not locked even when the lock lever is at the LOCK position, so when not operating the blade, be careful not to touch this lever.
- If digging work using the blade is continued for more than 1 hour, pay careful attention to the rise in the water temperature.

This lever is used to control the blade.

- ① LOWER
- ② RAISE

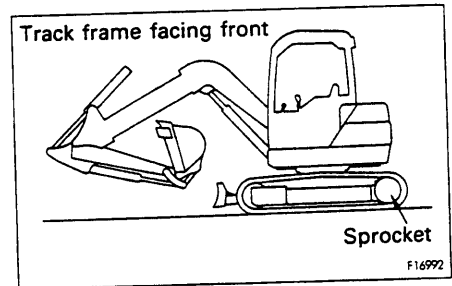


11. EXPLANATION OF COMPONENTS

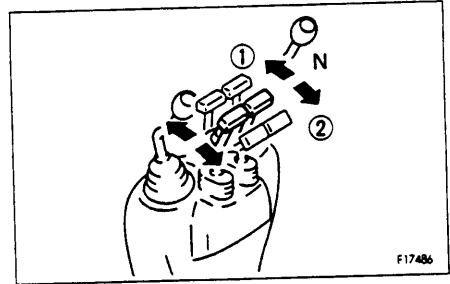
7. TRAVEL LEVERS

⚠ WARNING

When the track frame is facing the rear, the direction of the travel operation is reversed.
Before operating the travel lever, check if the track frame is facing the front or the rear.
(The track frame is facing the front if the sprocket is at the rear.)



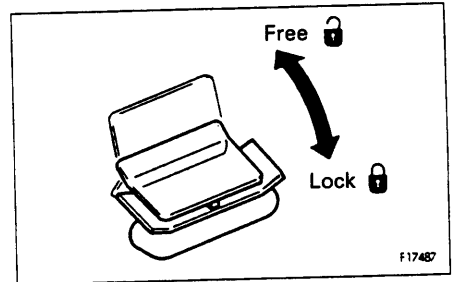
- ① FORWARD:
The lever is pushed forward
- ② REVERSE:
The lever is pulled back
- N (Neutral): The machine stops



8. PEDAL LOCK (FOR BOOM OFFSET CONTROL PEDAL)

⚠ WARNING

When not operating the boom offset, always keep it locked with the pedal lock.
If the control pedal is not locked and it is touched by mistake, it may lead to a serious accident.

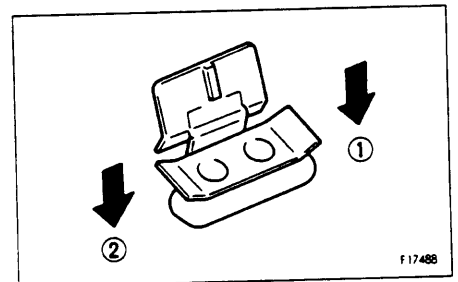


This locks the boom offset control pedal.
The pedal is locked by fitting the plate over the pedal.

9. BOOM OFFSET CONTROL PEDAL

This pedal offsets the boom to the left or right.

- ① Right offset
- ② Left offset

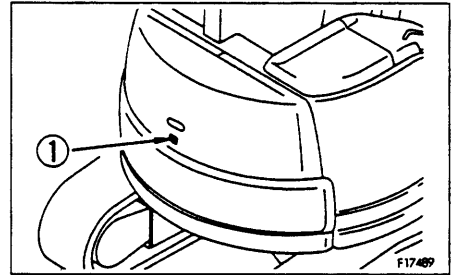


11.4 ENGINE HOOD

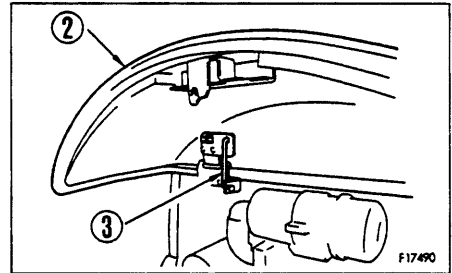
WARNING

When carrying out inspection or maintenance inside the engine hood, always use the hood support lever to keep the engine hood open.

1. Press engine hood open knob ① to release the lock.



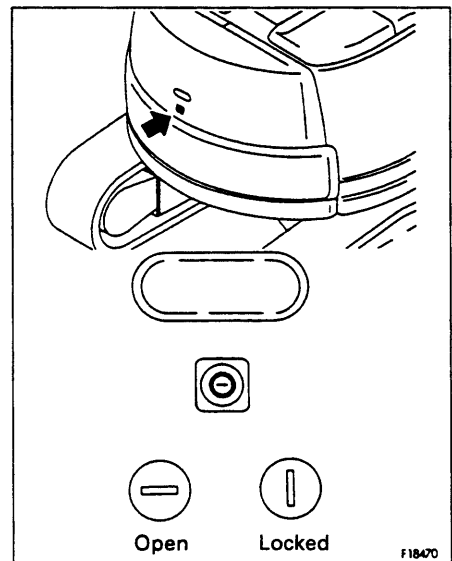
2. Push hood ② up, then fix the hood in position with hood support lever ③.



3. To close hood ②, remove hood support lever ③, secure it firmly in the lever lock, then lower the hood slowly and push the hood down to apply the lock.

NOTICE

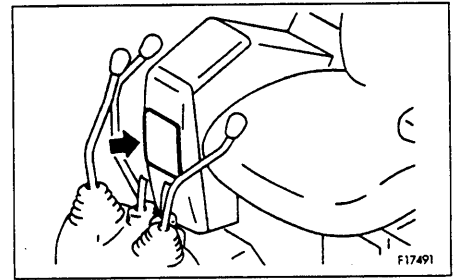
Always keep the hood locked except when opening the hood. It is possible to check if the lock is applied by looking at the direction of the key groove in the open knob.



11.5 FUSE BOX

NOTICE

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



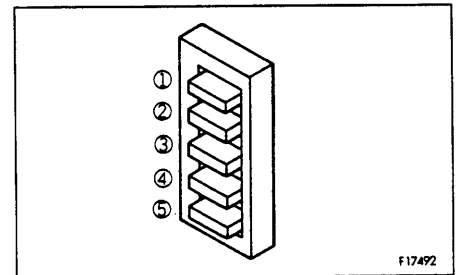
The fuses protect the electrical equipment and wiring from burning out.

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

Replace a fuse with another of the same capacity.

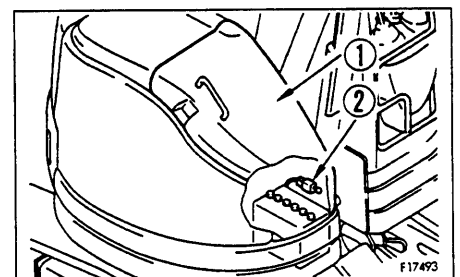
11.5.1 FUSE CAPACITY AND CIRCUIT NAME

No.	Fuse capacity	Name of circuit	Remarks
①	30 A	Stop solenoid Stop solenoid relay Stop solenoid timer	-
②	10 A	Cancel switch	-
③	15 A	Electrical system controller Monitor panel	-
④	20 A	Option, Alternator	-
⑤	25 A	Lamp, Buzzer, Horn	-



11.6 FUSIBLE LINK

If the power does not come on when the starting switch is turned to the ON position, the wire-shaped fusible link ② may be cut, so remove cover ① on the right side of the chassis, and check or replace.



REMARK

A fusible link is a large fuse wire installed in a circuit where there is a large current flowing.

It acts in the same way as a normal fuse to prevent electrical components and wiring from burning out if there is an abnormal current.

11.7 COVER WITH LOCK

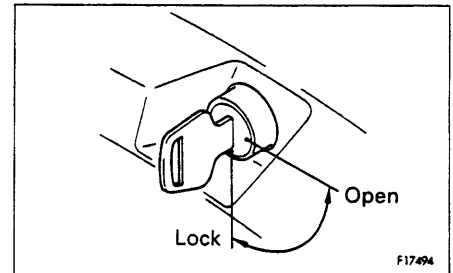
Locks are fitted to the engine hood, and tank cover at right side of machine.

Use the starting key to lock or unlock these places.

11.7.1 Method of locking and unlocking cover with lock

- To open the cover

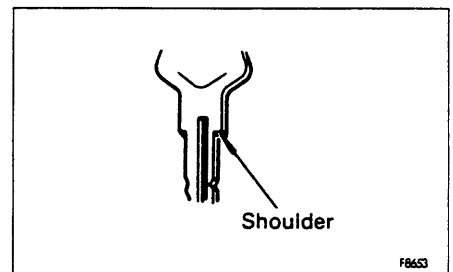
1. Insert the key.
2. Turn the key clockwise, then open the cover.



- To lock the cover

1. Close the cover.
2. Turn the key and take the key out.

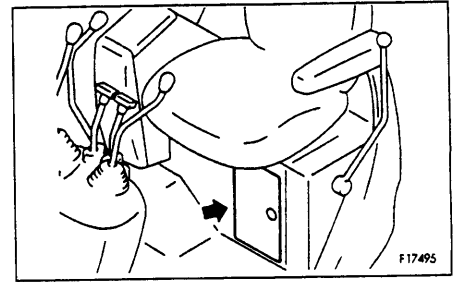
Insert the key as far as it will go. If the key is turned before it is inserted all the way, it may break.



11. EXPLANATION OF COMPONENTS

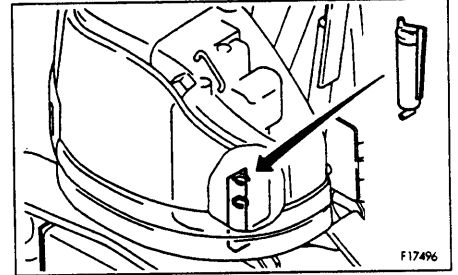
11.8 TOOL BOX

This is used for keeping tools.



11.9 GREASE GUN HOLDER

This is inside the tank cover at right side of machine. When not using the grease gun, fit it in the holder.



12. OPERATION

12.1 CHECK BEFORE STARTING ENGINE

12.1.1 WALK-AROUND CHECK

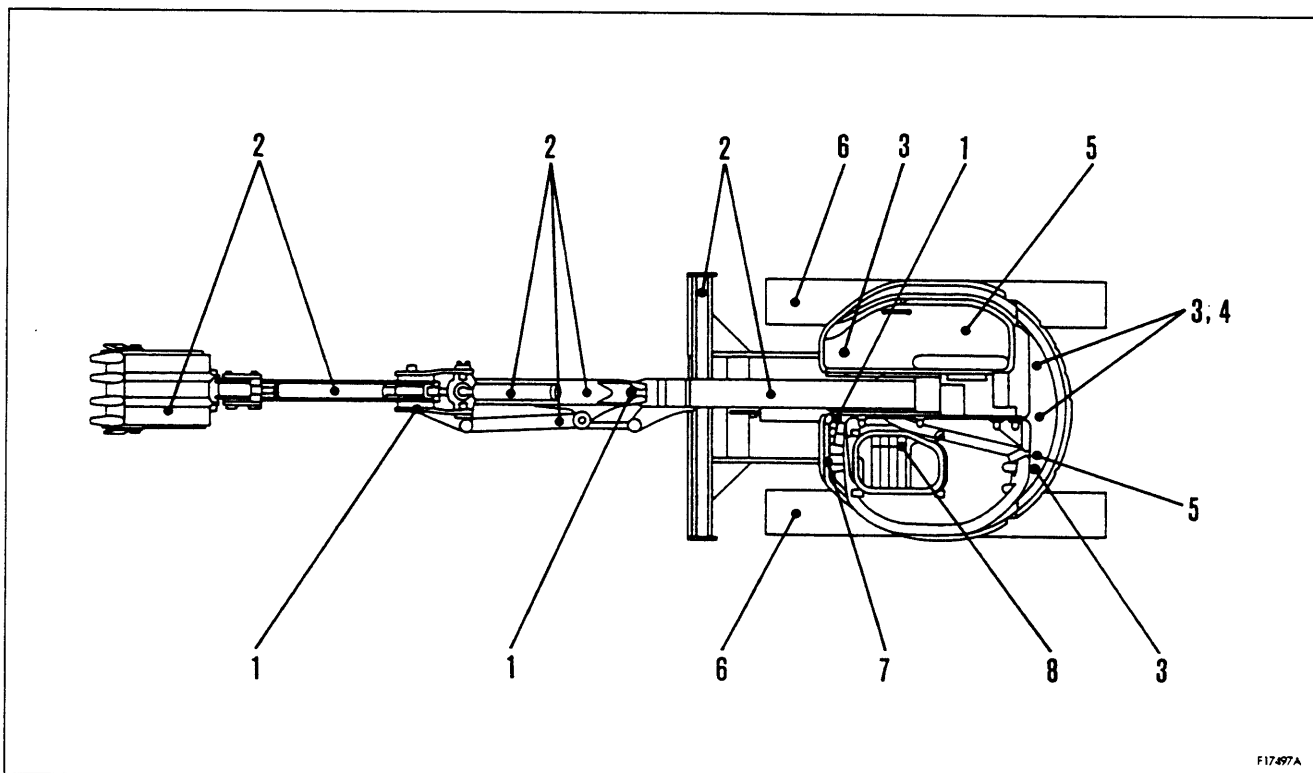
⚠ WARNING

Leakage of oil or fuel, or accumulation of flammable material around high temperature parts, such as the engine muffler may cause fire.

Check carefully, and if any abnormality is found, repair it or contact your Komatsu distributor.

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

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



1. Check sensors for damage

Check the sensors for damage. If any abnormality is found, please contact your Komatsu distributor for service or repair.

12. OPERATION

2. Check for damage, wear, play in work equipment, cylinders, linkage, hoses

Check that there are no cracks, excessive wear, or play in the work equipment, cylinders, linkage, or hoses. If any abnormality is found, repair it.

3. Remove dirt and dust from around engine, battery, radiator

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

4. Check for leakage of water or oil around engine

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

5. Check for oil leakage from hydraulic equipment, hydraulic tank, hoses, joints

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

6. Check the undercarriage (track, sprocket, idler) for damage, wear, loose bolts, or leakage of oil from rollers

7. Check for damage to handrail, loose bolts

Repair any damage and tighten any loose.

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

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

12.1.2 CHECK BEFORE STARTING

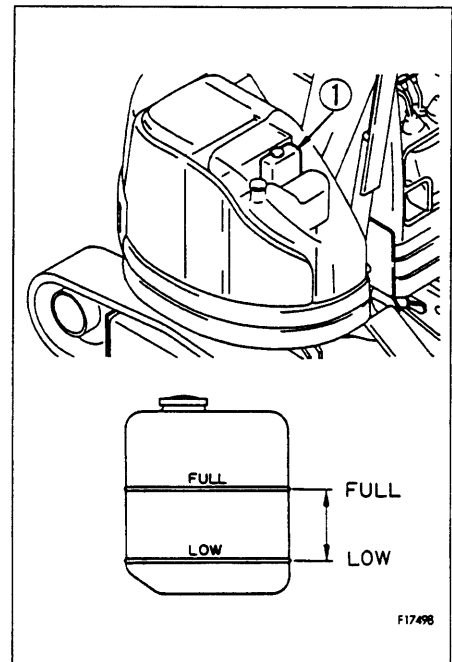
Always carry out the items in this section before starting the engine each day.

CHECK AND REFILL COOLANT

⚠ WARNING

Do not open the radiator cap unless necessary. When checking the coolant, always check the sub-tank when the engine is cold.

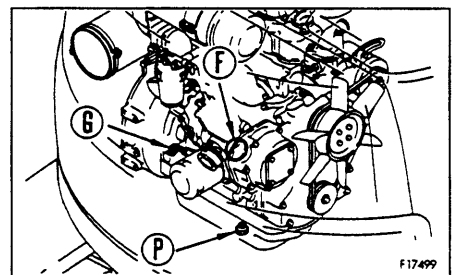
1. Open the tank cover at right side of machine and check that the cooling water level is between FULL and LOW on sub-tank ① (shown in the diagram on the right).
If the water level is low, add water through the water filler of sub-tank ① to the FULL level.
2. After adding water, tighten the cap securely.
3. If the sub-tank becomes empty, first inspect for water leaks and then fill the radiator and the sub-tank with water.



CHECK OIL LEVEL IN ENGINE OIL PAN, ADD OIL

1. Open the engine hood.
2. Remove dipstick ⑥ and wipe the oil off with a cloth.
3. Insert dipstick ⑥ fully in the oil filler pipe, then take it out again.
4. The oil level should be between the H and L marks on dipstick ⑥.
If the oil level is below the L mark, add engine oil through oil filler ⑦.

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".



12. OPERATION

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

REMARK

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

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

CHECK FUEL LEVEL, ADD FUEL

WARNING

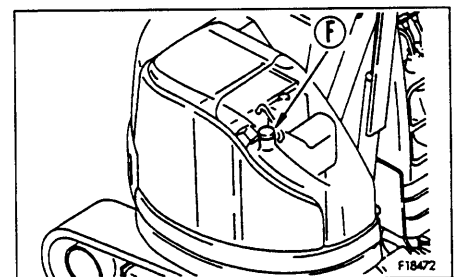
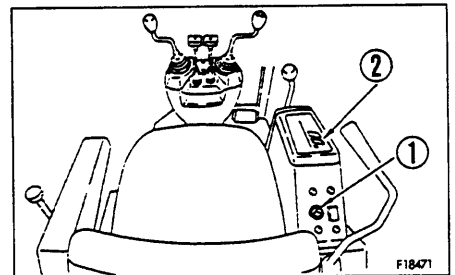
When adding fuel, never let the fuel overflow. This may cause a fire. If you spill fuel, thoroughly clean up any spillage.

1. Insert the key in starting switch **(1)**, and turn it to the ON position to light up the monitor.
2. Check the fuel level on fuel gauge **(2)**. If the fuel level is low, add fuel through fuel filler port **(F)**.

Fuel capacity: 35 l (9.24 US gal, 7.70 UK gal)

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".

3. After adding fuel, tighten the cap securely.

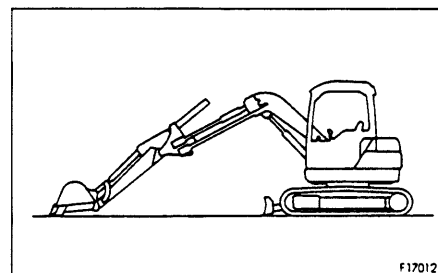


CHECK OIL LEVEL IN HYDRAULIC TANK, ADD OIL

WARNING

- When removing the oil filter cap, oil may spurt out, so stop the engine and wait for the oil temperature to go down, then turn the cap slowly to release the internal pressure before removing the cap.
- If oil has been added to above the H mark, stop the engine and wait for the hydraulic oil to cool down, then drain the excess oil from drain plug \textcircled{P} .

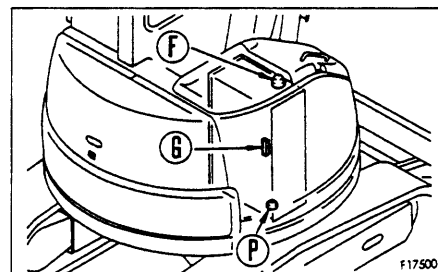
1. If the work equipment is not in the condition shown in the diagram on the right, run the engine at low speed, lower the blade to the ground, retract the arm and bucket cylinders, then lower the boom, set the bucket teeth in contact with the ground, and stop the engine.
2. Check that the oil level is between H and L line on sight gauge \textcircled{C} .

**NOTICE**

Do not add oil if the level is above the H line. This will damage the hydraulic equipment and cause the oil to spurt out.

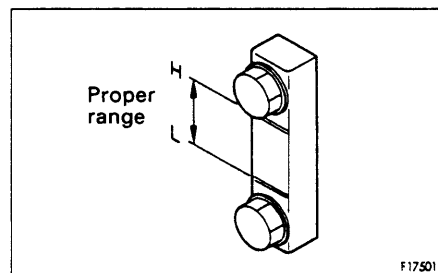
3. If the level is below that L mark, open the tank cover at the right side of the machine, add oil through oil filler \textcircled{F} .

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".

**REMARK**

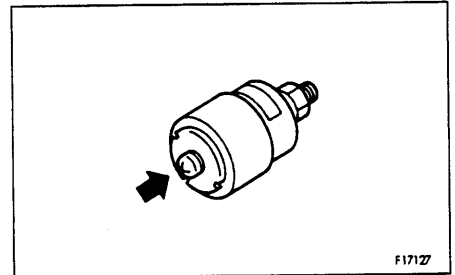
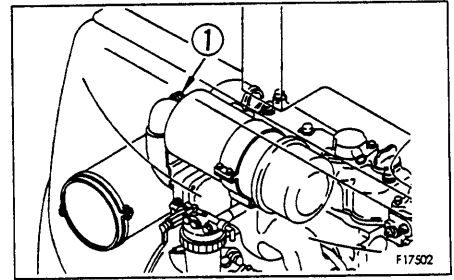
The oil level will vary depending upon the oil temperature. Accordingly, use the following as a guide:

- When the oil temperature is close to the ambient temperature (10 to 30°C (50 to 86°F)), the level will be close to bottom line L on the sight gauge.
- When the oil temperature is the normal operating temperature (50 to 80°C (122 to 176°F)), the level will be close to top line H on the sight gauge.



CHECK DUST INDICATOR

1. Open the engine hood and check that the red piston is not showing in dust indicator ①.
2. If the red piston has appeared, clean or replace the element immediately.
For details of the method of cleaning the element, see "24.2.1 CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT".
3. After checking, cleaning, and replacing, press the knob of dust indicator ① to return the red piston to its original position.

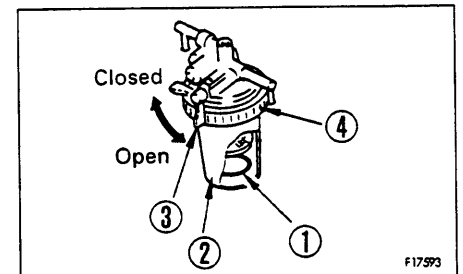
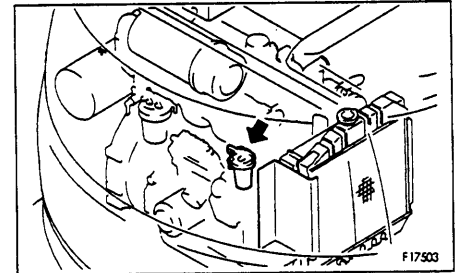


CHECK WATER SEPARATOR

If red ring ① of the water separator is at the bottom of case ②, there is no water.

If red ring ① is floating, there is water up to the bottom of the ring, so drain the water as follows.

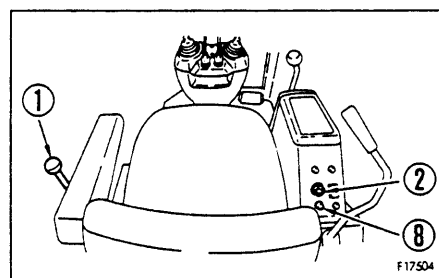
- Use a water separator filter wrench.
1. Open the engine hood, and set handle ③ to the CLOSED position.
 2. Using the filter wrench, loosen ring ④, then remove case ② and throw out the water inside it.
 3. Set case ② in position, then tighten ring ④ to install it.
 4. Set handle ③ to the OPEN position.
 5. Install grease gun holder ④ and fit grease gun ③ to it.
 6. Drain any water or sediment from the fuel tank. For details, see "24.2 WHEN REQUIRED".



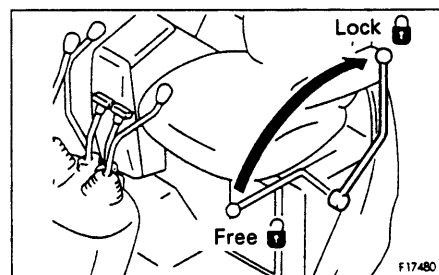
12.1.4 OPERATIONS AND CHECKS BEFORE STARTING ENGINE

WARNING

If the control levers are touched by accident, the work equipment may move suddenly. When leaving the operator's compartment, always set the lock lever securely to the LOCK position.



1. Check that lock lever ① is at the LOCK position.
2. Check the position of each lever.

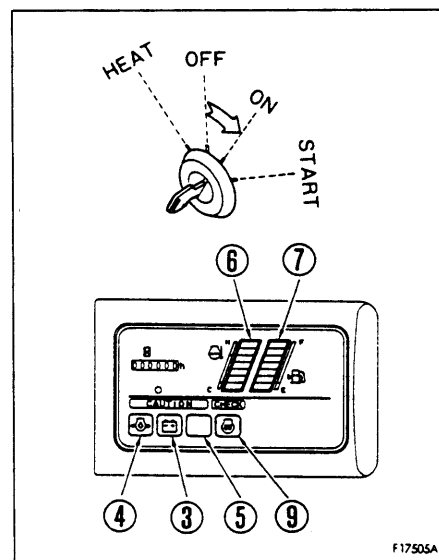


3. Insert the key in starting switch ②, turn the key to the ON position, then carry out the following checks.

(1) The buzzer will sound for approx. 1 sec., and the following monitors and gauges will light up for approx. 3 sec.

- Charge level monitor ③
- Engine oil pressure monitor ④
- Electric system monitor ⑤
- Engine water temperature gauge ⑥
- Fuel gauge ⑦
- Preheating monitor ⑨

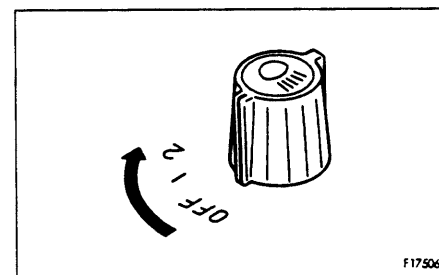
If the monitors or gauges do not light up or the buzzer does not sound, there is probably a broken bulb or disconnection in the monitor wiring, so contact your Komatsu distributor for repairs.



After approx. 3 sec., the following monitors will remain on and the other monitors will go out.

- Engine oil pressure monitor ④
- Engine water temperature gauge ⑥
- Fuel gauge ⑦

- (2) Turn lamp switch ⑧ to turn on the head lamps. If the lamps do not light up, there is probably a broken bulb or disconnection in the wiring, so contact your Komatsu distributor for repairs.

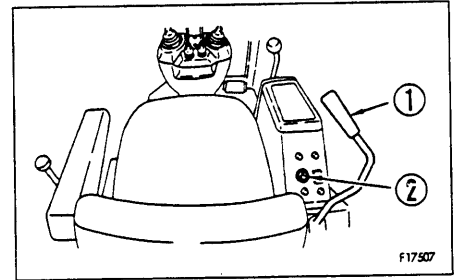


12.2 STARTING ENGINE

12.2.1 NORMAL STARTING

⚠ WARNING

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

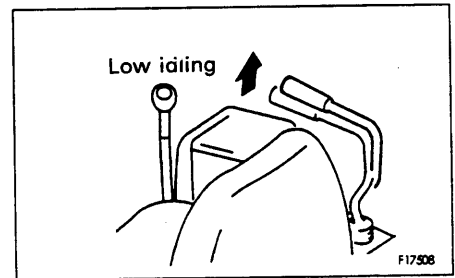


NOTICE

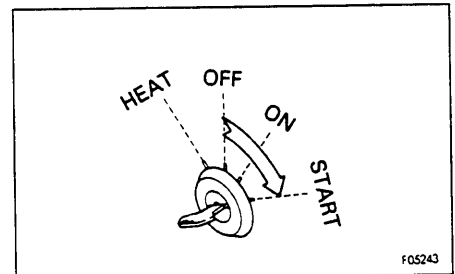
Do not keep the starting motor rotating continuously for more than 20 seconds.

If the engine will not start, wait for at least 2 minutes before trying to start the engine again.

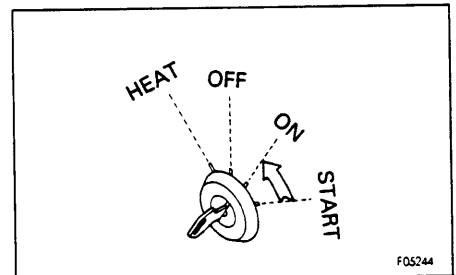
1. Pull fuel control lever ① to a position a little past the LOW IDLING position toward the HIGH IDLING position.



2. Insert the key into starting switch ② and turn the key to the START position. The engine will start.



3. When the engine starts, release the key in starting switch ②. The key will return automatically to the ON position.



12.2.2 STARTING IN COLD WEATHER

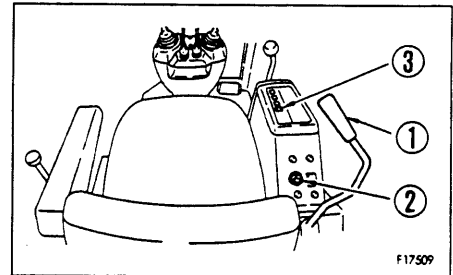
WARNING

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

NOTICE

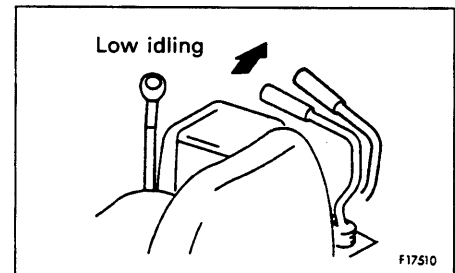
Do not keep the starting motor rotating continuously for more than 20 seconds.

If the engine fails to start, repeat steps 2 after waiting for about 2 minutes.

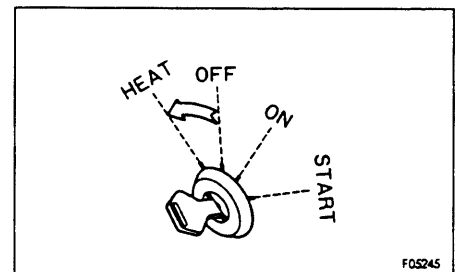


When starting in low temperatures, do as follows.

1. Pull fuel control lever ① to the center position between LOW IDLING and HIGH IDLING.

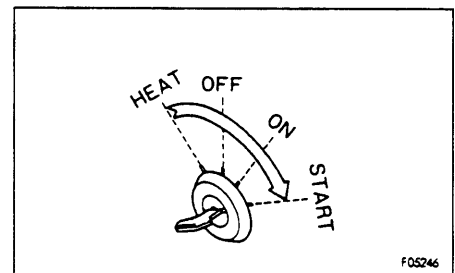


2. Hold the key in starting switch ② at the HEAT position, and check that preheating monitor ③ lights up. After approx. 18 seconds, preheating monitor ③ goes out to inform that the preheating is completed.

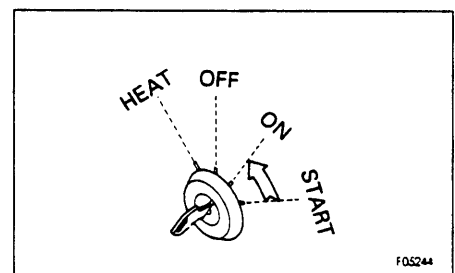
**REMARK**

The monitor and gauge also light up when the key is at the HEAT position, but this does not indicate any abnormality.

3. When preheating monitor ③ goes out, turn the key in starting switch ② to the START position to start the engine.



4. When the engine starts, release the key in starting switch ②. The key will return automatically to the ON position.



12.3 OPERATIONS AND CHECKS AFTER STARTING ENGINE

⚠ WARNING

- If operations are started without warming up the engine in cold areas, the automatic stop position for the interference protection device may change, so after starting the engine, always carry out the warming up operation.
- When checking the action of the interference protection device, operate the lever slowly.

NOTICE

The most suitable temperature for the hydraulic oil is 50 – 80°C (122 – 176°F), but in order to extend the life of the machine, the temperature must be raised to at least 20°C (68°F) before starting work.

NOTICE

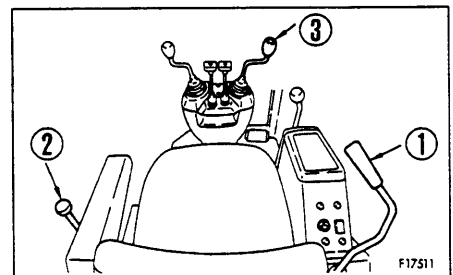
Do not suddenly operate the levers when the hydraulic oil temperature is below 20°C (68°F).

NOTICE

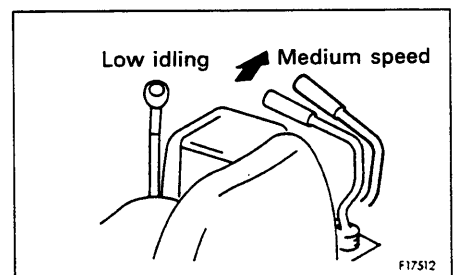
Avoid abrupt acceleration until warm-up run is completed.

Do not run the engine at low idling or high idling for more than 20 minutes. If it is necessary to run the engine at idling, apply a load or run at a medium speed from time to time.

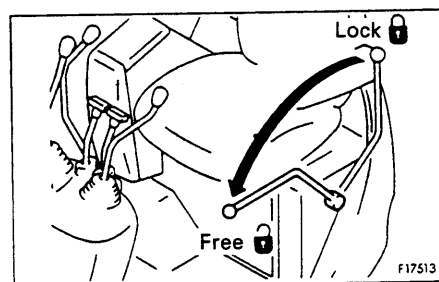
After starting the engine, do not immediately start operations. First, carry out the following operations and checks.



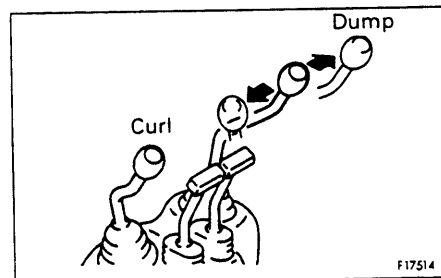
1. Pull fuel control lever ① to the center position between LOW IDLING and HIGH IDLING and run the engine at medium speed for about 5 minutes with no load.



2. Set lock lever ② to the FREE position, and raise the bucket from the ground.

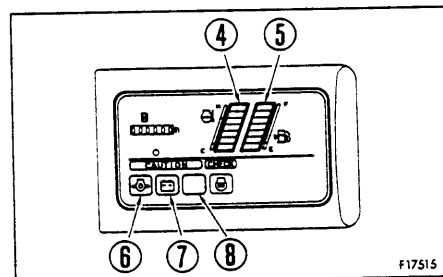


3. Operate bucket control lever ③ slowly to move the bucket cylinder to the end of the stroke and hold it for 5 minutes.



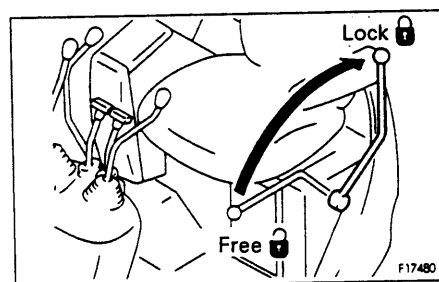
4. After carrying out the warming-up operation, check that each gauge and monitor lamp is in the following condition.

- Engine water temperature gauge ④: Inside green range
- Fuel gauge ⑤: Inside green range
- Engine oil pressure monitor ⑥: OUT
- Charge monitor ⑦: OUT
- Electric system monitor ⑧: OUT

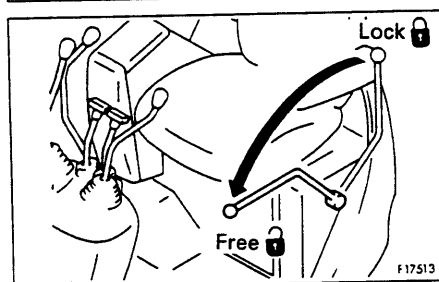


5. Check that there is no abnormal exhaust gas color, noise, or vibration.

6. Set lock lever ② to the LOCK position and check that it is impossible to operate the swing and work equipment with the left and right work equipment control levers.

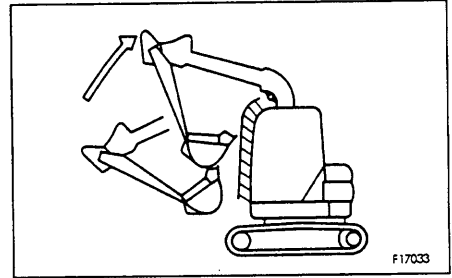


7. Set lock lever ② to the FREE position and carry out the following inspection of the actuation of the interference prevention device.

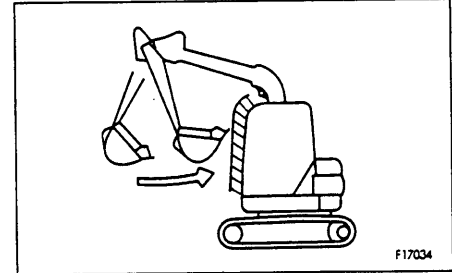


12. OPERATION

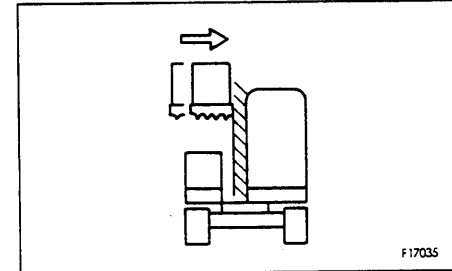
- Set the work equipment in the posture shown in the diagram on the right, then operate the boom RAISE and check that the work equipment automatically stops when it comes close to the operator's compartment.
If it stops, lower the boom and cancel the automatic stop.



- Set the work equipment in the posture shown in the diagram on the right, then operate the arm IN and check that the work equipment automatically stops when it comes close to the operator's compartment.
If it stops, move the arm out and cancel the automatic stop.



- Set the work equipment in the posture shown in the diagram on the right, then operate the left offset and check that the work equipment automatically stops when it comes close to the operator's compartment.
If it stops, operate the right offset and cancel the automatic stop.



If any abnormality is found during the check, carry out Step 3 and warm up the hydraulic oil, then carry out the check again.

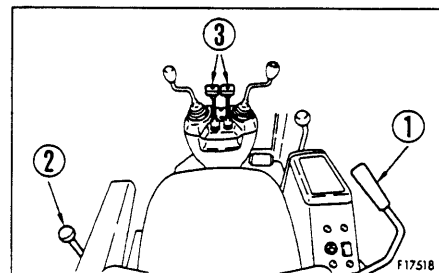
If there is still an abnormality, stop the machine in a safe place, then stop the engine and contact your Komatsu distributor for inspection and repair.

12.4 MOVING MACHINE OFF

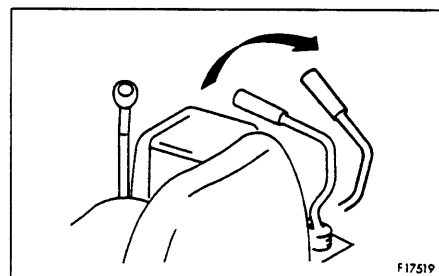
12.4.1 MOVING THE MACHINE FORWARD

⚠ WARNING

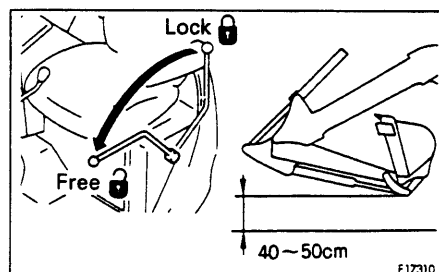
- Before operating the travel levers, check the direction of the track frame. If the sprocket is at the front, the operation of the travel levers is reversed.
- When moving off, check that the area around the machine is safe, and sound the horn before moving.
- Clear all personnel from the machine and the area.
- Clear all obstacles from the path of the machine.



1. Pull fuel control lever ① towards the high idling position to increase the engine speed.

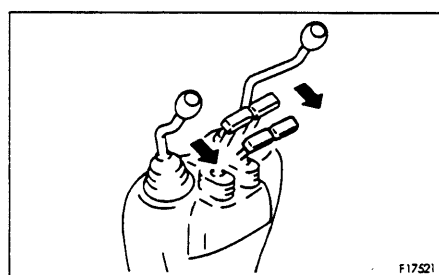
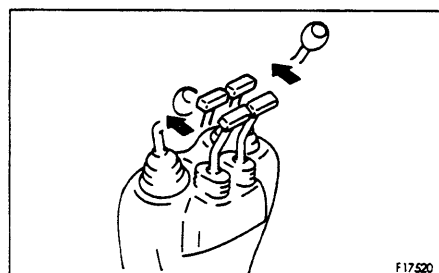


2. Set lock lever ② in the FREE position, fold the work equipment, and raise it 40 – 50 cm (16 – 20 in) from the ground.



3. Raise the blade.

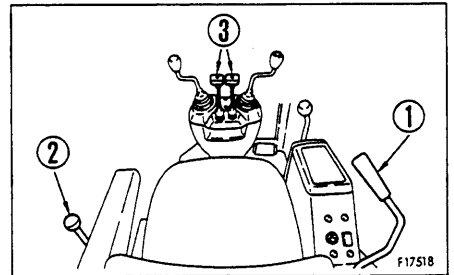
4. Operate right and left travel levers ③ as follows.
 - When the sprocket is at the rear of the machine. Pull levers ③ backward slowly to move the machine off.
 - When the sprocket is at the front of the machine Push levers ③ forward slowly to move the machine off.



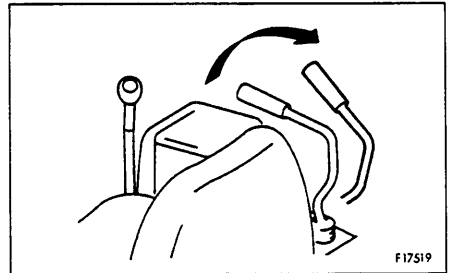
12.4.2 MOVING THE MACHINE BACKWARD

WARNING

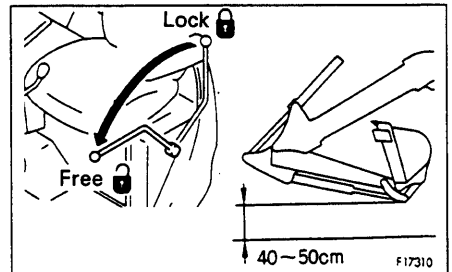
- Before operating the travel levers, check the direction of the track frame. If the sprocket is at the front, the operation of the travel levers is reversed.
- When moving off, check that the area around the machine is safe, and sound the horn before moving.
- Clear all personnel from the machine and the area.
- Clear all obstacles from the path of the machine.
- Use extreme care when reversing the machine. Note there is an blind spot behind the machine.



1. Pull fuel control lever ① towards the high idling position to increase the engine speed.

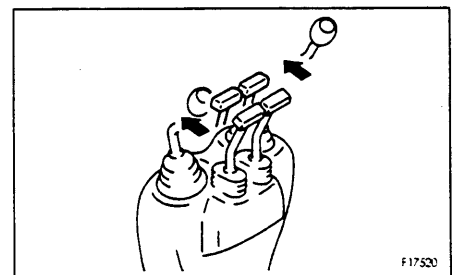
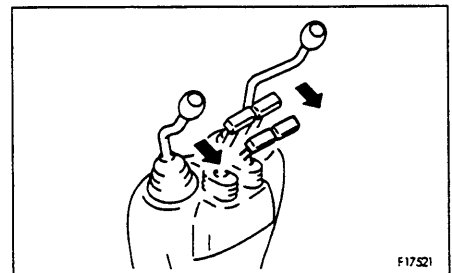


2. Set lock lever ② in the FREE position, fold the work equipment, and raise it 40 – 50 cm (16 – 20 in) from the ground.



3. Raise the blade.

4. Operate right and left travel levers ③ as follows.
 - When the sprocket is at the rear of the machine. Push levers ③ forward slowly to move the machine off.
 - When the sprocket is at the front of the machine Pull levers ③ backward slowly to move the machine off.



12.5 STEERING MACHINE

12.5.1 STEERING (CHANGING DIRECTION)

WARNING

Before operating the travel levers, check the position of the sprocket. If the sprocket is at the front, the operation of the travel levers is reversed.

Use the travel levers to change direction.

Avoid sudden changes of direction as far as possible. In particular, when carrying out counter-rotation (spin turn), stop the machine first before turning.

Operate two travel levers ① as follows.

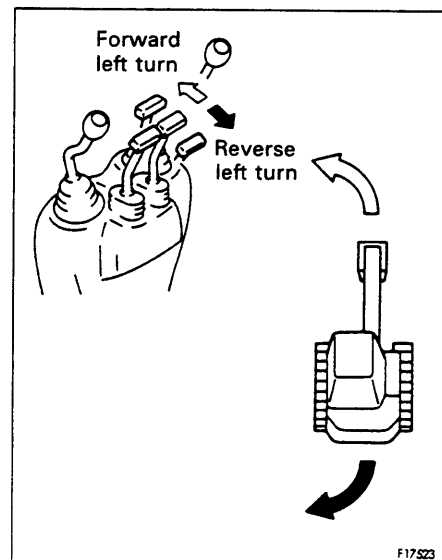
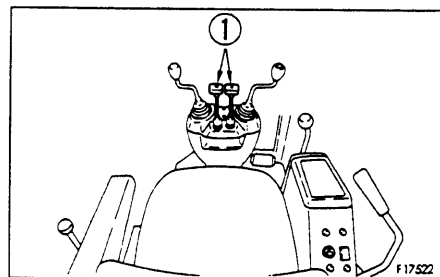
Changing direction of machine when stopped

When turning to the left:

Push the right travel lever forward to travel left when traveling forward; and pull it back to turn left when traveling in reverse.

REMARK

When turning to the right, operate the left travel lever in the same way.



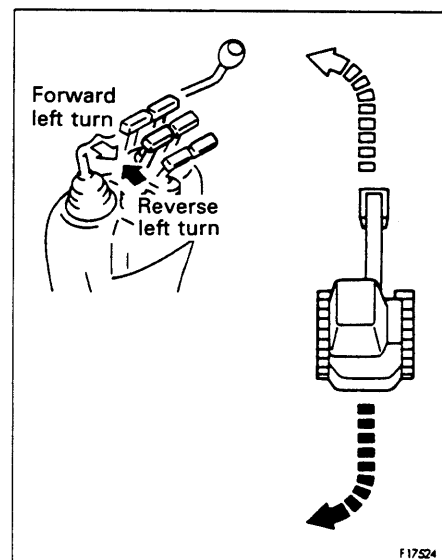
Steering when traveling (left and right travel levers both operated in same direction)

When turning to the left:

If the left travel lever is returned to the neutral position, the machine will turn to the left.

REMARK

When turning to the right, operate the right travel lever in the same way.



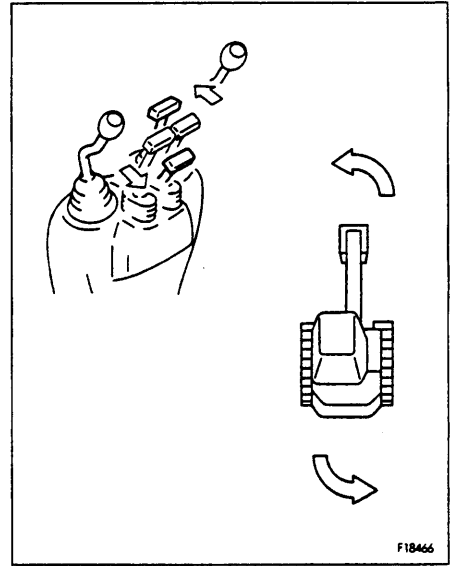
12. OPERATION

When making counter-rotation turn (spin turn)

When turning left using counter-rotation, pull the left travel lever back and push the right travel lever forward.

REMARK

When turning right using counter-rotation, pull the right travel lever back and push the left travel lever forward.



12.6 STOPPING MACHINE

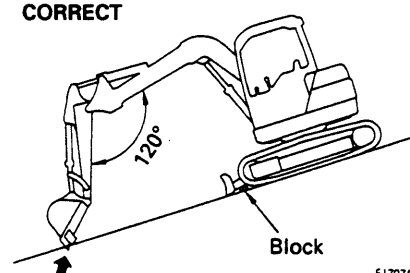
CAUTION

Avoid stopping suddenly. Give yourself ample room when stopping.

WARNING

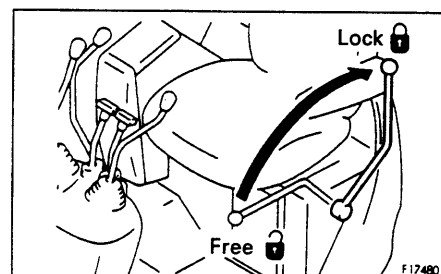
When stopping the machine, select flat hard ground and avoid dangerous places. If it is unavoidably necessary to park the machine on a slope, insert blocks underneath the track shoes. As an additional safety measure, thrust the bucket into the ground.

CORRECT

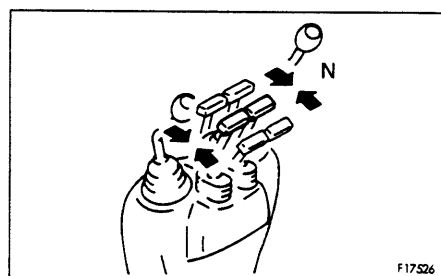
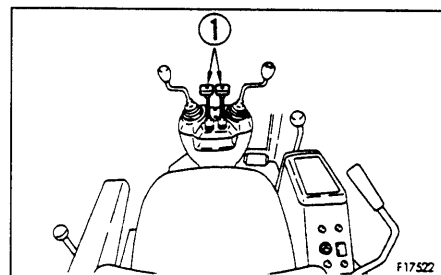


WARNING

If the control lever is touched by accident, the work equipment or the machine may move suddenly, and this may lead to a serious accident. Before leaving the operator's compartment, always apply the lock securely.



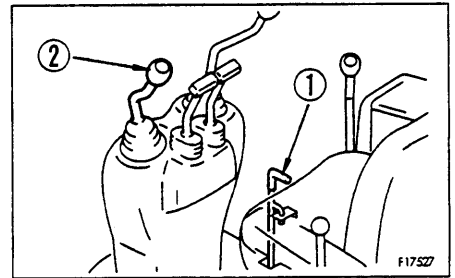
- Put the left and right travel levers ① in the neutral position, then stop the machine.



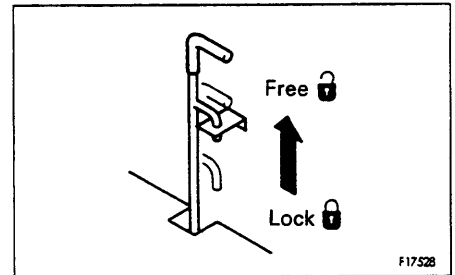
12.7 SWINGING

WARNING

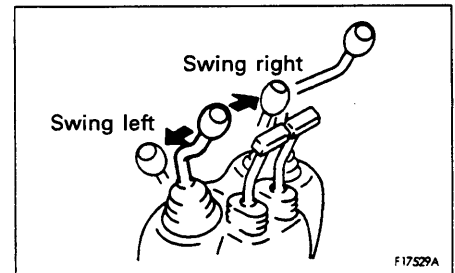
When operating the swing, check that the area around the machine is safe.



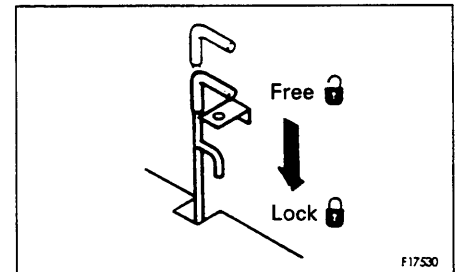
1. Before operating the swing, set swing lock lever ① to the FREE position.



2. Operate left work equipment control lever ② to swing the upper structure.



3. When not using the swing, set the upper structure and track frame parallel, then move lock lever ① to the LOCK position. When setting the lever to the LOCK position, always set the upper structure and track frame parallel and push lever ① down fully. If the upper structure and track frame are not parallel, the lock is not applied even if the lever is set to the LOCK position.



12.8 PROHIBITIONS FOR OPERATION

WARNING

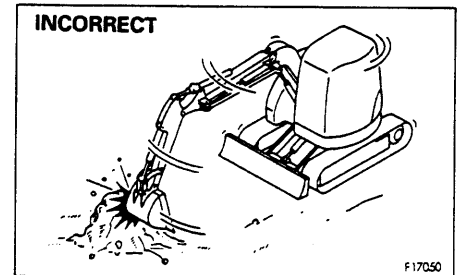
If it is necessary to operate the work equipment lever when the machine is traveling, stop the machine before operating the work equipment lever.

Prohibited operations using swing force

Do not use the swing force to compact soil or break earth mounds or walls.

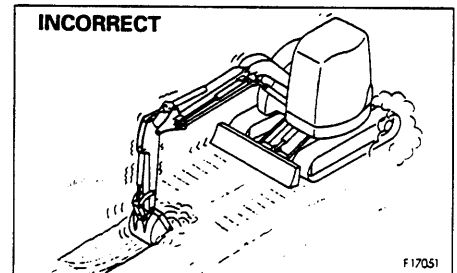
When swinging, do not dig the bucket teeth into the soil.

These operations will damage the work equipment.



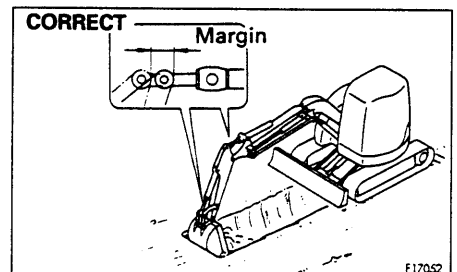
Prohibited operations using travel force

Do not leave the bucket dug into the ground and use the travel force to excavate. This will bring excessive force to bear on the rear of the machine.



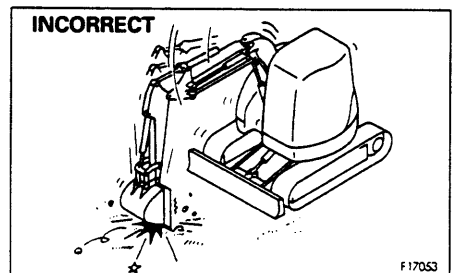
Precautions when operating hydraulic cylinders to end of stroke

If the cylinder is operated to the end of its stroke during operations, force will be brought to bear on the stopper inside the cylinder, and this will reduce the life of the machine. To prevent this, always leave a small safety margin when operating the cylinders.



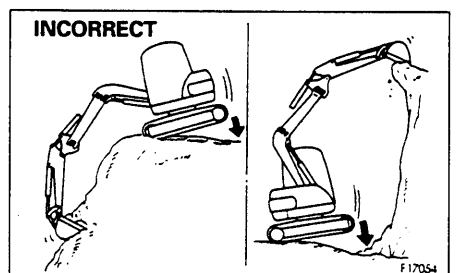
Prohibited operations using dropping force of bucket

Do not use the dropping force of the bucket as a pickaxe, breaker, or pile driver. This will bring excessive force to bear on the rear of the machine, and will not only damage the machine, but is also dangerous.



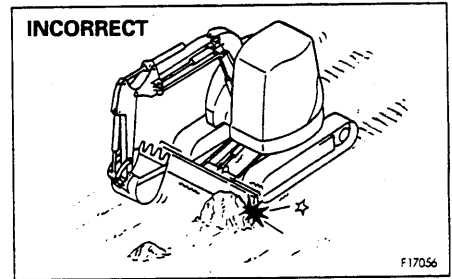
Prohibited operations using dropping force of machine

Do not use the dropping force of the machine for digging. It is better to excavate hard rocky ground after breaking it up by some other means. This will not only reduce damage to the machine but make for better economy.



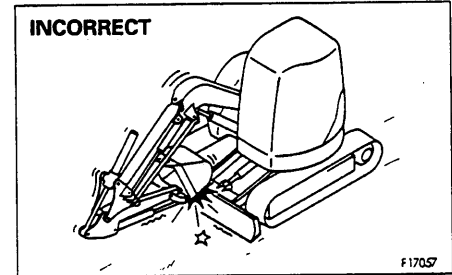
Avoid hitting blade

Be careful not to hit the blade against rocks or boulders. This will cause premature damage to the blade or cylinders.



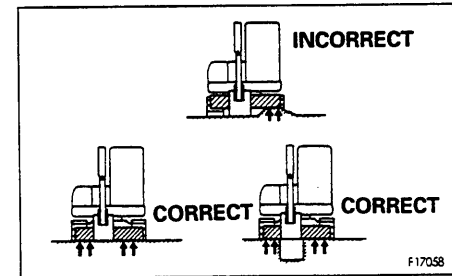
Be careful when folding in work equipment.

When folding in the work equipment to the travel or transportation posture, be careful not to let the bucket hit the blade.



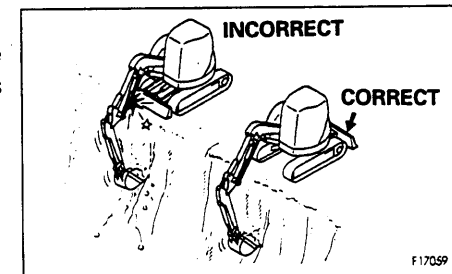
Support blade on both sides

When using the blade as an outrigger, never support the machine with only one end of the blade.



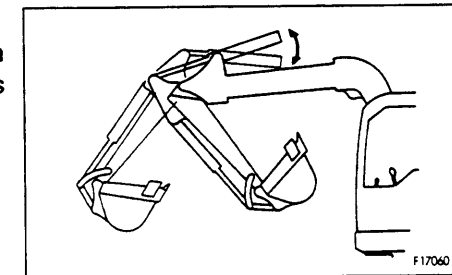
Be careful of blade during backhoe operations

When carrying out deep digging operations with the blade at the front, be careful not to let the boom cylinder hit the blade. Always position the blade at the back unless it is needed at the front.



Be careful of interference with arm cylinder

If the arm is operated, the position of the rear end of the arm cylinder will change. Be careful not to let it catch on electric wires or to contact anything in the surrounding area.



12.9 PRECAUTIONS FOR OPERATION

PRECAUTIONS WHEN TRAVELING

When traveling over obstacles such as boulders or tree stumps, the machine (in particular, the undercarriage) is subjected to a large shock, so reduce the travel speed and travel over the obstacle at the center of the tracks. As far as possible, remove such obstacles or avoid traveling over them.

PERMISSIBLE WATER DEPTH NOTICE

When driving the machine out of water, if the angle of the machine exceeds 15° , the rear of the upper structure will go under water, and water will be thrown up by the radiator fan. This may cause the fan to break.

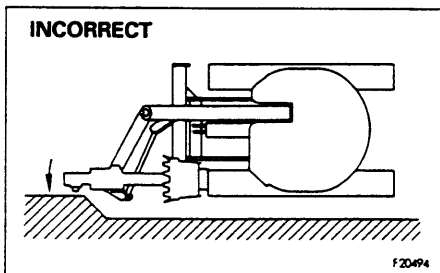
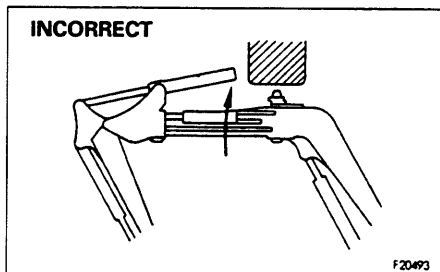
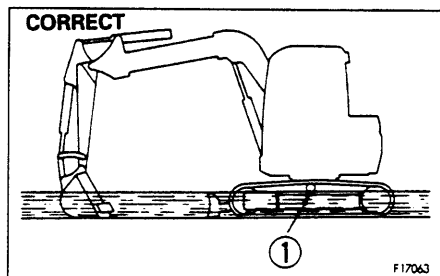
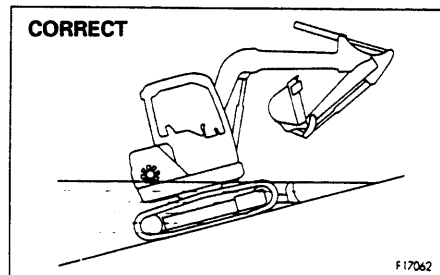
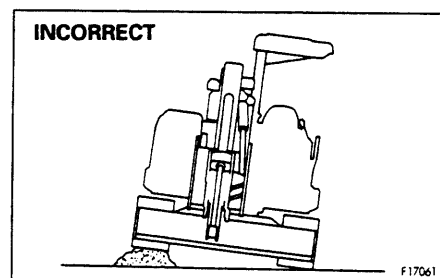
Be extremely careful when driving the machine out of water.

Do not immerse the machine in water by more than the permissible depth (under center of carrier roller ①).

In addition, for parts that have been immersed in water for a long time, pump in grease until the old grease comes out from the bearings. (Around the bucket pins)

PROTECTION OF SENSORS FROM OBSTACLES

Be careful not to hit interference prevention sensors or sensor levers with other objects (logs, ditches, steel sheets, etc.).

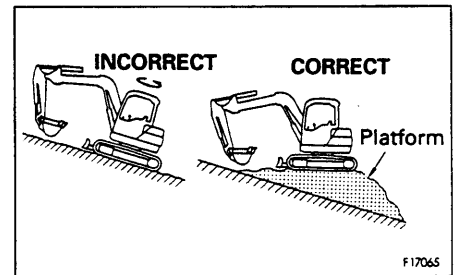
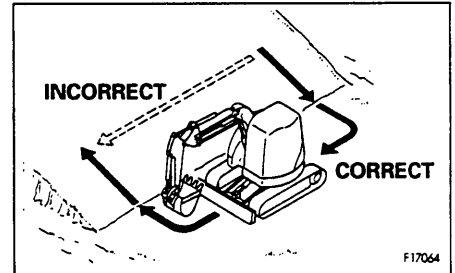


12.10 PRECAUTIONS WHEN TRAVELING UP OR DOWN HILLS

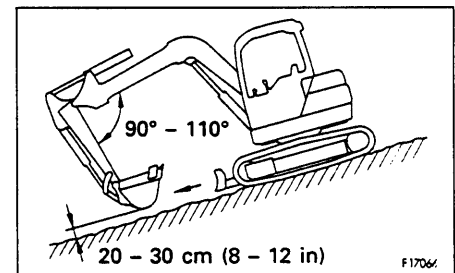
TRAVELING DOWNHILL

WARNING

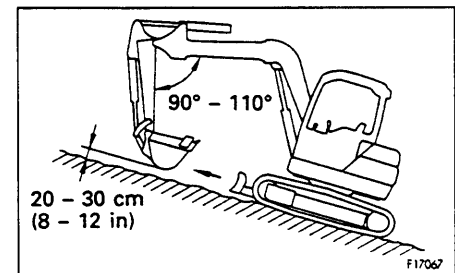
- When traveling, raise the bucket approx. 20 – 30 cm (8 – 12 in) from the ground.
Do not travel downhill in reverse.
- When traveling over ridges or other obstacles, keep the work equipment close to the ground and travel slowly.
- It is dangerous to turn on slopes or to travel across slopes. Always go down to a flat place to perform these operations. It may be longer, but it will ensure safety.
- If the machine starts to slide or loses stability, lower the bucket immediately and brake the machine.
- Turning or operating the work equipment when working on slopes may cause the machine to lose its balance and turn over, so avoid such operations. It is particularly dangerous to swing downhill when the bucket is loaded.
- If such operations have to be carried out, pile soil to make platform on the slope so that the machine can be kept horizontal when operating.
- Do not travel on slopes of over 30° as there is danger that the machine may overturn.



- 1) When traveling down steep hills, use the travel lever and fuel control lever to keep the travel speed low.
When traveling down slopes of more than 15°, set the work equipment in the posture shown in the figure on the right, and lower the engine speed.



- 2) When traveling up a steep hill of more than 15°, set the work equipment in the posture shown in the diagram on the right.



Braking when traveling downhill

To brake the machine during downhill runs, put the travel lever in the neutral position. This will cause the brake to be automatically applied.

If shoes slip

When traveling uphill, if the shoes slip or it is impossible to travel uphill using the force of the track only, it is possible to use the pulling force of the arm to help the machine travel uphill.

If engine stops

If the engine stops when traveling uphill, move the travel levers to the neutral position, lower the bucket to the ground, stop the machine, then start the engine again.

12.11 WORK POSSIBLE USING HYDRAULIC EXCAVATOR

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

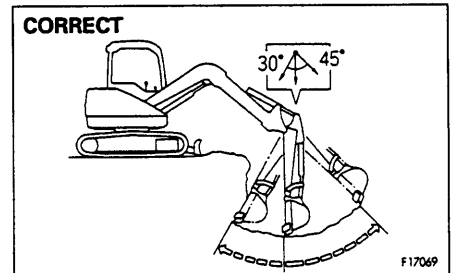
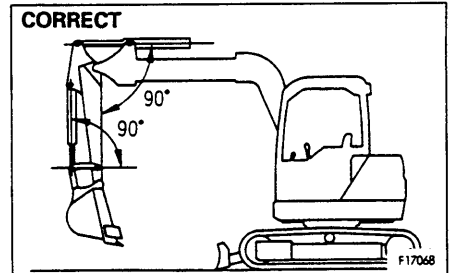
12.11.1 BACKHOE WORK

When condition of the machine is as shown in the diagram at right, each cylinders maximum pushing excavation force is obtained when the bucket cylinder and link, arm cylinder and arm are at 90°.

When excavating, use this angle effectively to optimize your work efficiency.

The range for excavating with the arm is from a 45° angle away from the machine to a 30° toward the machine.

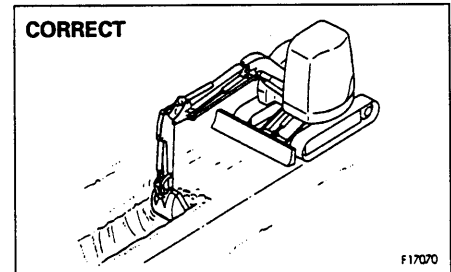
There may be some differences depending on the excavation depth, but try to use within the above range rather than going all the way to the extreme end of the cylinder stroke.



12.11.2 DITCHING WORK

Ditching work can be performed efficiently by attaching a bucket to match the width of the ditch and then setting the tracks parallel to the line of the ditch to be excavated.

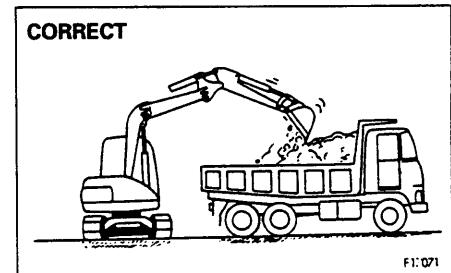
To excavate a wide ditch, first dig out both sides and then finally remove the center portion.



12.11.3 LOADING WORK

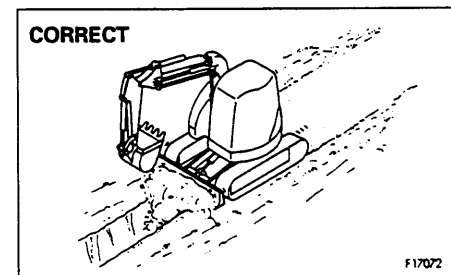
In places where the swing angle is small, work efficiency can be enhanced by locating the dump truck in a place easily visible to the operator.

Loading is easier and capacity greater if you begin from the front of the dump truck body than if loading is done from the side.



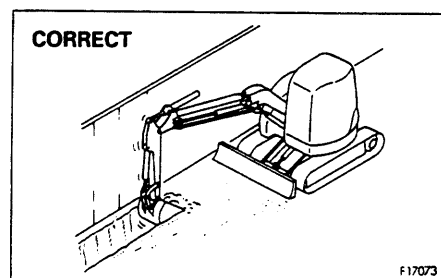
12.11.4 SMOOTHING WORK

When refilling after excavation and when smoothing the ground surface, use the blade.



12.11.5 SIDE DITCHING WORK

When the boom offset is used, it is possible to carry out side ditching work in confined spaces without swinging the upper works.

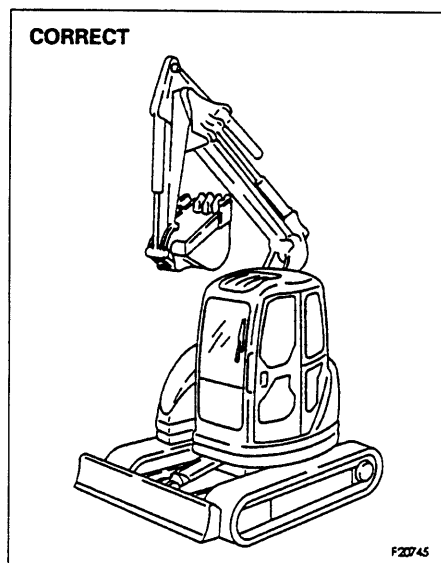


12.11.6 OPERATIONS IN CONFINED SPACES

When operating in a confined space, set the work equipment in the posture in the diagram on the right. This will allow the machine to swing freely in any area where it is possible for the tracks to enter.

Minimum swing posture

1. Offset the boom to the right.
2. Extend the arm cylinder and bucket cylinder fully, and fold the work equipment.
3. Extend the boom cylinder fully.
4. Offset the boom to the left and move to a point just before the interference prevention device is actuated.



12.12 PARKING MACHINE

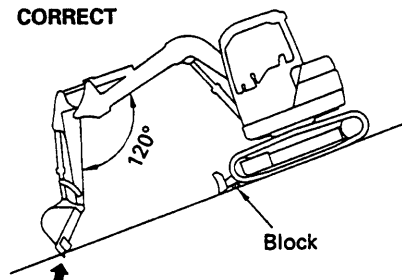
⚠ CAUTION

Avoid stopping suddenly. Give yourself ample room when stopping.

⚠ WARNING

When stopping the machine, select flat hard ground and avoid dangerous places. If it is unavoidably necessary to park the machine on a slope, insert blocks underneath the track shoes. As an additional safety measure, thrust the bucket into the ground.

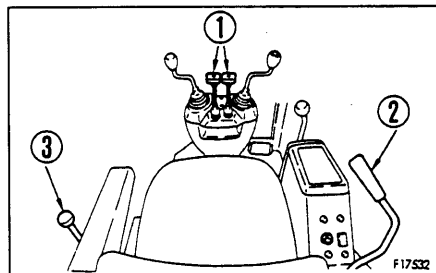
CORRECT



F17075

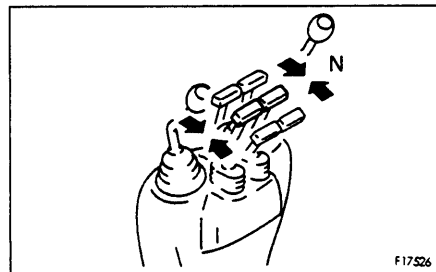
⚠ WARNING

If the control lever is touched by accident, the work equipment or the machine may move suddenly, and this may lead to a serious accident. Before leaving the operator's compartment, always apply the lock securely.



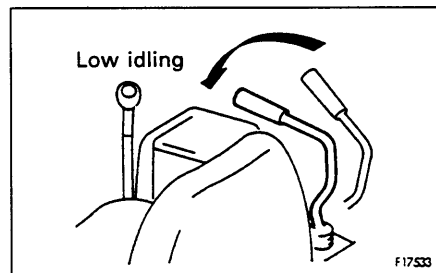
F17532

1. Put left and right travel levers ① in the neutral position.



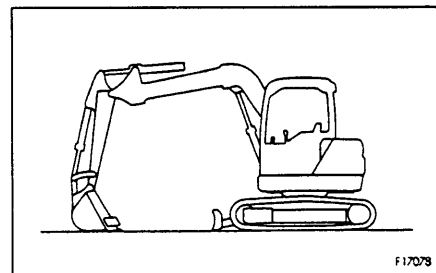
F17526

2. Lower the engine speed to low idling by fuel control lever ②.



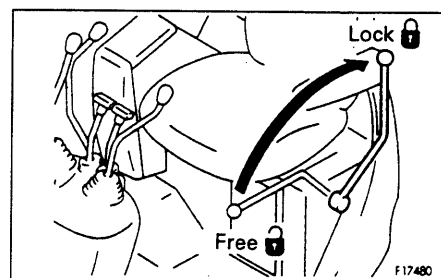
F17533

3. Lower the bucket horizontally until the bottom touches the ground.
4. Lower the blade to the ground.



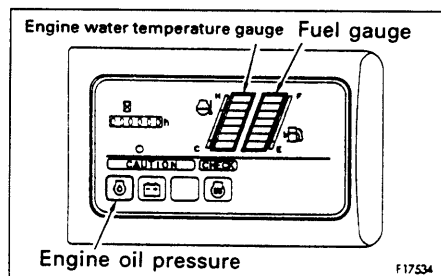
F17078

- Set lock lever ③ in the LOCK position.



12.13 CHECK AFTER FINISHING WORK

Check the engine water temperature, engine oil pressure and fuel level on the monitor.



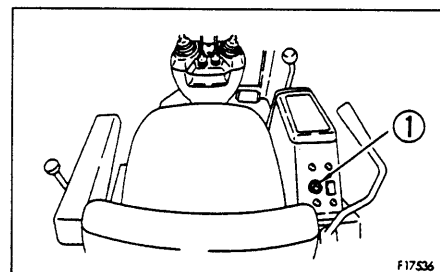
12.14 STOPPING ENGINE

NOTICE

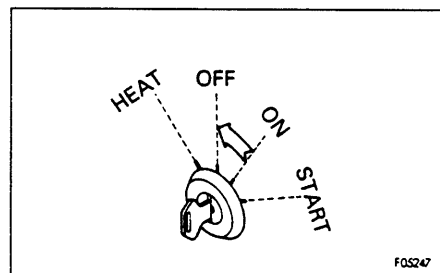
If the engine is abruptly stopped before it has cooled down, engine life may be greatly shortened. Consequently, do not abruptly stop the engine apart from an emergency.

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

- Run the engine at low idling speed for about 5 minutes to allow it to gradually cool down.



- Turn the key in starting switch ① to the OFF position and stop the engine.
- Remove the key from starting switch ①.



12.15 CHECK AFTER STOPPING ENGINE

1. Walk around the machine and check the work equipment, paint-work, and undercarriage, and check also for leakage of oil or water. If any abnormalities are found, repair them.
2. Fill the fuel tank.
3. Check the engine compartment for paper and debris. Clean out any paper and debris to avoid a fire hazard.
4. Remove any mud stuck to the undercarriage.

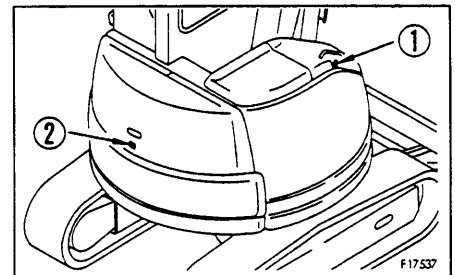
12.16 LOCKING

Always lock the following places.

- ① Tank cover at right side of machine
- ② Engine hood

REMARK

Use the starting switch key to open and close all these covers.



12.17 HOW TO ESCAPE FROM MUD

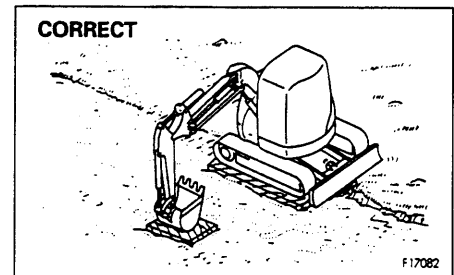
Always operate carefully to avoid getting stuck in mud. If the machine does get stuck in mud, use the following procedures to get the machine out.

12.17.1 WHEN ONE SIDE IS STUCK

When only one side is stuck in mud, use the bucket to raise the track, then lay boards or logs and drive the machine out. If necessary, put a board under the bucket also.

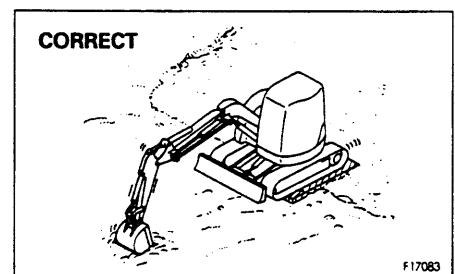
NOTICE

When using the boom or arm to raise the machine, always have the bottom of the bucket in contact with the ground. (Never push with the teeth). The angle between the boom and arm should be 90° to 110°.



12.17.2 WHEN BOTH SIDES ARE STUCK

When the tracks on both sides are stuck in mud and the machine will not move, lay boards as explained above, and dig the bucket into the ground in front. Then pull in the arm as in normal digging operations and put the travel levers in the FORWARD position to pull the machine out.



12.18 REPLACEMENT OF BUCKET

⚠ WARNING

- When knocking the pin in with a hammer, metal particles may fly and cause serious injury, particularly if they get into your eyes. When carrying out this operation, always wear goggles, helmet, gloves, and other protective equipment.
- When the bucket is removed, place it in a stable condition.

NOTICE

After removing the pins, make sure that they do not become contaminated with sand or mud and that the seals of bushing on both sides do not become damaged.

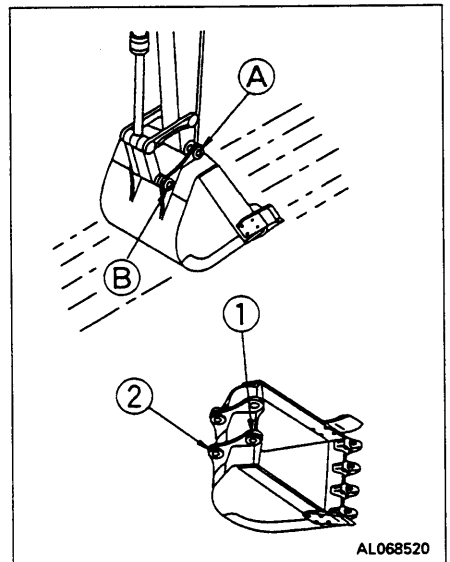
Stop the machine on a firm, flat surface. When performing joint work, make clear signals to each other and work carefully for safety's sake.

1. Place the bucket in contact with a flat surface. Remove pins ① and ②.

REMARK

When removing the pins, place the bucket so that it is in light contact with the ground. If the bucket is lowered strongly to the ground, the resistance will be increased and it will be difficult to remove the pins.

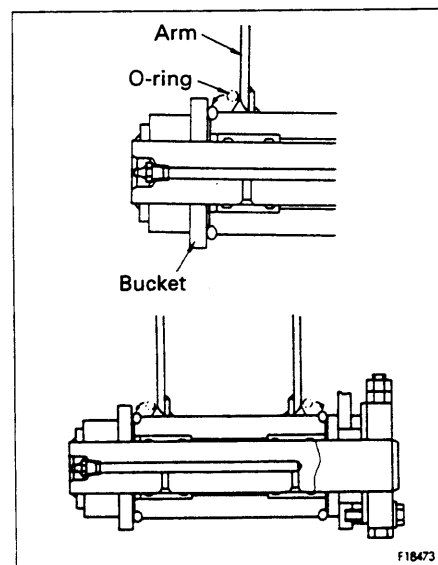
2. Align the arm with holes ① and the link with holes ②, then coat with grease and install pins ① and ②.



REMARK

When installing the bucket, the O-rings are easily damaged, so fit the O-rings on the boss of the arm end as shown in the diagram. When knocking the pin, move the O-ring down to the regular groove.

4. Install the stopper bolts and nuts for each pin, then grease the pin.



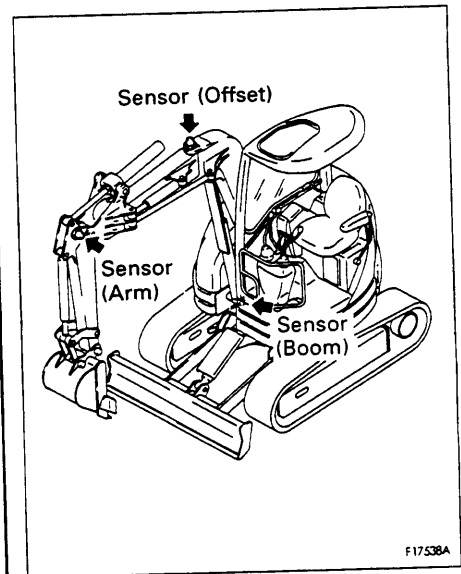
12.19 HANDLING 4-SYSTEM

The 4-system is an automatic control device for the work equipment and a device to prevent interference between the bucket and cab.

To ensure that this device works properly, always keep to the following points.

WARNING

- Never remove, install, or disassemble and repair any sensor. This will cause mistaken actuation of the interference prevention device.
Always contact your Komatsu distributor for repairs.
- If any sensor is hit or any external damage is found, check the actuation condition of the automatic stop.
If any abnormality is found, please contact your Komatsu distributor.
- Never carry out any work in which the sensors go below water.
If any sensor should be immersed in water, check the actuation condition of the automatic stop.
- The auto-stop cancel switch must only be used for moving the machine to a safe place when there is an abnormality in the 4-system. It must not be used for any other reason.
- When changing to the telescopic arm or long arm specified by Komatsu, ask your Komatsu distributor to change the attachment.
- If the attachment is changed from the standard work equipment, the 4-system will not work normally. If the work equipment is replaced by an attachment made by another company, please consult your Komatsu distributor first.

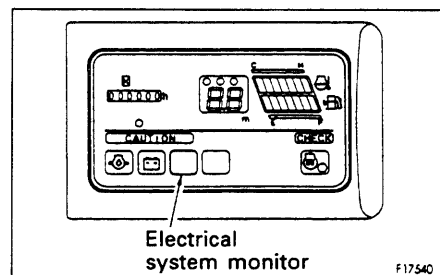
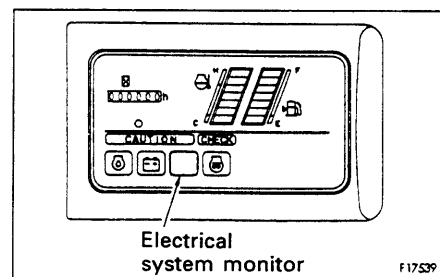


NOTICE

- If an abnormality occurs in the 4-system, the controller will carry out self diagnosis. Electrical system monitor ① on the monitor panel will flash, the buzzer will sound, and the error code will be displayed on the depth display.
For details of the correct action to carry out, see "16.5 OTHER TROUBLE".
- Depending on the location of the failure of the 4-system the controller may not carry out self diagnosis, and it may become impossible to operate the work equipment. If this happens, move the machine to a safe place, and contact your Komatsu distributor for inspection.

NOTICE

Before using the 4-system, always carry out the checks before starting and after starting.
In cold areas, carry out thorough warming up before using the machine. If the hydraulic oil temperature is low, the automatic stop may be out of position.



12.19.1 INTERFERENCE PREVENTION DEVICE (BETWEEN BUCKET AND CANOPY)

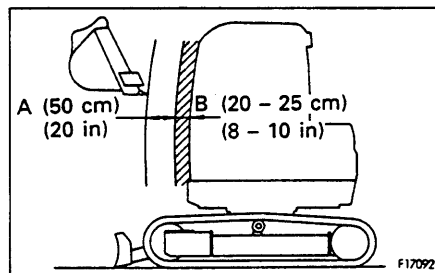
During left offset, if the arm and boom are pulled in too far, or during right offset, if the arm and boom are pulled in and it is attempted to offset to the left, this device will warn that the bucket will hit the cab, and will automatically stop the work equipment.

WARNING

This device is a preventive device intended only for unexpected cases, so it is dangerous to rely on it completely during operations. Always be careful that the work equipment does not come close to the cab during operations.

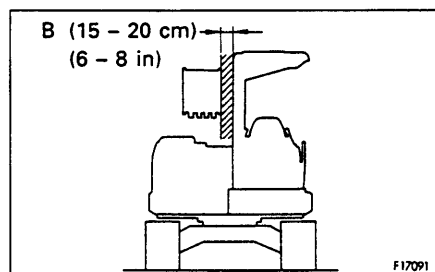
OPERATION OF INTERFERENCE PREVENTION DEVICE Reduced speed range (front to rear direction only)

If the work equipment is operated so that it comes close to the operator's compartment, when the bucket enters area A in the diagram on the right, the work equipment speed will drop. This is to prevent the load in the bucket from being spilled when the work equipment is stopped.



Automatic stop

If the bucket continues to come close and enters area B in the diagram on the right, the work equipment will automatically stop.

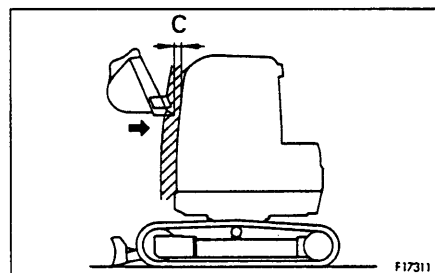


Emergency stop

If for any reason the work equipment is not automatically stopped in area B above, all operations (boom, arm, bucket, swing) will stop when it enters area C in the diagram on the right.

When this happens, error code 61 is displayed on the depth display on the monitor panel, and self diagnosis is carried out. If the cancel switch is operated and the bucket is moved to the front or the right, the self diagnosis is canceled and it becomes possible to carry out normal operations.

However, if this situation should occur, have the system checked immediately.



OPERATION WHEN THERE IS AUTOMATIC STOP** WARNING**

After using the cancel switch to cancel the automatic stop, never try to raise the boom, pull in the arm, or operate the left offset.

After automatic stop, it is impossible to raise the boom, pull in the arm, or operate the left offset.

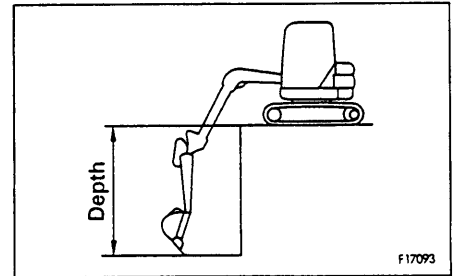
Move the work equipment to the front or to the right to move it away from the operator's compartment, then carry out normal operations.

REMARK

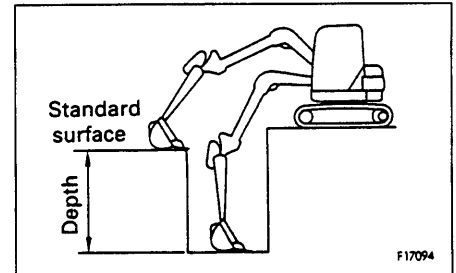
- (1) After automatic stop, even if the work equipment is moved 5 – 10 cm (2.0 – 4.0 in) to the front or right, it is impossible to raise the boom, pull in the arm, or operate the left offset, but this does not indicate a failure.
- (2) After automatic stop, if the work equipment is moved forward approx. 50 cm (20 in) and the boom is raised or the arm is pulled in, the movement will be slow (if the engine is running at low idling, it may even be impossible to raise the boom or pull the arm in), so move the work equipment more than 50 cm (20 in) before carrying out operations again.

12.19.2 HANDLING AUTOMATIC CONTROL DEVICE

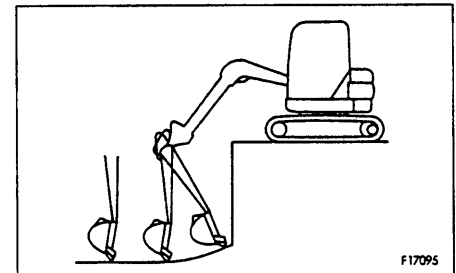
Depth display: This displays the depth from the ground surface.



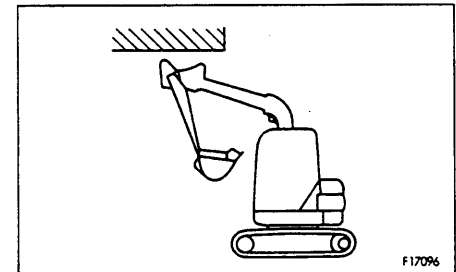
Depth display 0 set mode: This displays the depth from the standard surface.



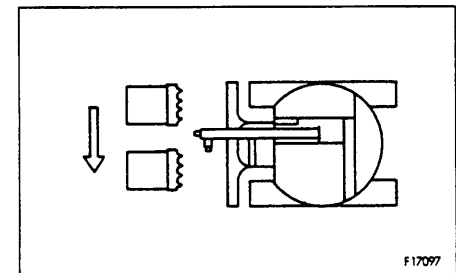
Depth mode: This sets the amount the boom can be lowered.



Height mode: This sets the amount the boom can be raised.



Offset mode: This determines the left offset position for operations such as ditch digging.

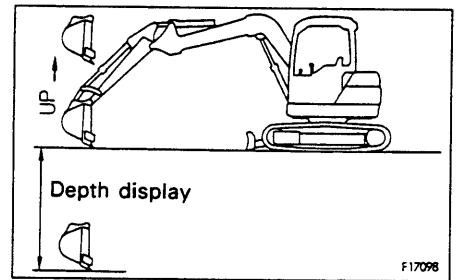


It is possible to set either the depth display or depth display 0 set mode together with the other three modes, so use these settings to match the operation.

Depth display (depth from ground surface)

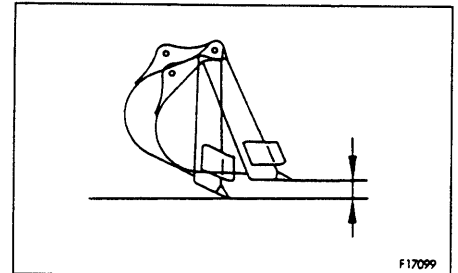
When the engine is started and the switch is ON, the depth display will always indicate the depth from the ground surface unless the depth display 0 set mode is being used.

If the work equipment is above ground level, UP is displayed.

**REMARK**

This display assumes that the bucket is pointing down, so if the bucket is in the condition shown in the diagram on the right, the actual depth may be different from the display depth.

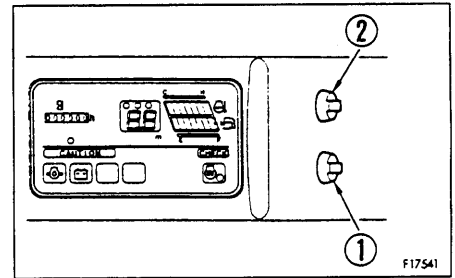
When measuring the depth, always set the machine horizontal.



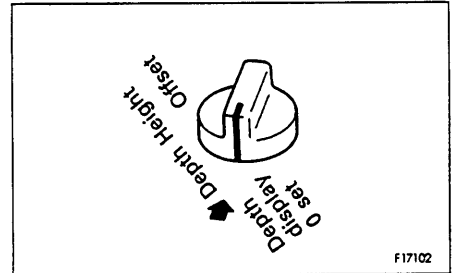
12. OPERATION

Setting depth display 0 set mode (depth from standard surface)

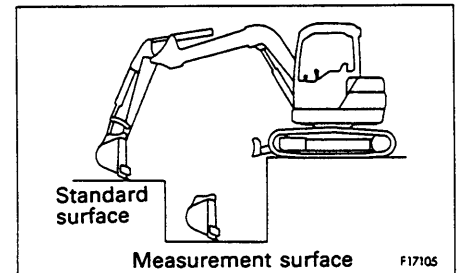
This displays the desired standard surface as 0.0 m (0.0 in), and displays the depth of the bucket from this surface.



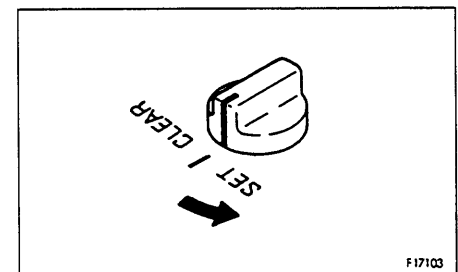
1. Turn mode selector switch ① to the depth display 0 set mode position.



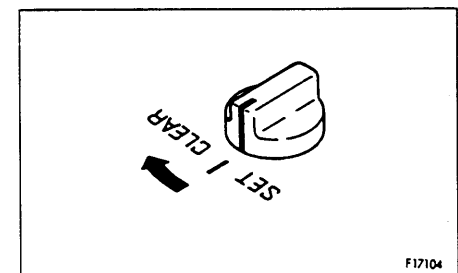
2. Set the machine horizontal, and align the bucket with the position to use as the standard surface. When aligning, the way in which the bucket is placed becomes the standard for the depth display.



3. Turn setting switch ② to the SET position. The depth display will become 0.0 m.
4. Move the bucket to the point that is to be measured (measurement surface).



5. To return the setting so that it measures the depth from the ground surface, turn mode selector switch ① to the depth display 0 set mode position, then turn setting switch ② to the CLEAR position. The display will return to the depth display measured from the ground surface.



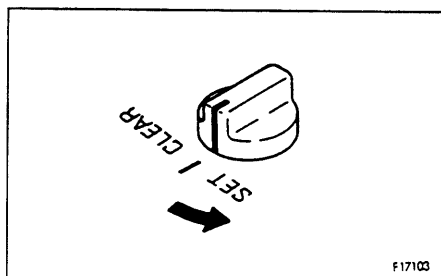
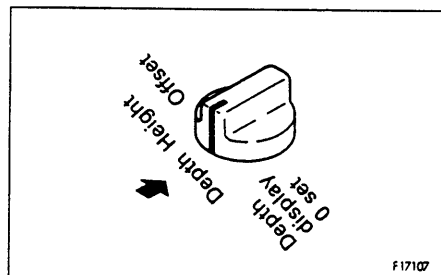
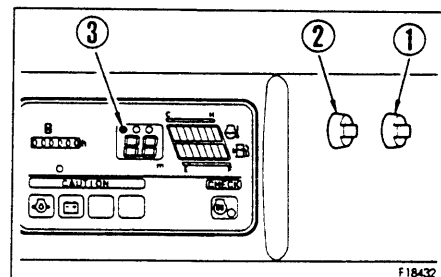
REMARK

- When carrying out the measurement, place the bucket in the same posture at the measurement point as it was at the standard surface.
- If the starting switch is turned OFF in the mode set condition, the mode set condition is canceled.

Setting depth mode

When the boom is lowered to the desired set depth, it will automatically stop.

1. Turn mode selector switch ① to the depth mode position.
2. Lower the boom to the position to be set.
3. Turn setting switch ② to the SET position. The buzzer will sound twice and indicator ③ will light up.
4. If the boom is raised, then lowered again, it will stop at the set point.

**REMARK**

The stop position may differ slightly as follows according to the operating conditions.

- (1) If the boom is lowered slowly, the boom will stop slightly before the set position.
- (2) In cold weather, it may go beyond the set position before stopping, so be sure to carry out the warming-up operation thoroughly to warm up the hydraulic oil before starting operations. For details of the warming up the procedure, see "12.3 OPERATIONS AND CHECKS AFTER STARTING ENGINE".

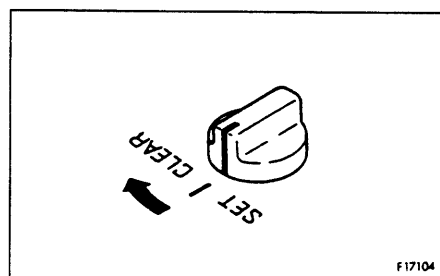
REMARK

In the depth mode, the amount the boom can be lowered is set. The arm and bucket cannot be set, so operations such as automatic horizontal digging cannot be carried out.

5. When canceling the depth mode, turn mode selector switch ① to the depth mode position, then turn setting switch ② to the CLEAR position. Indicator ③ will go out.

REMARK

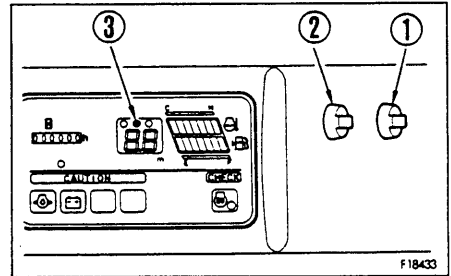
When the mode is set, if the starting switch is turned OFF, the mode setting is canceled.



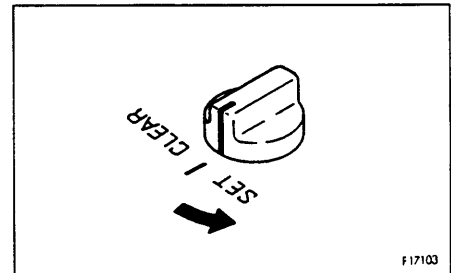
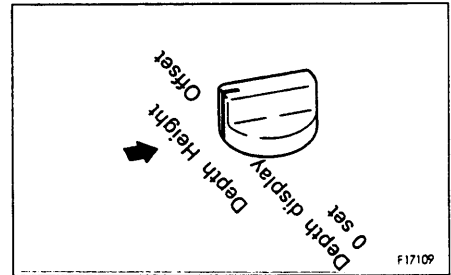
12. OPERATION

Setting height mode

When the boom is raised to the desired set height, it will automatically stop.

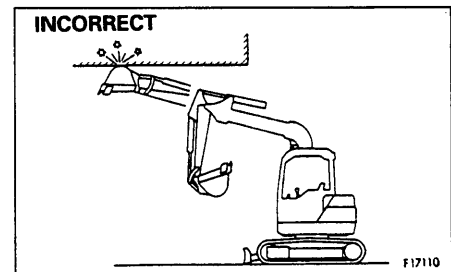


1. Turn mode selector switch ① to the height mode position.
2. Raise the boom to the position to be set.
3. Turn setting switch ② to the SET position. The buzzer will sound twice and indicator ③ will light up.
4. If the boom is lowered, then raised again, it will stop at the set point.



NOTICE

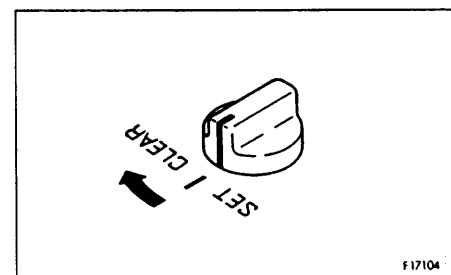
The height mode sets the amount that the boom can be raised. If the boom height is set with the arm and bucket pulled in as shown in the diagram on the right, the bucket may become higher when the arm and bucket are moved out, so be careful not to contact anything around the machine.



5. When canceling the height mode, turn mode selector switch ① to the height mode position, then turn setting switch ② to the CLEAR position. Indicator ③ will go out.

REMARK

When the mode is set, if the starting switch is turned OFF, the mode setting is canceled.



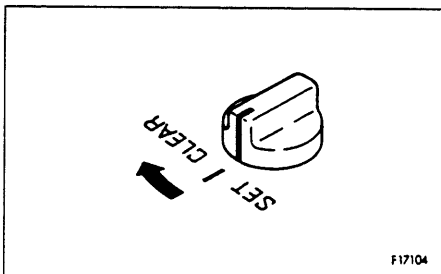
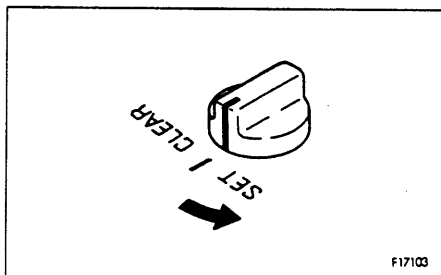
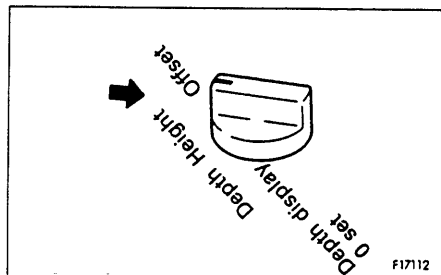
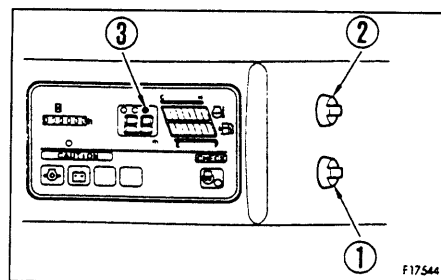
Setting offset mode

When the boom is offset to the left to the desired set position, it will automatically stop.

1. Turn mode selector switch ① to the offset mode position.
2. Offset the boom to the position to be set.
3. Turn setting switch ② to the SET position. The buzzer will sound twice and indicator ③ will light up.
4. If the boom is offset to the right, then to the left again, it will stop at the set point.
5. When canceling the offset mode, turn mode selector switch ① to the offset mode position, then turn setting switch ② to the CLEAR position. Indicator ③ will go out.

REMARK

When the mode is set, if the starting switch is turned OFF, the mode setting is canceled.



12.20 HANDLING RUBBER SHOES (RUBBER SHOES ONLY)

12.20.1 SKILLFUL USE OF RUBBER SHOES

Rubber shoes have excellent properties that are not found in metal shoes. However, if they are used in the same way as metal shoes, full use cannot be made of their advantages. Be sure to operate with rubber shoes in a way that matches the condition of the jobsite and the nature of the work.

Comparison of rubber shoes and metal shoes

	Rubber shoes	Metal shoes
Little vibration	Excellent	Average
Smooth travel	Excellent	Good
Little noise	Excellent	Average
No damage to paved surface	Excellent	Average
Easy to handle	Excellent	Average
Easily damaged	Average	Excellent
Strong drawbar pull	Excellent	Excellent

Considering the properties of the material used, rubber shoes offer various advantages. However, their weak point is lack of strength. Therefore, it is important to understand the advantages of rubber shoes, and to follow the precautions regarding handling and prohibited work. This will extend the life of the rubber shoes and will enable the machine to display the advantages of rubber shoes to the maximum. Before using rubber shoes, always read "12.20.3 PRECAUTIONS WHEN USING RUBBER SHOES".

12.20.2 WARRANTY FOR RUBBER SHOES

It is important to inspect and maintain the tracks at the correct tension. Furthermore, these shoes must not be used near objects where they are likely to suffer damage, such as the corners of steel plates, U-shaped grooves, and blocks, on crushed rock or the sharp edges of rocks, iron beams or scrap iron.

If the customer carries out prohibited work or does not follow the precautions for operation, the damage resulting from the customer's mistaken use of the machine shall not be included in the scope of the warranty.

12.20.3 PRECAUTIONS WHEN USING RUBBER SHOES

Prohibited work

Do not carry out the following types of work.

- Carrying out operations and steering on crushed rock, extremely rough hard rock, steel beams, scrap iron, or near the edges of steel plates will cause damage to the rubber shoes.
- In places such as riverbeds where there are large numbers of large and small boulders, the stones may get caught and damage the rubber shoes or make the shoes come off. If dozing operations are carried out when the shoes slip, this will also reduce the life of the rubber shoes.
- Be careful not to get oil, fuel, or chemical solvent on the rubber shoes. If such a substance should get on the shoes, remove it immediately. Furthermore, do not travel on road surfaces where oil has collected.
- When putting the machine into long-term storage (3 months or more), store the machine indoors where it is protected from direct sunlight or rain.
- Do not use the machine in high temperature areas, such as areas where there is burning wood, steel plate that have been left under the hot sun, or places where asphalt is being laid.
- Do not move the machine with the crawler on one side raised using the work equipment. This will cause damage to the rubber shoes and may cause the shoes to come off.

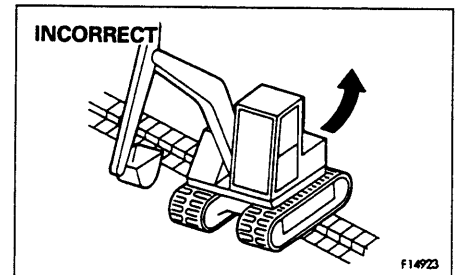
12.20.4 PRECAUTIONS WHEN USING

Be careful of the following points when carrying out work.

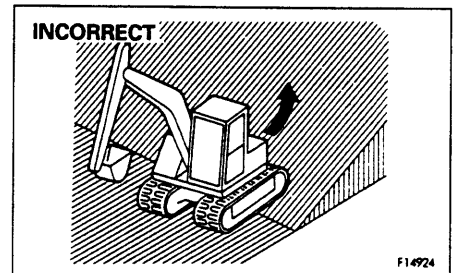
- Avoid carrying out counterrotation turns on concrete surfaces.
- Avoid making sudden changes in direction. This may cause premature wear or damage to the rubber shoes.
- Avoid operating the steering when traveling over places where there is a big difference in height. When traveling over obstacles or places where there is a difference in height, drive the machine at right angles to the obstacles to prevent the shoes from coming off.
- If the machine has been raised using the bucket, lower it slowly.
- Avoid doing work with materials that produce oil when crushed (soya beans, corn, or vegetables squeezed for oil), or wash the machine after using it.
- Avoid handling materials that will attach the adhesion of the steel core such as salt, ammonium sulphate, potassium chloride, potassium sulphate, calcium superphosphate; or wash the machine after use.
- The adhesion of the core will be attacked by salt, so avoid using the machine in coastal areas.
- When handling salt, sugar, wheat, or soya beans, if there is any deep cut in the rubber shoes, these substances may get into the lugs or cut portion of the rubber, so always repair the rubber before use.
- Do not carry out work that involves scraping against walls or concrete embankments.
- Rubber shoes slip extremely easily on snow or frozen roads. Be careful not to slip when traveling or working on slopes.
- The properties of rubber shoes change when working in extremely cold places, and this will reduce the life of the rubber shoe.
- Because of the properties of rubber, use the rubber shoes within a range of -25°C – $+55^{\circ}\text{C}$ (-13°F – 131°F).

- When working, be careful not to damage the rubber shoes with the bucket.
- To prevent the shoes from coming off, always maintain the correct tension. If the tracks are slack, the shoes will come off under the following conditions. Even when the tension is correct, be extremely careful when carrying out these operations.

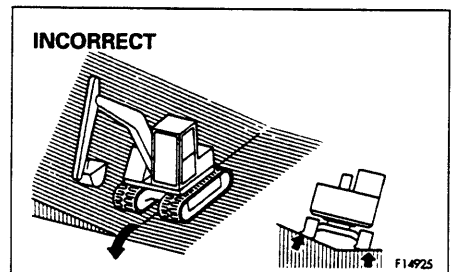
1. When traveling over curbs, rocks, or places where there is a big difference in level (approx. 20 cm (8 in)), do not turn the machine. When traveling over such objects, always travel at right angles to the object.



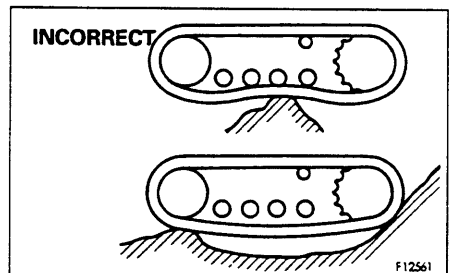
2. When traveling in reverse up a slope, do not turn when moving from flat ground onto the slope. If it is necessary to turn on slopes, be sure to turn gradually.



3. Avoid traveling along the edge of a slope or on rough ground with the track on one side raised (with the machine tilting at angle of more than approx. 10°), and one side on the flat ground. To avoid damage to the rubber shoes, travel with both tracks on flat ground.



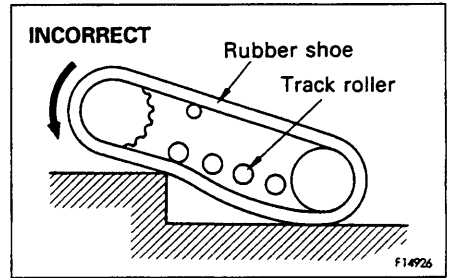
4. In Items 1 – 3, if the rubber track is loose, avoid turning in the posture in the diagram.



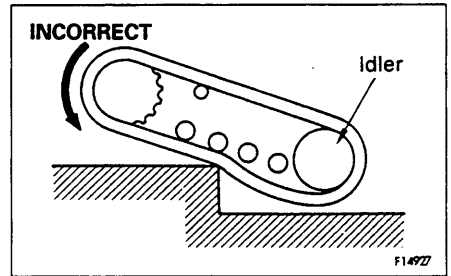
12. OPERATION

(Mechanism of rubber shoe coming off track)

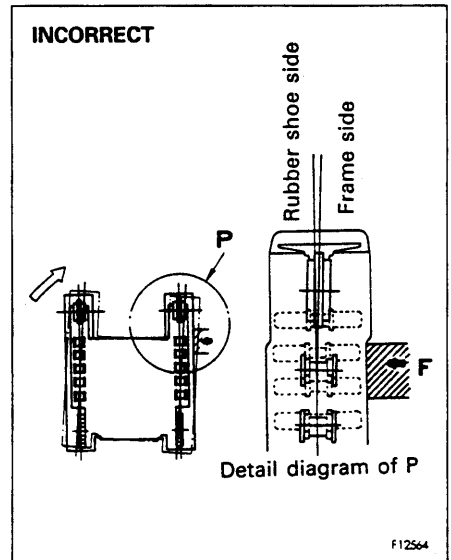
- 1) When traveling over an obstacle, a gap is formed between the track roller and the rubber shoe. In this condition, the rubber shoe may come off.



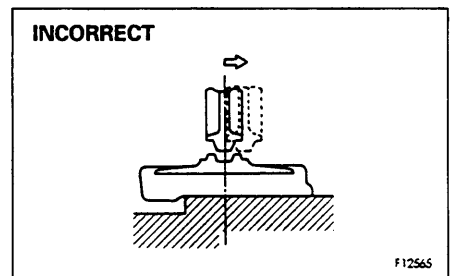
- 2) If the machine travels further in reverse, a gap is formed among the track roller, idler and the rubber shoe.



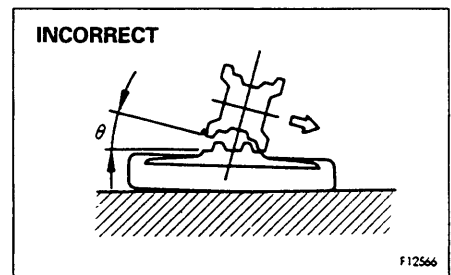
- When turning in a condition where the rubber shoe cannot move to the side because of the object it is passing over, or because of some other object.
- When the idler or track roller are out of alignment with the core because of movement of the rubber shoe out of alignment.



- If the machine travels in reverse in this condition, the rubber shoe will come off.



- If the machine is turned in this condition, the rubber shoe will come off.



13. TRANSPORTATION

When transporting the machine, observe all related laws and regulations, and be careful to assure safety.

13.1 LOADING, UNLOADING WORK

WARNING

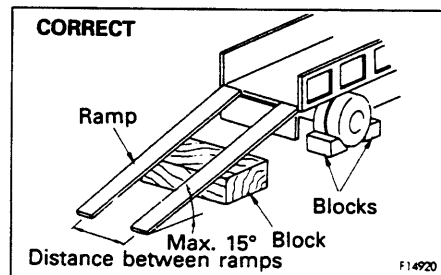
- Loading or unloading the machine can be a dangerous operation, so be particularly careful.
- Make sure the ramp has sufficient width, length and thickness to enable the machine to be safely loaded and unloaded. If the ramp sags appreciably, reinforce it with blocks, etc.
- When loading and unloading the machine, park the trailer on a flat firm roadbed. Keep a fairly long distance between the road shoulder and the machine.
- Remove the mud from the undercarriage to prevent the machine from slipping to the side on slopes. Be sure the ramp surface is clean and free of grease, oil, ice and loose materials.
- Never change the direction of travel when on the ramps. If it is necessary to change direction, drive off the ramps and correct the direction, then drive on to the ramps again.
- When turning the machine on the trailer, the machine's footing is unstable, so carry out the operation slowly.

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

1. Properly apply the brakes on the trailer and insert blocks beneath the tires to ensure that it does not move. Then fix the ramps in line with the centers of the trailer and the machine. Be sure that the two sides are at the same level as one another.

Make the angle of the gangplank a maximum of 15°.

Set the distance between the ramps to match the center of the tracks.



13. TRANSPORTATION

2. Lower the engine speed using the fuel control lever.
3. Set the swing lock lever to the LOCK position.
4. Set in the direction of the ramps, lower the work equipment as far as possible without letting it hit the trailer, then travel slowly to load or unload the machine.

If the work equipment is installed to the machine, load from the front; if the work equipment is not installed, load from the rear.

When on the ramps, do not operate any lever other than the travel lever.

5. Load the machine correctly in the specified position on the trailer.

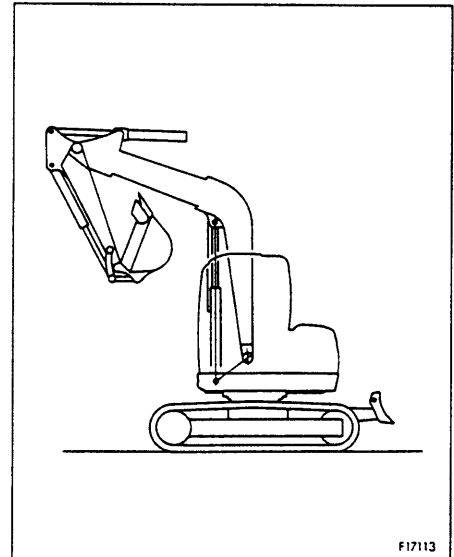
13.2 METHOD FOR LIFTING CHASSIS

WARNING

- Never raise the machine with any worker on it.
- Always make sure that the wire rope used for lifting the machine is of ample strength for the weight of the machine.
- Never try to lift the machine in any posture other than the posture given in the procedure below.
There is danger that the machine may lose its balance.

When lifting the chassis, carry out operation as follow on level ground.

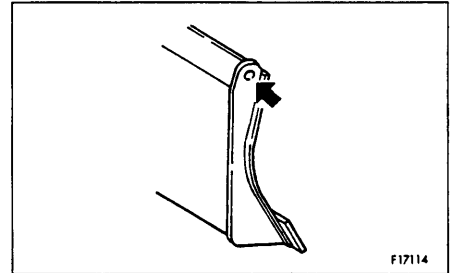
1. Start the engine, swing the upper structure so that the blade is at the rear of the machine, then place the swing lock lever at the LOCK position.
2. Raise the blade to the maximum height.
3. Extend the bucket cylinder and arm cylinder fully, operate the work equipment control lever so that the boom cylinder is perpendicular to the ground, then place the lock lever at the LOCK position.
4. If the boom is offset to the left or right, operate the offset pedal so that the boom is straight, then place the pedal lock in the LOCK position.



13. TRANSPORTATION

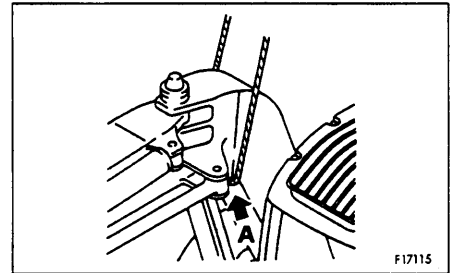
5. Stop the engine, check that there is nothing around the operator's compartment, then get down from the machine.

6. Install shackles to the two lifting holes at the ends of the blade, then fix the wire rope.



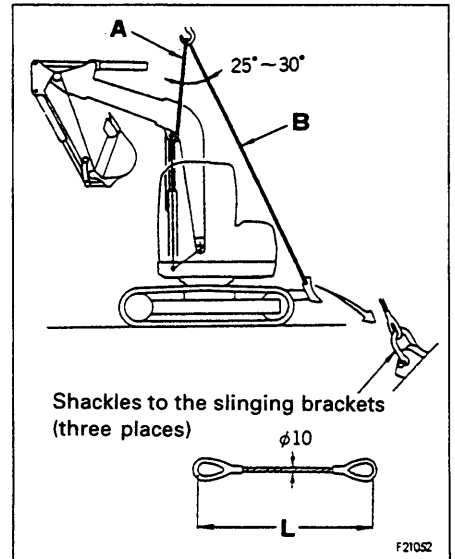
7. Pass the wire through portion A of the boom.

8. When operating the crane to apply tension to the wire, fit wooden blocks at the places where the wire contacts the chassis.



9. Make the lifting angle of the wire rope 25° – 30° and carry out the lifting operation.

10. After lifting the machine off the ground, check carefully that the machine is balanced.



REMARK

Proper lengths of wire ropes are as follows:

	Wire A	Wire B
L (mm)	4200	4000
Pieces/unit	1	2

13.3 PRECAUTIONS FOR LOADING

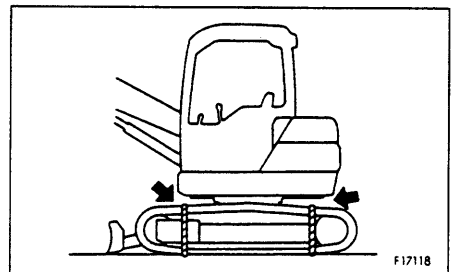
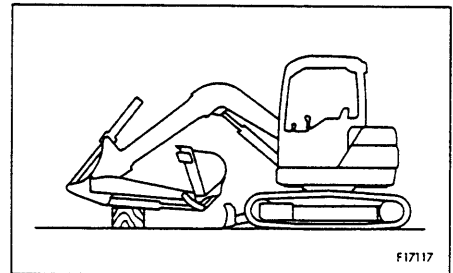
After loading to the specified position, secure the machine as follows.

1. After loading the machine, fully extend the bucket and arm cylinders, then slowly lower the boom.
2. Lower the blade.
3. Stop the engine and remove the starting switch key.

NOTICE

When transporting the machine, place rectangular timber under one end of the bucket cylinder to prevent it touching the ground, thereby saving it from possible damage.

4. Lock all the control levers securely with the lock lever.
5. When transporting the machine, place rectangular timber underneath the front and rear track shoes to prevent the machine from moving about. Also, hold it down with chains or rope. Be particularly careful to ensure that the machine does not slip sideways.



13.4 PRECAUTIONS FOR TRANSPORTATION

 **WARNING**

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

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

NOTICE

Always retract the car radio antenna.

 **WARNING**

For machines with cab specification, always check that the door is closed and locked before transporting the machine.

14. COLD WEATHER OPERATION

14.1 PRECAUTIONS FOR LOW TEMPERATURE

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

14.1.1 FUEL AND LUBRICANTS

Change to fuel and oil with low viscosity for all components. For details of the specified viscosity, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".

14.1.2 COOLANT

 **WARNING**

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

NOTICE

Never use methanol, ethanol or propanol based antifreeze.

Where no permanent antifreeze is available, an ethylene glycol antifreeze without corrosion inhibitor may be used only for the cold season. In this case, clean the cooling system twice a year (in spring and autumn). When refilling the cooling system, add antifreeze in autumn, but do not add any in spring.

Absolutely avoid using any water leak preventing agent irrespective of whether it is used independently or mixed with an antifreeze.

Do not mix one antifreeze with a different brand.

For details of the antifreeze mixture when changing the coolant, see "24.2 WHEN REQUIRED".

Use a Permanent Antifreeze (ethylene glycol mixed with corrosion inhibitor, antifoam agent, etc.) meeting the standard requirements as shown below. With permanent antifreeze, no change of coolant is required for a year. If it is doubtful that an available antifreeze meets the standard requirements, ask the supplier of that antifreeze for information.

Standard requirements for permanent antifreeze.

- SAE J1034
- FEDERAL STANDARD O-A-548D

14.1.3 BATTERY

⚠ WARNING

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

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

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

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

14.2 CAUTIONS AFTER COMPLETION OF WORK

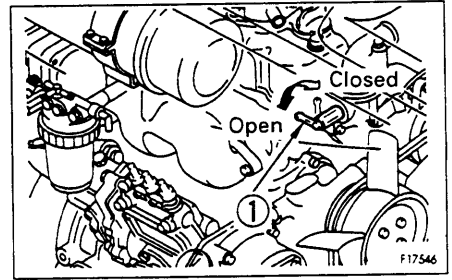
To prevent mud, water, or the undercarriage from freezing and making it impossible for the machine to move on the following morning, always observe the following precautions.

- Mud and water on the machine body should be completely removed. This is to prevent damage to the seal caused by mud or dirt getting inside the seal with frozen drops of water.
- Park the machine on concrete or hard ground. If this is impossible, park the machine on wooden boards. The boards help protect the tracks from being frozen in soil and the machine can start next morning.
- Open the drain valve and drain any water collected in the fuel system to prevent it from freezing.
- As the battery capacity drops markedly in low temperatures, cover the battery or remove it from the machine, keep it in a warm place, and install it again the next morning. If electrolyte level is found low, add distilled water in the morning before beginning work. Do not add the water after the day's work so as to prevent fluid in the battery from freezing in the night.

14.3 PREPARING THE CAB HEATER (if equipped)

If the ambient temperature drops, use the cab heater.

- When using the cab heater, turn valve ① on the water manifold counterclockwise to open it.
- When leaving the cab heater unused for a long time, turn valve ① clockwise to close it.



14.4 AFTER COLD WEATHER

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

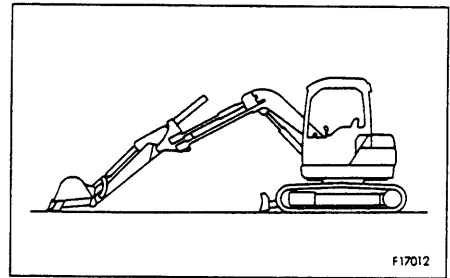
- Replace the fuel and oil for all parts with oil of the viscosity specified.
For details, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
- If for any reason permanent antifreeze cannot be used, and an ethyl glycol base antifreeze (winter, one season type) is used instead, or if no antifreeze is used, drain the cooling system completely, then clean out the inside of the cooling system thoroughly, and fill with fresh water.

15. LONG-TERM STORAGE

15.1 BEFORE STORAGE

NOTICE

To protect the cylinder rod when the machine is not being used, set the work equipment in the posture shown in the diagram. (This prevents rusting of the cylinder rod)



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

- After every part is washed and dried, the machine shall be housed in a dry building. Never leave it outdoors. In case it is indispensable to leave it outdoors, park the machine on the well-drained concrete and cover it with canvas etc.
- Completely fill the fuel tank, lubricate and change the oil before storage.
- Apply a thin coat of grease to metal surface of the hydraulic piston rods.
- Disconnect the negative terminals of the battery and cover it, or remove it from the machine and store it separately.
- If the ambient temperature is expected to drop below 0°C (32°F), always add antifreeze to the cooling water.
- Lock each control lever and pedal with the lock lever and pedal lock.

15.2 DURING STORAGE

 **WARNING**

If it is unavoidably necessary to carry out the rustpreventive operation while the machine is indoors, open the doors and windows to improve ventilation and prevent gas poisoning.

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

15.3 AFTER STORAGE

NOTICE

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

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

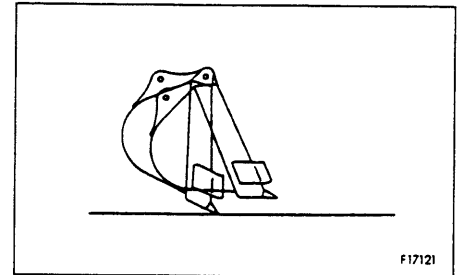
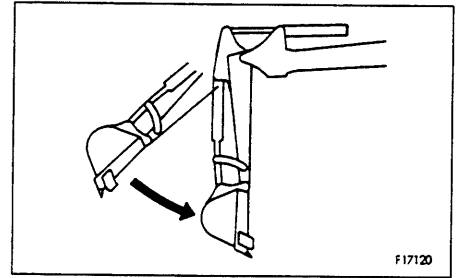
- Wipe off the grease from the hydraulic cylinder rods.
- Add oil and grease to all places.
- Because plastic materials are used for the fuel tank, never clean it using trichloroethylene as this will deteriorate the fuel tank strength.

16. TROUBLESHOOTING

16.1 PHENOMENA THAT ARE NOT FAILURES

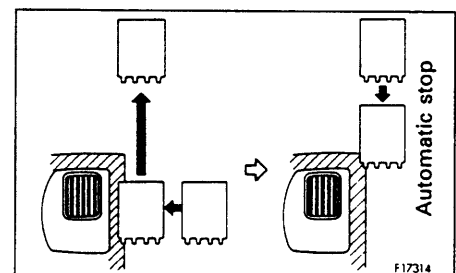
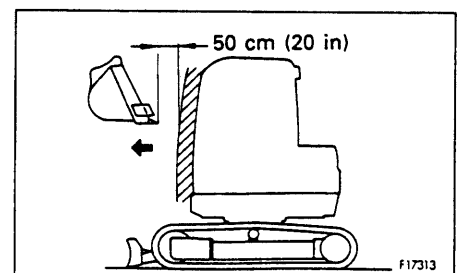
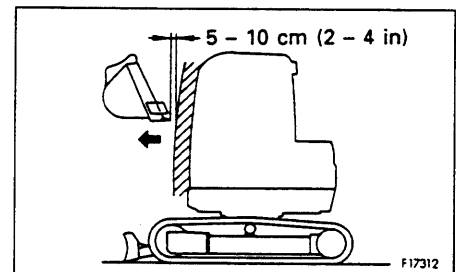
Note that the following phenomena are not failures:

- 1) When the arm is pulled in, the speed of movement will drop momentarily when the arm is more or less vertical.
- 2) The arm speed will drop momentarily when the bucket teeth are more or less horizontal.
- 3) When starting or stopping the swing, noise will be emitted from the brake valve.
- 4) When going down a steep slope at low speed, a noise will be emitted from the travel motor.



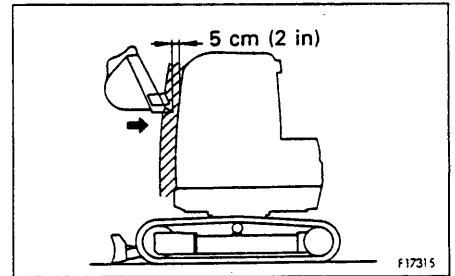
PHENOMENA THAT ARE NOT FAILURES ON THE 4-SYSTEM

- 1) After automatic stop, even when the work equipment has been moved 5 – 10 cm (2 – 4 in) to the front or right, it is impossible to raise the boom, pull the arm in, or operate the left offset.
- 2) After automatic stop, when the work equipment has been moved 50 cm to the front, the speed of the work equipment is slow when the boom is raised or the arm is pulled in. (If the engine is running at low idling, it may even be impossible to raise the boom or pull the arm in.)
- 3) After automatic stop when the boom is offset to the left, if the work equipment is moved to the front to escape from the condition, and is then returned to the original position, it automatically stops on the way. (If it is offset 5 cm (2 in) to the right, it can be returned to the original posture.)

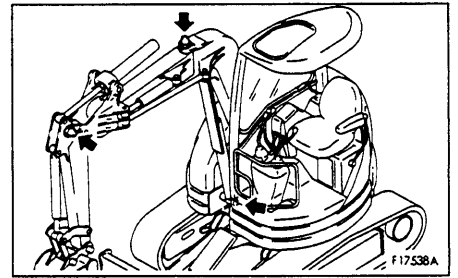


16. TROUBLESHOOTING

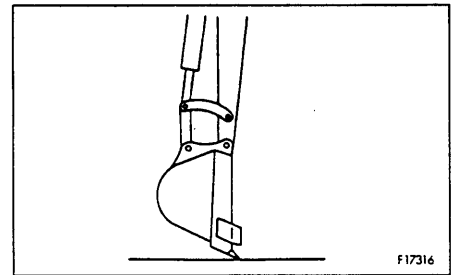
- 4) After automatic stop, when the cancel switch is turned on and the work equipment is moved closer to the operator's compartment, the controller carries out self diagnosis and it becomes impossible to operate the swing or any of the work equipment. (Error code 61 is displayed.)



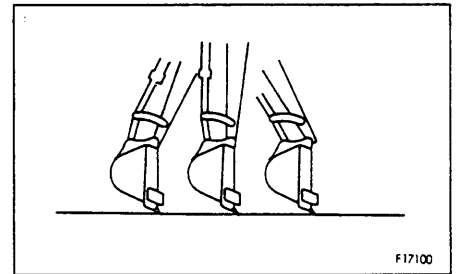
- 5) When the work equipment angle sensor has been removed and installed again, the automatic stop position will change.



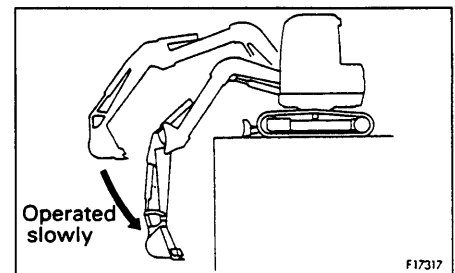
- 6) When the cutting edge of the bucket is lowered to the ground surface, the depth display does not become 0.0 m (0.0 in).



- 7) The depth display changes according to the position of the bucket.



- 8) The boom stops before the point set for the depth mode. (This happens particularly when the boom is lowered slowly.)
- 9) In cold weather, the stop position changes when the interference prevention device and automatic control device are actuated. (This returns to normal when the hydraulic oil is warmed up.)

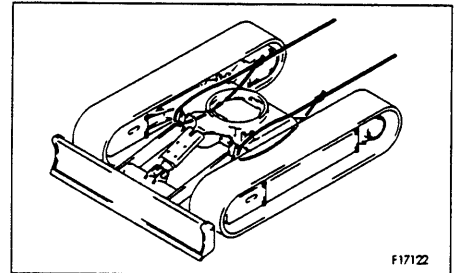


16.2 METHOD OF TOWING MACHINE

WARNING

When towing the machine, use a wire rope that has ample strength for the weight of the machine that is being towed.

If the machine sinks in mud and cannot get out under its own power, or if the drawbar pull of the excavator is being used to tow a heavy object, use a wire rope as shown in the diagram on the right.



16.3 PRECAUTIONS ON PARTICULAR JOBSITES

WARNING

Never carry out any operation where the sensor goes under water.

If the sensor should go under water, check the actuation of the automatic stop.

If there is any abnormality, please contact your Komatsu distributor for repairs.

1. When carrying out digging operations in water, if the work equipment mounting pin goes into the water, carry out greasing every time the operation is carried out.
2. For heavy-duty operations and deep digging, carry out greasing of the work equipment mounting pins every time before operation.

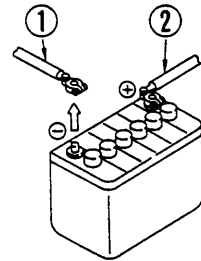
After greasing, operate the boom, arm, bucket, and blade several times, then grease again.

16.4 IF BATTERY IS DISCHARGED

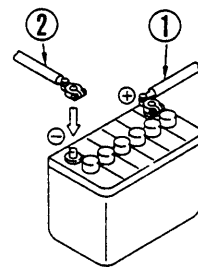
⚠ WARNING

- When checking or handling the battery, stop the engine and turn the starting key to the OFF position before starting.
- The battery generates hydrogen gas, so there is danger of explosion. Do not bring lighted cigarettes near the battery, or do anything that will cause sparks.
- Battery electrolyte is dilute sulphuric acid, and it will attack your clothes and skin. If it gets on your clothes or on your skin, wash it immediately off with large amounts of water. If it gets in your eyes, wash it out with fresh water, and consult a doctor.
- When handling battery, always wear protective goggles.
- When removing the battery, first disconnect the cable from the ground (normally, from the negative \ominus terminal). When installing, install the positive \oplus terminal first. If a tool touches the cable connecting the positive terminal and the chassis, there is danger that it will cause sparks.
- If the terminals are loose, there is danger that the defective contact may generate sparks that will cause an explosion. When installing the terminals, install them tightly.

When removing, disconnect the cable from the ground terminal first.



When installing, connect the cable to the positive \oplus terminal first.



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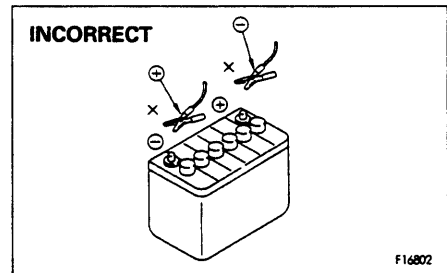
16.4.1 STARTING ENGINE WITH BOOSTER CABLE

When starting the engine with a booster cable, do as follows:

Precautions when connecting and disconnecting booster cable

WARNING

- When connecting the cables, never contact the positive \oplus and negative \ominus terminals.
- When starting the engine with a booster cable, always wear safety glasses.
- Be careful not to let the normal machine and problem machine contact each other. This prevents sparks from generating near the battery which could ignite the hydrogen gas given off by the battery. If hydrogen gas explodes. It could cause serious injury.
- Make sure that there is no mistake in the booster cable connections. The final connection is to the revolving frame, but sparks will be generated when this is done, so connect to a place as far as possible from the battery.
- Use care when removing the cables from the machine that has been started. Do not allow the cable ends to contact each other or the machine, to avoid hydrogen explosion.



NOTICE

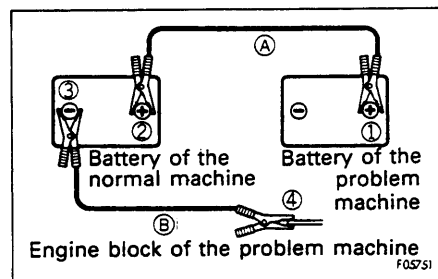
- The size of the booster cable and clip should be suitable for the battery size. (Wire with capacity of at least 180A)
- The battery of the normal machine must be the same capacity as that of the engine to be started.
- Check the cables and clips for damage or corrosion.
- Make sure that the cables and clips are firmly connected.

Connecting the booster cables

Keep the starting switch at the OFF position.

Connect the booster cable as follows, in the order of the numbers marked in the diagram.

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

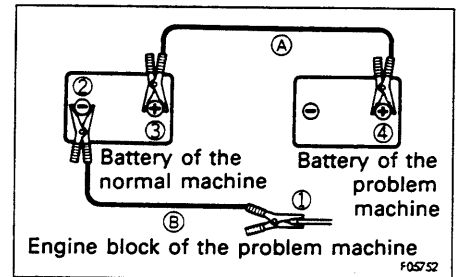
**Starting the engine**

1. Make sure the clips are firmly connected to the battery terminals.
2. Start the engine of the normal machine and keep it to run at high idling speed.
3. Turn the starting switch of the problem machine to the START position and start the engine. Refer to "12.2 STARTING ENGINE".

Disconnecting the booster cables

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

1. Remove one clip of booster cable **(B)** from the engine block of the problem machine.
2. Remove the other clip of booster cable **(B)** from the negative \ominus terminal of the normal machine.
3. Remove one clip of booster cable **(A)** from the positive \oplus terminal of the normal machine.
4. Remove the other clip of booster cable **(A)** from the positive \oplus terminal of the problem machine.



16.5 OTHER TROUBLE

16.5.1 ELECTRICAL SYSTEM

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

Problem	Main causes	Remedy
Lamp does not glow brightly even when the engine runs at high speed	<ul style="list-style-type: none"> ● Defective wiring ● Defective adjustment of fan belt tension 	<ul style="list-style-type: none"> ● Check, repair loose terminals, disconnections ● Adjust fan belt tension For details, see EVERY 250 HOURS SERVICE
Lamp flickers while engine is running		
Charge lamp does not go out even when engine is running	<ul style="list-style-type: none"> ● Blown fuse ● Defective alternator ● Defective wiring 	<ul style="list-style-type: none"> ● Replace (● Replace) ● Check, repair)
Abnormal noise is generated from alternator	<ul style="list-style-type: none"> ● Defective alternator 	(● Replace)
Starting motor does not turn when starting switch is turned to ON	<ul style="list-style-type: none"> ● Blown fuse ● Defective wiring ● Insufficient battery charge 	<ul style="list-style-type: none"> ● Replace (● Check, repair) ● Charge
Pinion of starting motor keeps going in and out	<ul style="list-style-type: none"> ● Insufficient battery charge 	● Charge
Starting motor turns engine sluggishly	<ul style="list-style-type: none"> ● Insufficient battery charge ● Defective starting motor 	<ul style="list-style-type: none"> ● Charge (● Replace)
Starting motor disengages before engine starts	<ul style="list-style-type: none"> ● Defective wiring ● Insufficient battery charge 	<ul style="list-style-type: none"> (● Check, repair) ● Charge
Pre-heating monitor does not light	<ul style="list-style-type: none"> ● Defective wiring ● Defective monitor 	<ul style="list-style-type: none"> (● Check, repair) (● Replace)
Oil pressure monitor does not light up when engine is stopped (starting switch at ON position)	<ul style="list-style-type: none"> ● Defective monitor ● Defective oil pressure switch 	<ul style="list-style-type: none"> (● Replace) (● Replace)

16.5.2 CHASSIS

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

Problem	Main causes	Remedy
Speed of travel, swing, boom, arm, bucket is slow	<ul style="list-style-type: none"> ● Lack of hydraulic oil 	<ul style="list-style-type: none"> ● Add oil to specified level, see CHECK BEFORE STARTING
Pump generates abnormal noise	<ul style="list-style-type: none"> ● Clogged element in hydraulic tank strainer 	<ul style="list-style-type: none"> ● Clean, see EVERY 2000 HOURS SERVICE
Does not swing	<ul style="list-style-type: none"> ● Swing lock pin not removed 	<ul style="list-style-type: none"> ● Remove pin
Excessive rise in hydraulic oil temperature	<ul style="list-style-type: none"> ● Loose fan belt ● Lack of hydraulic oil 	<ul style="list-style-type: none"> ● Adjust fan belt tension, see EVERY 250 HOURS SERVICE ● Add oil to specified level see CHECK BEFORE STARTING
Track comes off	<ul style="list-style-type: none"> ● Track too loose 	<ul style="list-style-type: none"> ● Adjust track tension, see WHEN REQUIRED
Abnormal wear of sprocket		

16.5.3 ENGINE

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

Problem	Main causes	Remedy
Engine oil pressure monitor lights up	<ul style="list-style-type: none"> ● Engine oil pan oil level is low (sucking in air) ● Clogged oil filter element ● Defective tightening of oil pipe joint, oil leakage from damaged part ● Defective monitor lamp 	<ul style="list-style-type: none"> ● Add oil to specified level, see CHECK BEFORE STARTING ● Replace cartridge, see EVERY 250 HOURS SERVICE (● Check, repair) (● Replace lamp)
Steam is emitted from top part of radiator (pressure valve)	<ul style="list-style-type: none"> ● Cooling water level low, water leakage ● Loosen fan belt ● Dirt or scale accumulated in cooling system ● Clogged radiator fin or damaged fin 	<ul style="list-style-type: none"> ● Add cooling water, repair, see CHECK BEFORE STARTING ● Adjust fan belt tension, see EVERY 250 HOURS SERVICE ● Change cooling water, clean inside of cooling system, see WHEN REQUIRED ● Clean or repair, see EVERY 500 HOURS SERVICE
Red range on engine water temperature gauge lights up	<ul style="list-style-type: none"> ● Defective thermostat ● Loose radiator filler cap (high altitude operation) ● Defective water level sensor 	<ul style="list-style-type: none"> (● Replace thermostat) ● Tighten cap or replace packing (● Replace sensor)
White range on engine water temperature gauge lights up	<ul style="list-style-type: none"> ● Defective thermostat 	<ul style="list-style-type: none"> (● Replace thermostat)
Engine does not start when starting motor is turned	<ul style="list-style-type: none"> ● Lack of fuel ● Air in fuel system ● Water in fuel system ● Defective fuel injection pump or nozzle ● Starting motor cranks engine sluggishly ● Preheating monitor does not light up ● Defective compression <ul style="list-style-type: none"> ○ Defective valve clearance 	<ul style="list-style-type: none"> ● Add fuel, see CHECK BEFORE STARTING ● Repair place where air is sucked in, see EVERY 500 HOURS SERVICE ● Drain water, see CHECK BEFORE STARTING and WHEN REQUIRED (● Replace pump or nozzle) — See ELECTRICAL SYSTEM (○ Adjust valve clearance)

ENGINE (cont'd) (16.5.3)

Problem	Main causes	Remedy
Exhaust gas is white or blue	<ul style="list-style-type: none"> ● Too much oil in oil pan ● Improper fuel 	<ul style="list-style-type: none"> ● Add oil to specified level, see CHECK BEFORE STARTING ● Change to specified fuel
Exhaust gas occasionally turns black	<ul style="list-style-type: none"> ● Clogged air cleaner element ● Defective nozzle ● Defective compression 	<ul style="list-style-type: none"> ● Clean or replace, see WHEN REQUIRED (● Replace nozzle) (● See defective compression above)
Combustion noise occasionally makes breathing sound	<ul style="list-style-type: none"> ● Defective nozzle 	<ul style="list-style-type: none"> (● Replace nozzle)
Abnormal noise generated (combustion or mechanical)	<ul style="list-style-type: none"> ● Low grade fuel being used ● Overheating ● Damage inside muffler ● Excessive valve clearance 	<ul style="list-style-type: none"> ● Change to specified fuel ● Red range of engine water temperature gauge lights up as above (● Replace muffler) (● Adjust valve clearance)

16.5.4 4-SYSTEM RELATED PARTS

If any error code is displayed on the depth display portion of the monitor panel, follow the procedure given in the table below for the action to take after self diagnosis.

Action to take after self diagnosis

Error code	Machine condition	Probable cause	Action
21	Auto stop distance is too far	Abnormality in model selector signal	Operations can still be carried out, but have the machine checked immediately.
22	Auto stop distance is too far	Abnormality in work equipment selector signal	
31	Boom RAISE, arm IN, offset left cannot be carried out	Abnormality in boom angle sensor	Use the cancel switch to move the machine to a safe place, then have the machine checked immediately.
32	Boom RAISE, arm IN, offset left cannot be carried out	Abnormality in arm angle sensor	
34	Boom RAISE, arm IN, offset left cannot be carried out	Abnormality in offset angle sensor	
41	Swing operation and operation of all work equipment cannot be carried out	Abnormality in basic pressure lock solenoid valve	Use the cancel switch to move the machine to a safe place, then have the machine checked immediately. However, depending on the location of the failure, it may be impossible to carry out operations even when the cancel switch is turned on, so in such cases, have the machine checked immediately.
42	Boom RAISE, arm IN, offset left cannot be carried out	Abnormality in offset solenoid valve	
44	Boom LOWER, arm IN, offset left cannot be carried out	Abnormality in boom LOWER solenoid valve	
51	Boom RAISE, arm IN, offset left cannot be carried out	Abnormality in boom RAISE solenoid valve	
52	Boom RAISE, arm IN, offset left cannot be carried out	Abnormality in arm IN solenoid valve	
61	Swing operation and operation of all work equipment cannot be carried out	Abnormality in automatic stop position	If the cancel switch is used to move the bucket to the front or to the right, the self diagnosis is canceled and it becomes possible to operate the machine again, but have the machine checked immediately.
No error code is displayed, but swing operation and operation of all work equipment cannot be carried out			Have the machine checked immediately.

MAINTENANCE

17. GUIDES TO MAINTENANCE

Do not carry out any inspection and maintenance operation that is not given in this manual.

Perform maintenance work on hard, flat ground.

Check service meter:

Check the service meter reading every day to see if the time has come for any necessary maintenance to be carried out.

Komatsu genuine replacement parts:

Use Komatsu genuine parts specified in the parts list as replacement parts.

Komatsu genuine oils:

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

Always use clean washer fluid:

Use automobile window washer fluid and be careful not to let any dirt get into it.

Clean oil and grease:

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

Keeping the machine clean:

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

Be careful of hot water and oil:

Draining hot oils and coolants and removing their filters immediately after the engine stops are hazardous. Allow the engine to cool.

If the oil has to be drained when it is cold, warm up the oil to a suitable temperature (approx. 20 – 40°C) before draining it.

Checking foreign materials in drained oil:

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

Fuel strainer:

If your machine is equipped with a fuel strainer, do not remove it while fueling.

Oil change:

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

Warning tag:

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

Obey precautions:

During the operation, always obey the precautions on the safety label stuck to the machine.

Welding instructions:

- Turn off the engine starting switch.
- Do not apply more than 200 V continuously.
- Connect grounding the cable within 1 m from the area to be welded.
- Avoid seals or bearings from being between the area to be welded and the position of grounding point.
- Do not use the area around the work equipment pins or the hydraulic cylinders as the grounding point.

Fire prevention:

Use nonflammable cleaner or light oil for cleaning parts. Keep flame or cigarette light away from light oil.

Clamp faces:

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

Objects in your pockets:

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

Checking undercarriage:

When working in rocky areas, check for damage to the undercarriage and for looseness, flaws, wear and damage in bolts and nuts. Loosen the track tension a little when working in such areas.

Precautions when washing machine:

- Never spray steam or water directly on the connectors and mechatronics parts.
- Do not allow water to get on the monitors and controllers inside the operator's cab.
- Never spray steam or water directly at the radiator or oil cooler portions.
- Acryl is used for the rear face, roof, and left face of the cab specification machine, so do not wipe it with any dirty cloth or chemical (thinner, gasoline, etc.). If any of these parts is scratched, polish it with a compound. When cleaning it, use water and a clean cloth to remove all the mud and dirt.
- Plastic is used for the fuel tank, so never use trichlene when washing. Washing with trichlene will lower the strength of the fuel tank.

Pre-and post-work checks:

Before starting work in mud, rain, snow or at seashore, check plugs and valves for tightness.

Wash the machine immediately after the work to protect components from rusting.

Lubricate components more frequently than usual. Be sure to lubricate work equipment pins daily if they are submerged in water.

Dusty worksites:

When working at dusty worksites, do as follows:

- Inspect the dust indicator to see whether the air cleaner is blocked up. Clean the air cleaner at shorter intervals than specified.
- Clean the radiator core frequently to avoid clogging.
- Clean and replace the fuel filter frequently.
- Clean electrical components, especially the starting motor and alternator, to avoid accumulation of dust.

Avoid mixing oils:

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

18. OUTLINES OF SERVICE

- Use Komatsu genuine parts for replacement.
- When changing or adding oil, do not use a different type of oil.
- Unless otherwise specified, the oil and coolant used at the time of shipment from the factory are as shown in the table below.

Item	Kind of fluid
Engine oil pan	SAE 10W-30 API classification CD
Swing machinery case Final drive case	SAE 30 API classification CD
Hydraulic tank	SAE 10W API classification CD
Fuel tank	ASTM D975 No. 2
Radiator	Komatsu Supper Coolant (AF-ACL) 30% added to water

18.1 OUTLINE OF OIL, FUEL, COOLANT

18.1.1 OIL

- Oil is used in the engine and work equipment under extremely severe conditions (high temperature, high pressure), and it deteriorates with use.
Always use oil that matches the grade and temperature for use given in the Operation and Maintenance Manual. Even if the oil is not dirty, always replace the oil after the specified interval.
- Oil corresponds to blood in the human body, so always be careful when handling it to prevent any impurities (water, metal particles, dirt, etc.) from getting in.
The majority of problems with machine are caused by the entry of such impurities.
Take particular care not to let any impurities get in when storing or adding oil.
- Never mix oils of different grades or brands.
- Always add the specified amount of oil.
Having too much oil or too little oil are both causes of problems.
- If the oil in the work equipment is not clear, there is probably water or air getting into the circuit.
In such cases, please contact your Komatsu distributor.
- When changing the oil, always replace the related filters at the same time.
- We recommend you to have an analysis made of the oil periodically to check the condition of the machine. For those who wish to use this service, please contact your Komatsu distributor.

18.1.2 FUEL

- The fuel pump is a precision instrument, and if fuel containing water or dirt is used, it cannot work properly.
- Be extremely careful not to let impurities get in when storing or adding fuel.
- Always use the fuel specified in the Operation and Maintenance Manual.
Fuel may congeal depending on the temperature when it is used (particularly in low temperature below -15°C (5°F)), so it is necessary to change to a fuel that matches the temperature.
- To prevent the moisture in the air from condensing and forming water inside the fuel tank, always fill the fuel tank after completing the day's work.
- Before starting the engine, or when 10 minutes have passed after adding fuel, drain the sediment and water from the fuel tank.
- If the engine runs out of fuel, or if the filters have been replaced, it is necessary to bleed the air from the circuit.

18.1.3 COOLANT

- River water contains large amounts of calcium and other impurities, so if it is used, scale will stick to the engine and radiator, and this will cause defective heat exchange and overheating.
Do not use water that is not suitable for drinking.
- When using anti-freeze, always observe the precautions given in the Operation and Maintenance Manual.
- Komatsu machines are supplied with Komatsu original anti-freeze in the coolant when the machine is shipped.
This anti-freeze is effective in preventing corrosion of the cooling system.
The anti-freeze can be used continuously for two years or 4000 hours. Therefore, it can be used as it is even in hot areas.
- Anti-freeze is inflammable, so be extremely careful not to expose it to flame or fire.
- The proportion of anti-freeze to water differs according to the ambient temperature.
For details of the mixing proportions, see "24.2 WHEN REQUIRED".
- If the engine overheats, wait for the engine to cool before adding coolant.
- If the coolant level is low, it will cause overheating and will also cause problems with corrosion from the air in the coolant.

18.1.4 GREASE

- Grease is used to prevent twisting and noise at the joints.
- The nipples not included in the maintenance section are nipples for overhaul, so they do not need grease.

If any part becomes stiff after being used for a long time, add grease.

- Always wipe off all of the old grease that is pushed out when greasing. Be particularly careful to wipe off the old grease in places where sand or dirt sticking in the grease would cause wear of the rotating parts.

18.1.5 STORING OIL AND FUEL

- Keep indoors to prevent any water, dirt, or other impurities from getting in.
- When keeping drum cans for a long period, put the drum on its side so that the filler port of the drum can is at the side. (To prevent moisture from being sucked in)
If drum cans have to be stored outside, cover them with a waterproof sheet or take other measures to protect them.
- To prevent any change in quality during long-term storage, be sure to use in the order of first in – first out (use the oldest oil or fuel first).

18.1.6 FILTERS

- Filters are extremely important safety parts. They prevent impurities in the fuel and air circuits from entering important equipment and causing problems.
Replace all filters periodically. For details, see the Operation and Maintenance Manual.
However, when working in severe conditions, it is necessary to consider replacing the filters at shorter intervals according to the oil and fuel (sulfur content) being used.
- Never try to clean the filters (cartridge type) and use them again. Always replace with new filters.
- When replacing oil filters, check if any metal particles are stuck to the old filter. If any metal particles are found, please contact your Komatsu distributor.
- Do not open packs of spare filters until just before they are to be used.
- Always use Komatsu genuine filters.

18.2 RELATING TO ELECTRIC SYSTEM

- If the wiring gets wet or the insulation is damaged, the electric system leaks and this could result in hazardous malfunction of the machine.
- Services relating to the electric system are (1) check of fan belt tension ,(2) check of damage or wear in the fan belt and (3) check of battery fluid level.
- Never remove or disassemble any electric components installed in the machine.
- Never install any electric components other than these specified by Komatsu.
- Be careful to keep the electric system free of water when washing the machine or when it rains.
- Interference from electric waves may cause the 4-system controller to malfunction, so when installing any radio or similar device, please contact your Komatsu distributor.
- When working on the seashore, carefully clean the electric system to prevent corrosion.
- When installing a car cooler or any other electrical equipment, connect it to an independent power source connector. The optional power source must never be connected to the fuse, starting switch, or battery relay.

19. WEAR PARTS LIST

Wear parts such as the filter element, bucket tooth, etc. are to be replaced at the time of periodic maintenance or before their abrasion limits.

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

For part change, Komatsu genuine parts of excellent quality should be used.

The parts in parentheses are to be replaced at the same time.

Item	Part No.	Part Name	Q'ty	Replacement frequency
Hydraulic oil filter	21U-60-11320	Cartridge	1	Every 250 hours
Engine oil filter	YM129150-35151	Oil filter Ass'y	1	Every 250 hours
Fuel filter	YM119833-55650 (YM124321-00650)	Element (O-ring)	1 (1)	Every 500 hours
Air cleaner	YM121120-12901	Element	1	-
Bucket	20N-70-71370	Point (Tooth)	4	-
	20N-70-71380	Pin	4	-
	20S-70-71340	Cutter (L.H.)	1	-
	20S-70-71330 (01675-31443) (112-32-11220)	Cutter (R.H.) (Bolt) (Nut)	1 (6) (6)	-

20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE

PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE										CAPACITY			
		-22 -30	-4 -20	14 -10	32 0	50 10	68 20	86 30	104 40	122 50	F	C	Specified	Refill	
Engine oil pan	Engine oil											SAE 30			
												SAE 10W		5.7ℓ	5.7ℓ
												SAE 10W-30		1.5 US gal	1.5 US gal
												SAE 15W-40		1.25 UK gal	1.25 UK gal
Swing machinery case														0.9ℓ	0.9ℓ
												SAE 30		0.24 US gal	0.24 US gal
Final drive case														0.20 UK gal	0.20 UK gal
												SAE 30		0.6ℓ	0.6ℓ
														0.16 US gal	0.16 US gal
														0.13 UK gal	0.13 UK gal
											SAE 10W		(each)	(each)	
Hydraulic system											SAE 10W		54.0ℓ	34.0ℓ	
											SAE 10W-30		14.26 US gal	8.98 US gal	
											SAE 15W-40		11.88 UK gal	7.48 UK gal	
Fuel tank	Diesel fuel										ASTM D975 No.2		35.0ℓ	-	
		*											9.42 US gal	-	
													7.70 UK gal	-	
Cooling system	Water										Add antifreeze		3.85ℓ	-	
													1.02 US gal	-	
													0.85 UK gal	-	

* ASTM D975 No. 1

REMARK

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

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

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

- When starting the engine in an atmospheric temperature of lower than 0°C (32°F), be sure to use engine oil of SAE10W, SAE10W-30 and SAE15W-40, even though an atmospheric temperature goes up to 10°C (50°F) more or less in the day time.
- Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.
- There is no problem if single grade oil is mixed with multigrade oil (SAE10W-30, 15W-40), but be sure to add single grade oil that matches the temperature in the table.
- We recommend Komatsu genuine oil which has been specifically formulated and approved for use in engine and hydraulic work equipment applications.

Specified capacity: Total amount of oil including oil for components and oil in piping.

Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

ASTM: American Society of Testing and Material

SAE: Society of Automotive Engineers

API: American Petroleum Institute

20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE

No.	Supplier	Engine Oil [CD or CE] SAE10W, 30, 40 10W30, 15W40 (The 15W40 oil marked * is CE.)	Gear Oil [GL-4 or GL-5] SAE80, 90, 140	Grease [Lithium-Base] NLGI No. 2	Anti-freeze Coolant [Ethylene Glycol Base] Permanent Type
1	KOMATSU	EO10-CD EO30-CD EO10-30CD EO15-40CD	GO90 GO140	G2-LI G2-LI-S	AF-ACL AF-PTL AF-PT (Winter, one season type)
2	AGIP	Diesel sigma S Super dieselmulti- grade *Sigma turbo	Rotra MP	GR MU/EP	-
3	AMOCO	*Amoco 300	Multi-purpose gear oil	RYKON premium grease	-
4	ARCO	*Arcofleet S3 plus	Arco HD gear oil	Litholine HEP 2 Arco EP moly D	-
5	BP	Vanellus C3	Gear oil EP Hypogear EP	Energrease LS-EP2	Antifreeze
6	CALTEX	*RPM delo 400 RPM delo 450	Universal thuban Universal thuban EP	Marfak all purpose 2 Ultra-duty grease 2	AF engine coolant
7	CASTROL	*Turbomax *RX super CRD	EP EPX Hypoy Hypoy B Hypoy C	MS3 Spheerol EPL2	Anti-freeze
8	CHEVRON	*Delo 400	Universal gear	Ultra-duty grease 2	-
9	CONOCO	*Fleet motor oil	Universal gear lubricant	Super-sta grease	-
10	ELF	Multiperformance 3C Performance 3C	-	Tranself EP Tranself EP type 2	Glacelf
11	EXXON (ESSO)	Essolube D3 *Essolube XD-3 *Essolube XD-3 Extra *Esso heavy duty Exxon heavy duty	Gear oil GP Gear oil GX	Beacon EP2	All season coolant
12	GULF	Super duty motor oil *Super duty plus	Multi-purpose gear lubricant	Gulfcrown EP2 Gulfcrown EP special	Antifreeze and coolant
13	MOBIL	Delvac 1300 *Delvac super 10W-30, 15W-40	Mobilube GX Mobilube HD	Mobilux EP2 Mobilgrease 77 Mobilgrease special	-

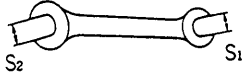
20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE

No.	Supplier	Engine Oil [CD or CE] SAE10W, 30, 40 10W30, 15W40 (The 15W40 oil marked * is CE.)	Gear Oil [GL-4 or GL-5] SAE80, 90, 140	Grease [Lithium-Base] NLGI No. 2	Anti-freeze Coolant [Ethylene Glycol Base] Permanent Type
14	PENNZOIL	*Supreme duty fleet motor oil	Multi-purpose 4092 Multi-purpose 4140	Multi-purpose white grease 705 707L White – bearing grease	Anti-freeze and summer coolant
15	PETROFINA	FINA kappa TD	FINA potonic N FINA potonic NE	FINA marson EPL2	FINA tamidor
16	SHELL	Rimula X	Spirax EP Spirax heavy duty	Alvania EP grease	–
17	SUN	–	Sunoco GL5 gear oil	Sunoco ultra prestige 2EP Sun prestige 742	Sunoco antifreeze and summer coolant
18	TEXACO	*Ursa super plus Ursa premium	Multigear	Multifak EP2 Starplex 2	Code 2055 startex antifreeze coolant
19	TOTAL	Rubia S *Rubia X	Total EP Total transmission TM	Multis EP2	Antigel/antifreeze
20	UNION	*Guardol	MP gear lube LS	Unoba EP	–
21	VEEDOL	*Turbostar *Diesel star MDC	Multigear Multigear B Multigear C	–	Antifreeze

21. STANDARD TIGHTENING TORQUES FOR BOLTS AND NUTS

21.1 INTRODUCTION OF NECESSARY TOOLS

The following tools are needed when carrying out maintenance.

No.	Name of tool	Part No.	Remarks
1	Wrench set	09000-30006	Applicable width across flats ($S_1 - S_2$) 8 mm - 10 mm, 12 mm - 14 mm 13 mm - 17 mm, 19 mm - 22 mm 24 mm - 27 mm, 30 mm - 32 mm
			
2	Filter wrench	09019-08035	For hydraulic oil filter
3	Filter wrench	YM119640-92750	For engine oil filter
4	Filter wrench	YM171050-92760	For fuel filter
5	Filter wrench	YM171051-92760	For water separator
6	Grease pump	07952-70002	For greasing work
7	Nozzle	07951-11400	For rubber shoe (For the machine equipped with rubber shoes)
8	Grease cartridge	07950-90403	(Lithium base grease, 400 g)

If any of the above tools are broken, please order them from your Komatsu distributor.


21.2 TORQUE LIST

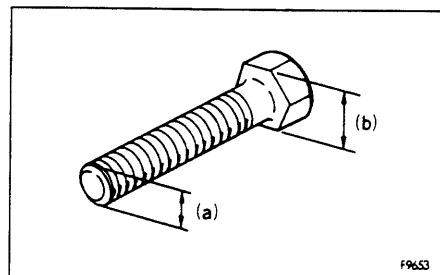
Unless otherwise specified, tighten the metric bolts and nuts to the torque shown in the table.

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

If it is necessary to replace any nut or bolt, always use a Komatsu genuine part of the same size as the part that was replaced.

Nm (newton meter): 1 Nm \approx 0.74 lbft

Thread diameter of bolt (mm) (a)	Width across flat (mm) (b)			
		kgm	Nm	lbft
6	10	1.35 \pm 0.15	13.2 \pm 1.4	9.73 \pm 1.03
8	13	3.2 \pm 0.3	31.4 \pm 2.9	23.2 \pm 2.1
10	17	6.7 \pm 0.7	65.7 \pm 6.8	48.5 \pm 5.0
12	19	11.5 \pm 1.0	112 \pm 9.8	82.6 \pm 7.2
14	22	18.0 \pm 2.0	177 \pm 19	131 \pm 14
16	24	28.5 \pm 3	279 \pm 29	206 \pm 21
18	27	39 \pm 3	383 \pm 39	282 \pm 29
20	30	56 \pm 6	549 \pm 58	405 \pm 43
22	32	76 \pm 8	745 \pm 78	549 \pm 58
24	36	94.5 \pm 10	927 \pm 98	684 \pm 72
27	41	135 \pm 15	1320 \pm 140	973 \pm 100
30	46	175 \pm 20	1720 \pm 190	1270 \pm 140
33	50	225 \pm 25	2210 \pm 240	1630 \pm 180
36	55	280 \pm 30	2750 \pm 290	2030 \pm 210
39	60	335 \pm 35	3280 \pm 340	2420 \pm 250



NOTICE

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

22. PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

To ensure safety at all times when operating or driving the machine, the user of the machine must always carry out periodic maintenance. In addition, to further improve safety, the user should also carry out periodic replacement of the parts given in the table. These parts are particularly closely connected to safety and fire prevention.

With these parts, the material changes as time passed, or they easily wear or deteriorate. However, it is difficult to judge the condition of the parts simply by periodic maintenance, so they should always be replaced after a fixed time has passed, regardless of their condition. This is necessary to ensure that they always maintain their function completely.

However, if these parts show any abnormality before the replacement interval has passed, they should be repaired or replaced immediately.

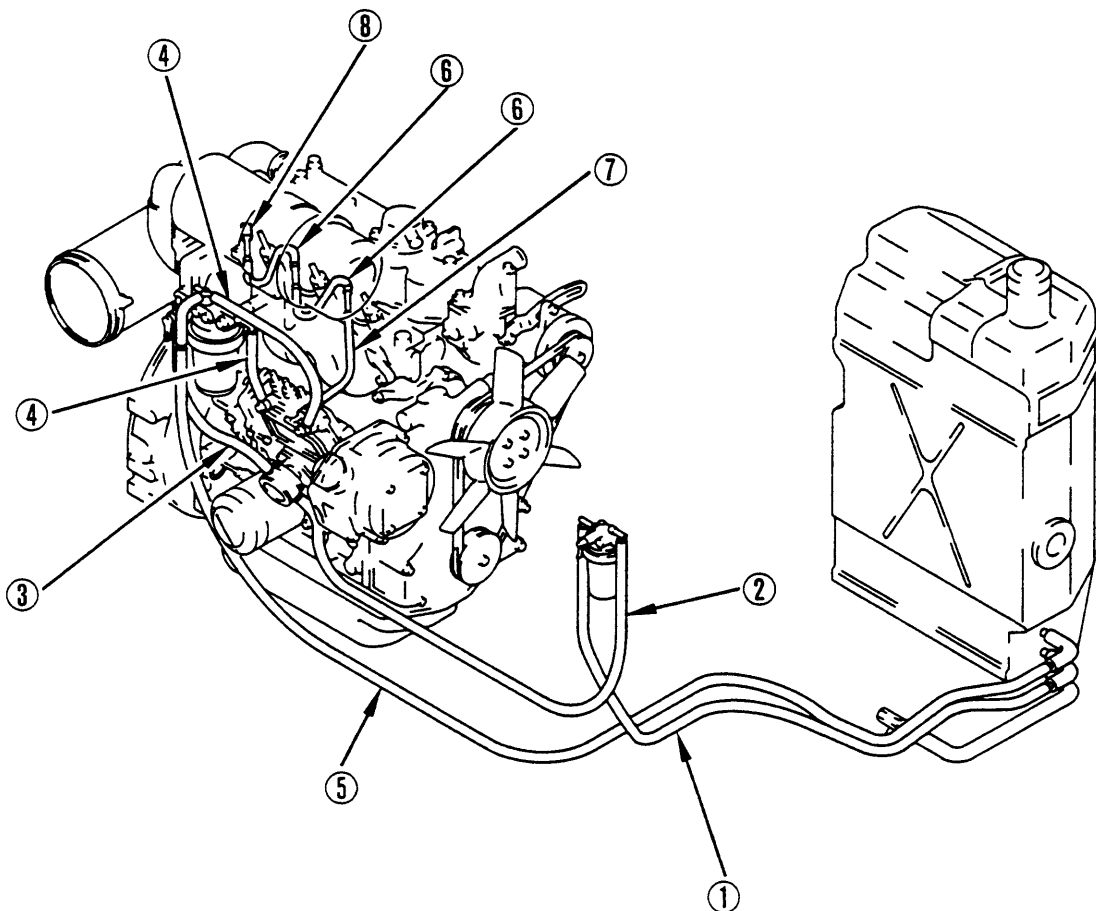
If the hose clamps show any deterioration, such as deformation or cracking, replace the clamps at the same as the hoses.

When replacing the hoses, always replace the O-rings, gaskets, and other such parts at the same time.

Ask your Komatsu distributor to replace the critical parts.

CRITICAL PARTS

No.	Critical parts for periodical replacement	Q'ty	Replacement interval
1	Fuel hose (fuel tank – water separator)	1	Every 2 years or 4000 hours whichever comes sooner
2	Fuel hose (water separator – feed pump)	1	
3	Fuel hose (feed pump – fuel filter)	1	
4	Fuel hose (fuel filter – injection pump)	2	
5	Fuel hose (fuel filter – fuel tank)	1	
6	Spill hose (between nozzles)	2	
7	Spill hose (nozzle – injection pump)	1	
8	Spill cap	1	



23. MAINTENANCE SCHEDULE CHART

23.1 MAINTENANCE SCHEDULE CHART

SERVICE ITEM	PAGE
INITIAL 250 HOURS SERVICE (only after the first 250 hours)	
Check engine valve clearance, adjust	3-63
WHEN REQUIRED	
Check, clean and replace air cleaner element	3-22
Clean inside of cooling system	3-25
Drain water, sediment from fuel tank	3-29
Check level of battery electrolyte	3-30
Clean water separator element	3-31
Check electric wirings	3-32
Check rubber shoes (Machine equipped with rubber shoes)	3-33
Check and adjust track tension (Machine equipped with rubber shoes)	3-35
Replace rubber shoes (Machine equipped with rubber shoes)	3-38
Check and adjust track tension (Machine equipped with steel shoes)	3-41
Replace bucket teeth	3-44
CHECK BEFORE STARTING	
Check and refill coolant	3-45
Check oil level in engine oil pan, add oil	3-45
Check fuel level	3-46
Check oil level in hydraulic tank, add oil	3-47
Check dust indicator	3-48
Check water separator	3-48
EVERY 100 HOURS SERVICE	
Lubricating	3-49
● Swing circle (1 point)	3-49
● Swing pinion (1 point)	3-49
● Blade cylinder foot pin (1 point)	3-49
● Blade cylinder rod end (1 point)	3-49

SERVICE ITEM	PAGE
● Blade foot pin (2 points)	3-49
● First boom foot pin (2 points)	3-49
● Boom cylinder foot pin (1 point)	3-49
● Boom cylinder rod end pin (1 point)	3-49
● First boom – Second boom coupling pin (2 points)	3-49
● Offset cylinder foot pin (1 point)	3-50
● Offset cylinder rod end pin (1 point)	3-50
● Sub-link coupling pin (2 points)	3-50
● Second boom – Third bracket coupling pin (2 points)	3-50
● Arm cylinder trunnion pin (2 points)	3-50
● Third bracket – Arm coupling pin (1 point)	3-50
● Bucket cylinder foot pin (1 point)	3-50
● Bucket cylinder rod end pin (1 point)	3-50
● Arm – Link coupling pin (1 point)	3-50
● Link coupling pin (1 point)	3-50
● Bucket – Link coupling pin (1 point)	3-50
● Arm – Bucket coupling pin (1 point)	3-50
EVERY 250 HOURS SERVICE	
Change oil in engine oil pan, replace engine oil filter cartridge	3-51
Check oil level in final drive case, add oil	3-53
Replace hydraulic filter cartridge	3-54
Check fan belt tension, adjust	3-55
EVERY 500 HOURS SERVICE	
Replace fuel filter cartridge	3-56
Clean, check radiator fins	3-58

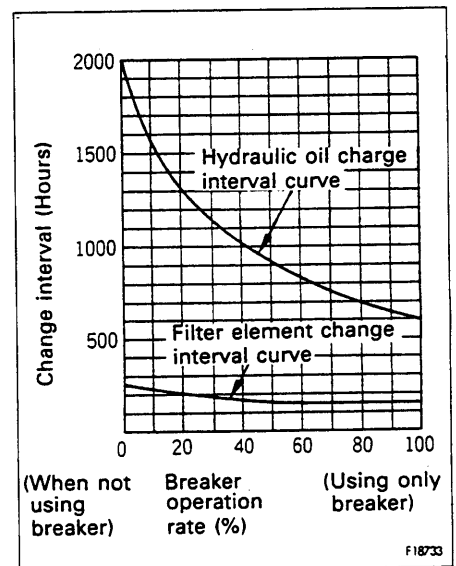
23. MAINTENANCE SCHEDULE CHART

SERVICE ITEM	PAGE
EVERY 1000 HOURS SERVICE	
Change oil in swing machinery case	3-59
Change oil in final drive case	3-60
EVERY 2000 HOURS SERVICE	
Change oil in hydraulic tank, clean strainer	3-61
Check alternator, starting motor	3-63
Check engine valve clearance, adjust	3-63

23.2 MAINTENANCE INTERVAL WHEN USING HYDRAULIC BREAKER

If a hydraulic breaker is installed, the hydraulic oil deteriorates far more rapidly than when carrying out normal bucket operations, so set the maintenance interval as follows.

- Replacing hydraulic filter element
On new machines, replace after the first 100 – 150 hours, and after that, replace the element at the interval shown on the graph on the right.
- Changing oil in hydraulic tank
Change the oil at the interval shown on the graph on the right.



24. SERVICE PROCEDURE

24.1 INITIAL 250 HOURS SERVICE

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

- **CHECK ENGINE VALVE CLEARANCE, ADJUST**

For details of the method of maintenance, see "24. 8 EVERY 2000 HOURS SERVICE".

24.2 WHEN REQUIRED

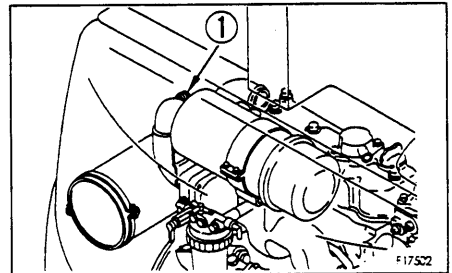
24.2.1 CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT

⚠ WARNING

- Never clean or replace the air cleaner element with the engine running.
- When using pressure air to clean the element wear safety glasses or goggles to protect the eyes.

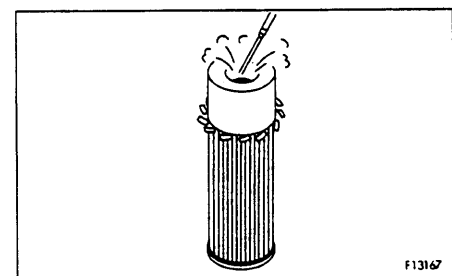
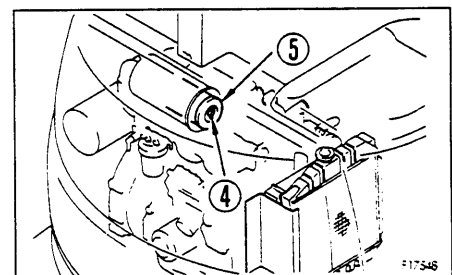
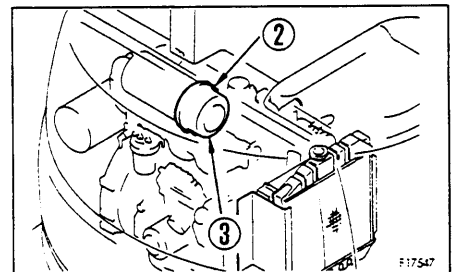
Checking

Whenever the red piston in dust indicator ① appears, clean the air cleaner element.



Cleaning or replacing outer element

1. Open the engine hood at the rear of the machine, loosen clip ②, remove dust cup ③.
2. Throw away the dust inside the dust cup ③ and clean the inside of the cup.
3. Remove wing nut ④, take out element ⑤, then use a clean cloth or tape to cover the air connector inside the air cleaner body to prevent dust from entering.
4. Clean the inside of the air cleaner body.
5. Direct dry compressed air (less than 700 kPa (7 kg/cm², 100 psi)) to the element from inside along its folds, then direct it from outside along its folds and again from inside.



- (1) Replace the element which has been cleaned 5 times repeatedly or used throughout a year.
- (2) Replace element when the dust indicator red piston appears soon after installing the cleaned element even though it has not been cleaned 5 times.

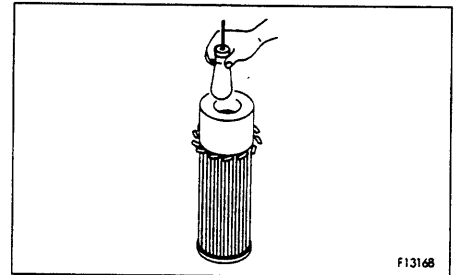
6. If small holes or thinner parts are found on the element when it is checked with an electric bulb after cleaning, replace the element.

NOTICE

Do not use an element whose folds or gasket or seal are damaged.

When cleaning the element, do not hit it or beat it against something.

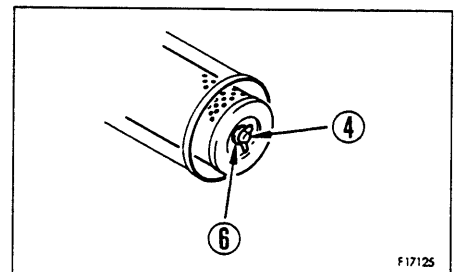
Wrap unused elements and store them in a dry place.



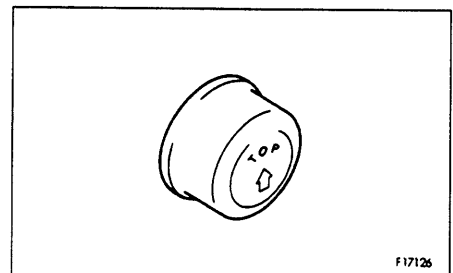
7. Remove the cloth or tape used as a cover in Step 3.

8. Set the cleaned element in position, and secure it with the wing nut.

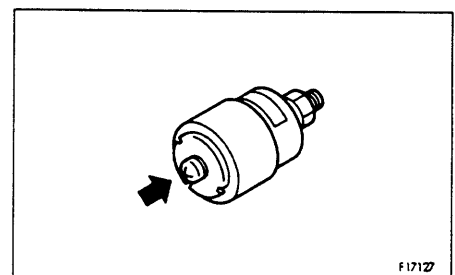
9. Replace seal washer (6) or wing nut (4) with new parts if they are broken.



10. Set dust cap (3) with the arrow pointing up, then set it to the air cleaner body and secure it with clip (2).

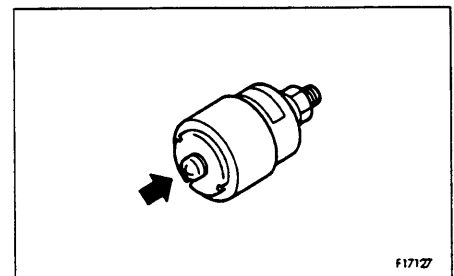
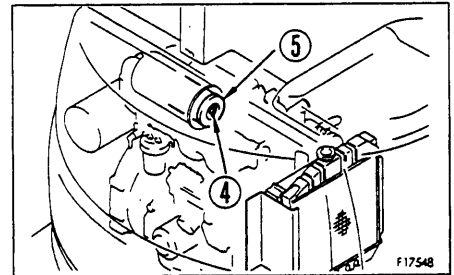
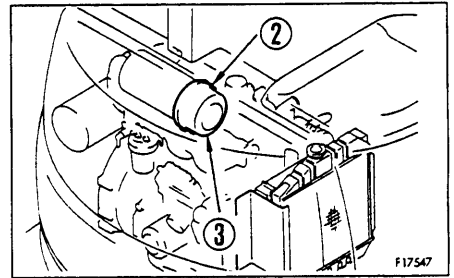


11. Press the button of dust indicator (1) to return the red piston to its original position.



Replacing element

1. Open the engine hood at the rear of the machine, release clip ②, and remove dust cap ③. Remove wing nut ④, take out element ⑤, then use a clean cloth or tape to cover the air connector inside the air cleaner body to prevent dust from entering.
2. Clean the inside of the air cleaner body, then remove the cloth or tape used as a cover in Step 1.
3. Set the new element in position, and secure it with wing nut ④.
4. Install dust cup ③.
5. After replacing the element, return the red piston in the dust indicator to its original position.



24.2.2 CLEAN INSIDE OF COOLING SYSTEM

WARNING

- Soon after the engine has been stopped, the coolant is hot and can cause personal injury. Allow the engine to cool before draining water.
 - When the engine is running, never stand behind the machine. The cleaning is carried out with the engine running, so it is extremely dangerous if the machine moves when the operator is standing behind the machine. There is also danger of touching the fan when the engine hood is open.
 - Never remove the radiator cap when the engine is at operating temperature. At operating temperature, the coolant is under pressure. Steam blowing up from the radiator could cause personal injury. Allow the engine to cool until the radiator filler cap is cool enough to touch with your hand. Remove the filler cap slowly to relieve pressure.
 - Antifreeze is flammable, so keep it away from any flame.
 - Flushing agents, neutralizing agents, and anti-corrosive agents are strong acids or alkalize, so be careful not to get them on your skin. If you should get any of these on your skin, wash off immediately with ample water.
 - After using the agent, do not use the empty packet for keeping food, etc.
- Clean the inside of the cooling system, change the coolant and add corrosion resistant KI (powder) according to the table below.

Kind of coolant	Cleaning inside of cooling system and changing coolant	Adding corrosion resistant KI (in hard water areas)
Permanent type antifreeze (All season type)	Every year (autumn) or every 2000 hours whichever comes first	Every 1000 hours and when cleaning the inside of the cooling system and when changing coolant
Non permanent type antifreeze containing ethylene glycol (Winter, one season type)	Every 6 months (spring, autumn) (Drain antifreeze in spring, add antifreeze in autumn)	
When not using antifreeze	Every 6 months or ever 1000 hours whichever comes first	

- Use a permanent type of antifreeze.
If, for some reason, it is impossible to use permanent type antifreeze, use an antifreeze containing ethylene glycol.
- Stop the machine on level ground when cleaning or changing the coolant.
- To restrict the formation of rust and scale in hard water areas, add Komatsu genuine corrosion resistant KI (powder) to the cooling water.
Never use commercial available anti-corrosive agents (made by Fleetguard, etc.).
- When deciding the ratio of antifreeze to water, check the lowest temperature in the past, and decide from the mixing rate table given below.
It is actually better to estimate a temperature about 10°C lower when deciding the mixing rate.

Mixing rate of water and antifreeze

Min. atmospheric temperature	°C	-10	-15	-20	-25
	°F	14	5	-4	-13
Amount of antifreeze	ℓ	1.16	1.39	1.58	1.77
	US gal	0.31	0.37	0.42	0.47
	UK gal	0.26	0.31	0.35	0.39
Amount of water	ℓ	2.69	2.46	2.27	2.08
	US gal	0.71	0.65	0.60	0.55
	UK gal	0.59	0.54	0.50	0.46

⚠ WARNING

Antifreeze is flammable, so keep it away from any flame.

- We recommend use of an antifreeze density gauge to control the mixing proportions.
- Use city water for the cooling water.
If river water, well water or other such water supply must be used, contact your Komatsu distributor.

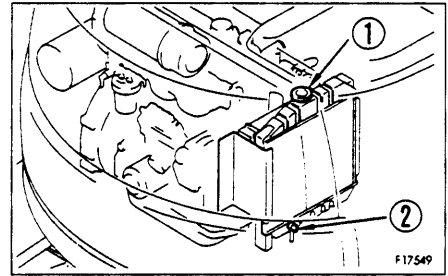
⚠ WARNING

When removing drain plug, avoid pouring coolant on yourself.

Prepare the following.

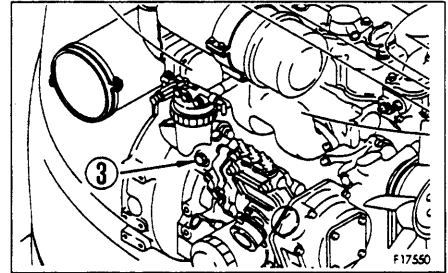
- Container to catch drained coolant: Min 4 ℓ (1.06 US gal, 0.88 UK gal) capacity
- Water inlet hose

1. Turn radiator cap ① slowly to remove it.



2. Set a container to catch the coolant under drain valve ② and drain plug ③.

3. Open the engine food and open drain valve ② at the bottom of the radiator to drain the water.
Remove drain plug ③ on the side face of cylinder block to drain the water.



4. After draining the water, close drain valve ② and drain plug ③, and fill with city water.

5. Open drain valve ② and drain plug ③, run the engine at low idling, and flush water through the system for 10 minutes.
When doing this, adjust the speed of filling and draining the water so that the radiator is always full.
While flushing water through the system, watch carefully that the water inlet hose does not come out of the radiator water filler.

6. After flushing, stop the engine, open drain valve ② and drain plug ③, then close it again after all the water has drained out.

7. After draining the water, clean with a flushing agent.

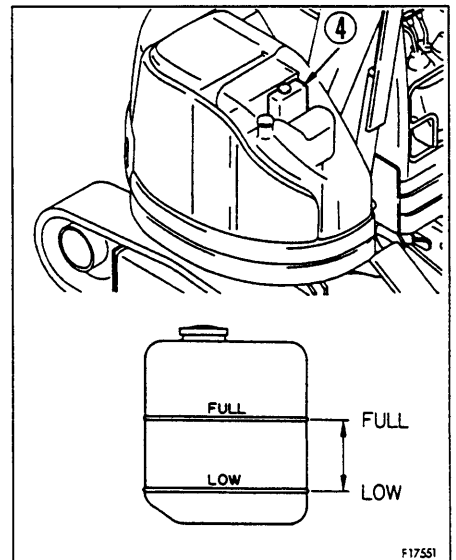
We recommend use of a Komatsu genuine cleaning agent. For details of the cleaning method, see the instructions given with the cleaning agent.

8. After cleaning, open drain valve ② and drain plug ③ to drain all the cooling water, then close them, and fill slowly with clean water.

24. SERVICE PROCEDURE

9. When the water comes up to near the water filler port, open drain valve ② and drain plug ③, run the engine at low idling, and continue to run water through the system until clean color less water comes out.
When doing this, adjust the speed of filling and draining the water so that the radiator is always full.
10. When the water is completely clean, stop the engine, close drain valve ② and drain plug ③.
11. Add cooling water until it overflows from the water filler.
12. To remove the air in the cooling water, run for five minutes at low idling, then for another five minutes at high idling.
When doing this, leave radiator cap ① off.

13. After draining off the cooling water of sub-tank ④, clean the inside of the sub-tank and refill the water between FULL and LOW level.
14. Stop the engine, wait for about three minutes, add cooling water up to near the radiator water filler port, then tighten cap ①.

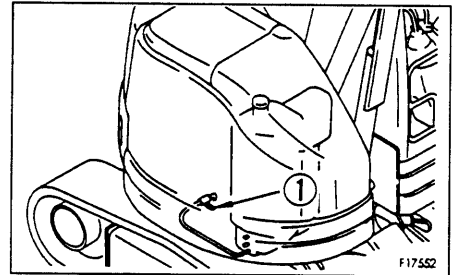


24.2.3 DRAIN WATER, SEDIMENT FROM FUEL TANK

1. Carry out this procedure before operating the machine.
2. Prepare a container to catch the fuel that is drained.
3. Open valve ① at the bottom of the tank and drain the sediment and water that has accumulated at the bottom together with fuel. When doing this, be careful not to get fuel on yourself.
4. When only clean fuel comes out, close drain valve ①.

NOTICE

Never use trichlene for washing the inside of the tank.



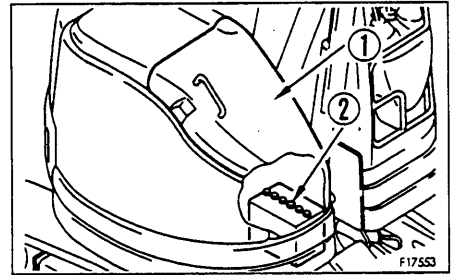
F17552

24.2.4 CHECK LEVEL OF BATTERY ELECTROLYTE

⚠ WARNING

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

1. Remove cover ①.
2. Remove cap ②, and check that the electrolyte is at the specified level (10 to 12 mm (0.40 to 0.47 in) above the plate). If the electrolyte level is low, add distilled water to the specified level. If the battery electrolyte is spilled, have dilute sulphuric acid added.
3. Clean the air hole in the battery cap, then tighten the cap securely.



When adding distilled water in cold weather, add it before starting operations in the morning to prevent the electrolyte from freezing.

24.2.5 CLEAN WATER SEPARATOR ELEMENT

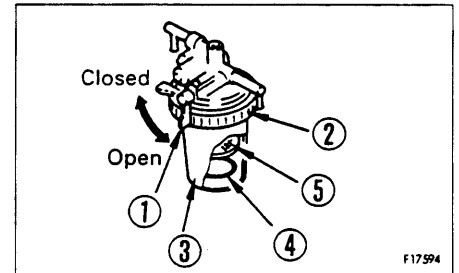
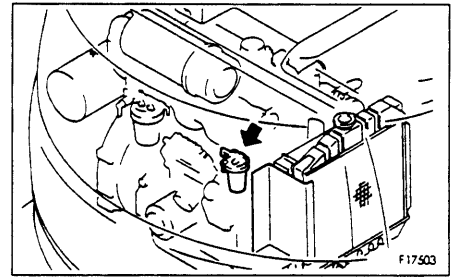
Prepare the following.

- Filter wrench to water separator
- Container to catch drained oil

1. Open the engine hood, and set handle ① to the CLOSED position.
2. Using a filter wrench, loosen ring ②, then remove case ③ and throw out the water inside it.

Be careful not to lose red ring ④ inside the case.

3. Clean the inside of the case and element ⑤ with diesel oil.
4. Set case ③ in position, then tighten ring ② to install it.
5. Set handle ① to the OPEN position.



24.2.6 CHECK ELECTRIC WIRINGS

 **WARNING**

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

Carry out this check before operating the machine.

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

- Battery
- Starting motor
- Alternator

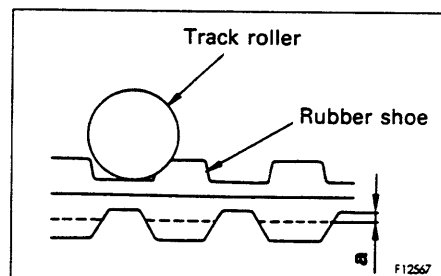
Please contact your Komatsu distributor for investigation and correction of the cause.

24.2.7 CHECK RUBBER SHOES (MACHINE EQUIPPED WITH RUBBER SHOES)

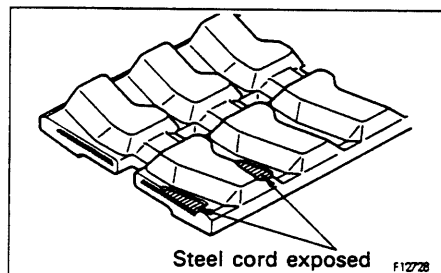
If the rubber shoes are in the following condition, they must be repaired or replaced, so please contact your Komatsu distributor for repair or replacement.

Height of lug

- If lug height "a" is reduced by wear, the drawbar pull will drop. If "a" is less than 5 mm (0.2 in), replace with a new part.

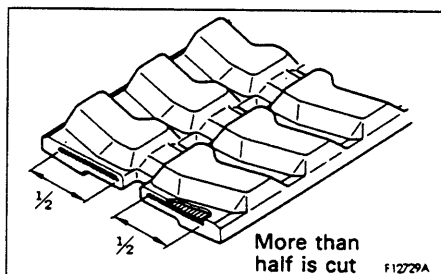


- If the lug wears and the steel cord inside the shoe is exposed for two links or more, replace with a new part.



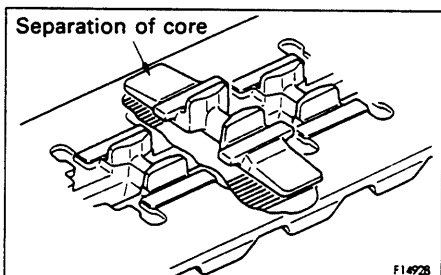
Cuts in rubber shoe steel cord

If more than half of the steel cord layer on one side is cut, replace with a new part.



Separation of rubber shoe core

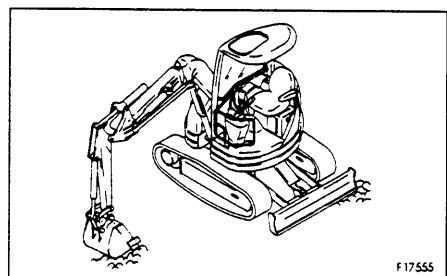
If the rubber core has separated at one place or more, replace with a new part.



Rubber shoe tension

If the rubber shoe is still slack even when grease is pumped in, replace with a new part or replace the seal inside the cylinder.

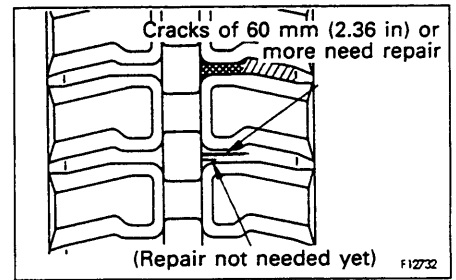
If the track tension can only be increased to a level where the rubber shoe may come off, there may be not only elongation of the rubber shoe but also damage to the grease cylinder.



Cracks in rubber shoe

If the cracks between the rubber shoe lugs increase to a size of approx. 60 mm (2.36 in) the rubber shoe must be repaired. Even if the track is small and short, if the steel cord can be seen inside, carry out repairs immediately.

If the length is less than 30 mm (1.18 in) or the depth of the crack is less than 10 mm (0.39 in), there is no particular need to carry out repairs.



When making judgement whether to replace, repair, or continue using rubber shoes, please contact your Komatsu distributor.

24.2.8 CHECK AND ADJUST TRACK TENSION (MACHINE EQUIPPED WITH RUBBER SHOES)

WARNING

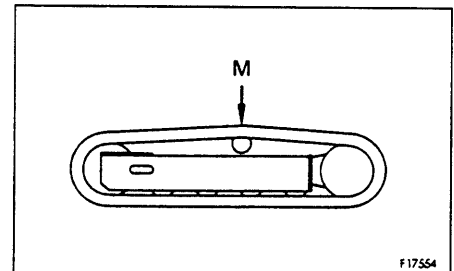
Carry out this operation with two workers. The operator must move the machine in accordance with the signals from the other worker. The track tension is checked with the chassis raised, so it is extremely dangerous if the machine is lowered by mistake during the inspection. Never move the machine while anyone is carrying out measurements.

The wear of the rubber shoe will vary with the working conditions and type of soil. Therefore, it is necessary to inspect the wear and track tension frequently.

After fitting new parts, be sure to carry out the first inspection after 30 hours of use.

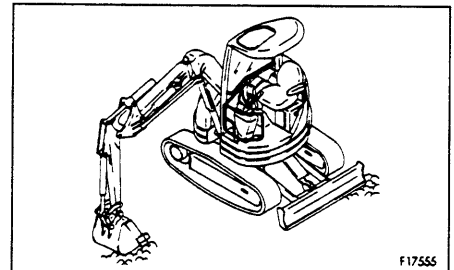
Inspection

1. Set the connection (M mark) of the rubber shoe at the top midway between the two axles.



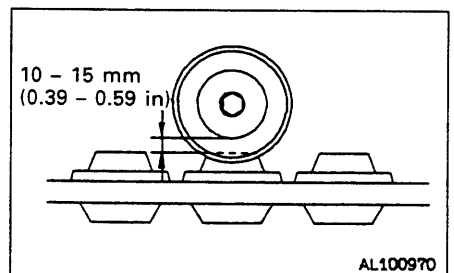
F17554

2. Raise the chassis with the boom and arm. When doing this, operate the levers slowly.



F17555

3. The standard tension is a clearance of 10 – 15 mm (0.39 – 0.59 in) between the roller surface of the track shoe and the track roller tread at the 2nd track roller from the sprocket. If the track tension is not at the standard value, adjust it in the following manner. If the rubber track is loose (if the clearance of the rubber shoes is more than 20 mm (0.79 in)) and the machine is operated, the track may come off, or there will be premature wear of the core.

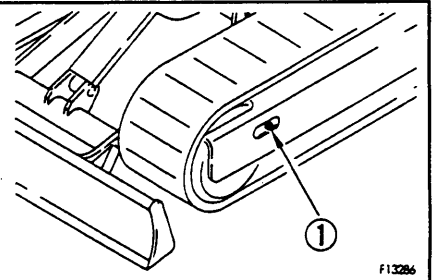


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Adjustment

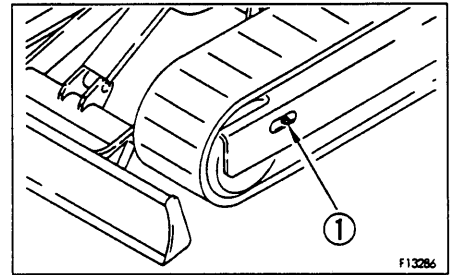
⚠ WARNING

Grease inside the adjusting mechanism is under high pressure. Grease coming from lubricator ① under pressure can penetrate the body causing injury or death. For this reason, do not loosen lubricator ① more than one turn. Do not loosen any part other than lubricator ①. If the track tension is not relieved by this procedure, please contact your Komatsu distributor.



- **When increasing tension**
- Prepare a grease gun

1. Pump in grease through lubricator ① with a grease gun.
2. To check that the correct tension has been achieved, move the machine backwards and forwards.
3. Check the track tension again, and if the tension is not correct, adjust it again.
4. If the tension is yet loose after applying pressurized injection of grease, it is necessary to replace the rubber shoes or seal inside of cylinder. Consult your Komatsu distributor for repair.

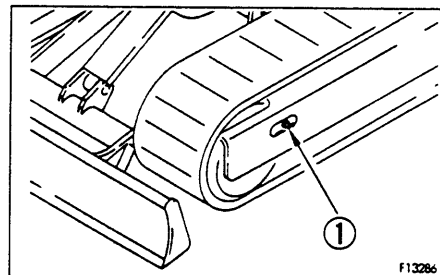


- When loosening tension

⚠ WARNING

It is extremely dangerous to release the grease by any method except the procedure given below. If the track tension is not relieved by this procedure, please contact your Komatsu distributor.

1. Loosen lubricator ① gradually to release the grease.
2. Turn lubricator ① a maximum of one turn.
3. If the grease does not come out smoothly, move the machine backwards and forwards a short distance.
4. Tighten lubricator ①.
5. To check that the correct tension has been achieved, move the machine backwards and forwards.
6. Check the track tension again, and if the tension is not correct, adjust it again.



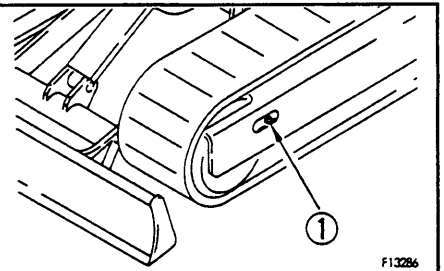
24.2.9 REPLACE RUBBER SHOES (MACHINE EQUIPPED WITH RUBBER SHOES)

⚠ WARNING

Carry out this operation with two workers. The operator must move the machine in accordance with the signals from the other worker. The track is replaced with the chassis raised, so it is extremely dangerous if the machine is lowered by mistake while the track is being replaced. During the replacement operation, operate only the track that is being replaced. Do not operate any other part.

⚠ WARNING

Grease inside the adjusting mechanism is under high pressure. Grease coming from lubricator ① under pressure can penetrate the body causing injury or death. For this reason, do not loosen lubricator ① more than one turn. Do not loosen any part other than lubricator ①.
If the track tension is not relieved by this procedure, please contact your Komatsu distributor.



Prepare the following:

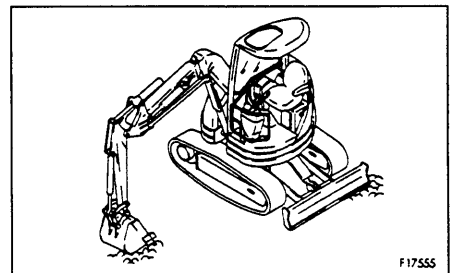
- Grease gun
- Steel pipe

REMOVAL OF RUBBER SHOE

⚠ WARNING

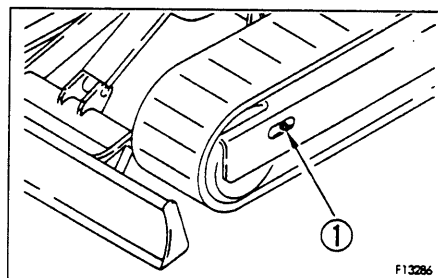
- It is extremely dangerous to release the grease by any method except the procedure given below. If the track tension is not relieved by this procedure, please contact your Komatsu distributor.
- Check that all the grease has been released before rotating the sprocket to remove the rubber shoe.

1. Raise the chassis with the boom and arm.
When doing this, operate the levers slowly.

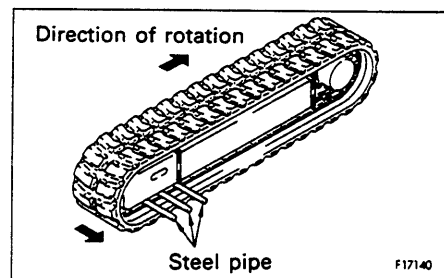


2. Loosen lubricator ① gradually to release the grease.

3. Turn lubricator ① a maximum of one turn.

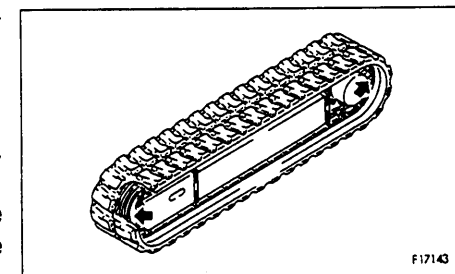
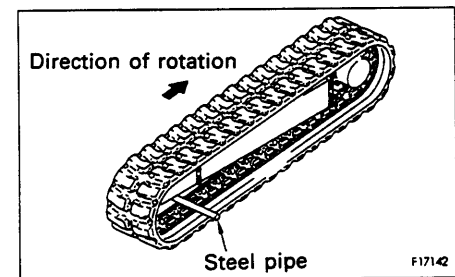
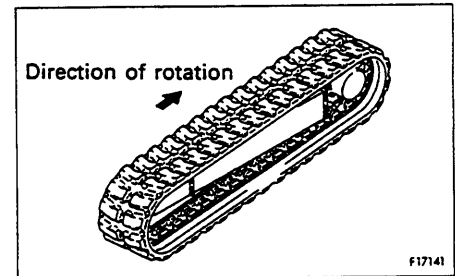
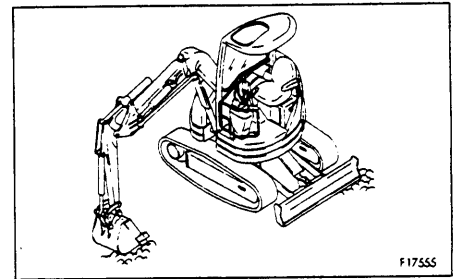


4. Fit the steel pipes inside the rubber shoe, rotate the sprocket in reverse, so that the steel pipes make the rubber shoe come up from the idler, then slide to the side to remove.



INSTALLATION OF RUBBER SHOE

1. Raise the chassis with the boom and arm.
When doing this, operate the levers slowly.
2. Mesh the rubber shoe with the sprocket and fit it over the idler.
3. Rotate the sprocket in reverse, then push in the rubber shoe and stop the rotation.
4. Mesh a steel pipe with the rubber shoe, then rotate the sprocket again and fit the rubber shoe securely on the idler.
5. Stop the rotation, and check that the rubber shoe is securely fitted to the sprocket and idler.
6. Adjust the tension of the rubber shoe.
For details, see "24.2.8 CHECK AND ADJUST TRACK TENSION".
7. Check that the track tension is correct and that the rubber shoe is correctly meshed on the sprocket and idler, then lower the machine to the ground.



24.2.10 CHECK AND ADJUST TRACK TENSION (MACHINE EQUIPPED WITH STEEL SHOES)

WARNING

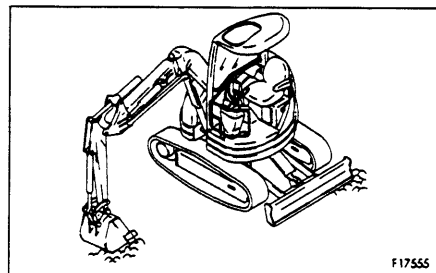
Carry out this operation with two workers. The operator must move the machine in accordance with the signals from the other worker. The track tension is checked with the chassis raised, so it is extremely dangerous if the machine is lowered by mistake during the inspection. Never move the machine while anyone is carrying out measurements.

The wear of pins and bushings on the undercarriage will vary with the working conditions and soil properties. It is thus necessary to continually inspect the track tension so as to maintain the standard tension.

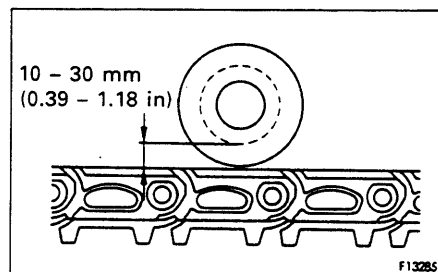
Carry out the check and adjustment under the same conditions as when operating (on jobsites where the track becomes clogged with mud, measure with the track clogged with mud).

Inspection

1. Raise the chassis with the boom and arm.
When doing this, operate the levers slowly.
2. The standard tension is a clearance of 10 – 30 mm (0.39 – 1.18 in) between the roller surface of the track shoe and the track roller tread at the 2nd track roller from the sprocket.



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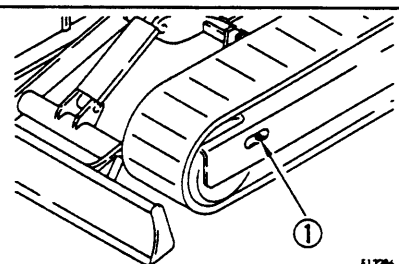
If the track tension is not at the standard value, adjust it in the following manner.

Adjustment

WARNING

Grease inside the adjusting mechanism is under high pressure. Grease coming from lubricator ① under pressure can penetrate the body causing injury or death. For this reason, do not loosen lubricator ① more than one turn. Do not loosen any part other than lubricator ①.

If the track tension is not relieved by this procedure, please contact your Komatsu distributor.

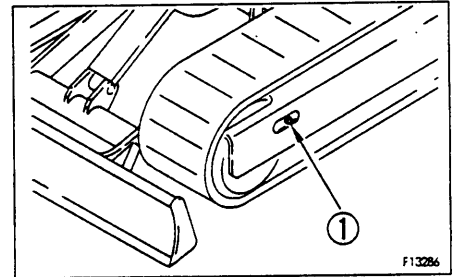


F13286

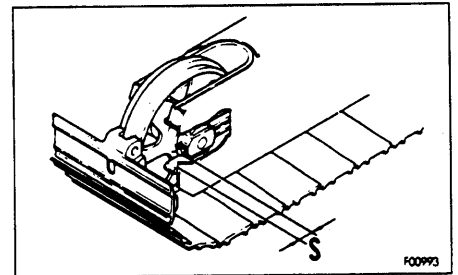
24. SERVICE PROCEDURE

- **When increasing tension**
- Prepare a grease gun

1. Pump in grease through lubricator ① with a grease pump.
2. To check that the correct tension has been achieved, move the machine backwards and forwards.
3. Check the track tension again, and if the tension is not correct, adjust it again.



4. Continue to pump in grease until S becomes 0 mm (0.0 in). If the tension is still loose, the pin and bushing are excessively worn, so they must be either turned or replaced. Please contact your Komatsu distributor.

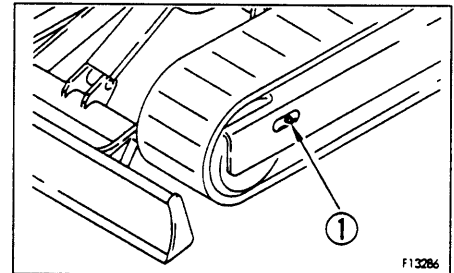


- When loosening tension

⚠ WARNING

It is extremely dangerous to release the grease by any method except the procedure given below. If the track tension is not relieved by this procedure, please contact your Komatsu distributor.

1. Loosen lubricator ① gradually to release the grease.
2. Turn lubricator ① a maximum of one turn.
3. If the grease does not come out smoothly, move the machine backwards and forwards a short distance.
4. Tighten lubricator ①.
5. To check that the correct tension has been achieved, move the machine backwards and forwards.
6. Check the track tension again, and if the tension is not correct, adjust it again.

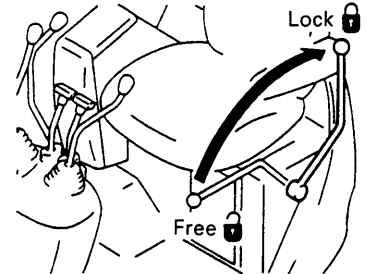


24.2.11 REPLACE BUCKET TEETH

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

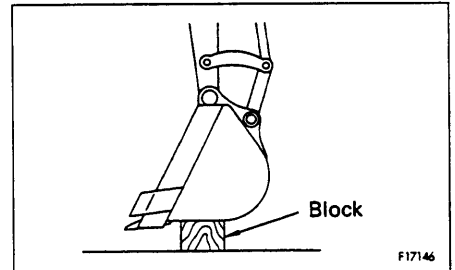
⚠ WARNING

It is dangerous if the work equipment moves by mistake when the teeth are being replaced. Set the work equipment in a stable condition, then stop the engine and apply the locks securely to the levers.



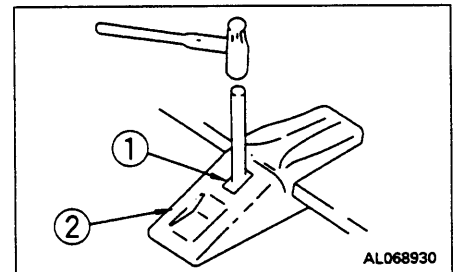
F17480

1. Set a block under the bottom face of the bucket, check that the work equipment is in a stable condition, then set the safety lock lever to the LOCK position. Set so that the bottom face of the bucket is horizontal.



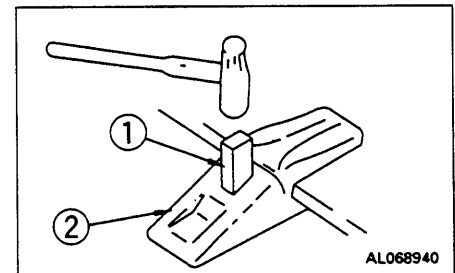
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2. Put a bar in contact with pin ①, then hit with a hammer and remove tooth ②.



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3. Wipe the mounting surface clean, fit new tooth ②, insert new pin ①, then hit it perpendicularly with a hammer to drive it into position and install the tooth to the bucket.



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NOTICE

Always replace the pin with a new pin. Do not use the old pin again.

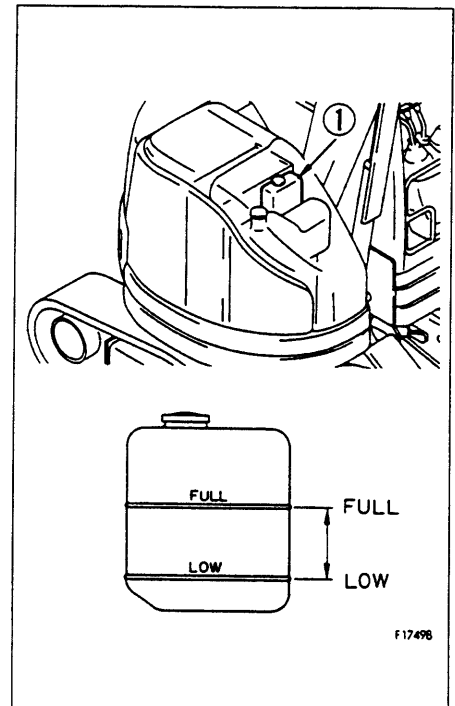
24.3. CHECK BEFORE STARTING

24.3.1 CHECK AND REFILL COOLANT

⚠ WARNING

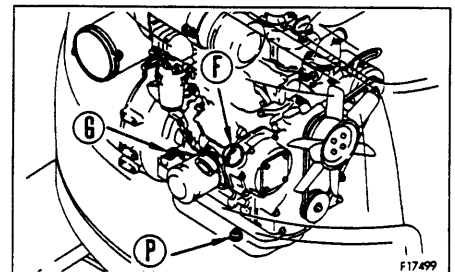
Do not open the radiator cap unless necessary. When checking the coolant, always check the sub-tank when the engine is cold.

1. Open the engine hood and check that the cooling water level is between FULL and LOW on sub-tank ① (shown in the diagram on the right).
If the water level is low, add water through the water filler of sub-tank ① to the FULL level.
2. After adding water, tighten the cap securely.
3. If the sub-tank becomes empty, first inspect for water leaks and then fill the radiator and the sub-tank with water.



24.3.2 CHECK OIL LEVEL IN ENGINE OIL PAN, ADD OIL

1. Open the engine hood.
2. Remove dipstick ⑥ and wipe the oil off with a cloth.
3. Insert dipstick ⑥ fully in the oil filler pipe, then take it out again.
4. The oil level should be between the H and L marks on dipstick ⑥.
If the oil level is below the L mark, add engine oil through oil filler ⑦.
For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
5. If the oil is above the H mark, drain the excess engine oil from drain plug ⑧, and check the oil level again.
6. If the oil level is correct, tighten the oil filler cap securely and close the engine hood.



REMARK

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

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

24.3.3 CHECK FUEL LEVEL

⚠ WARNING

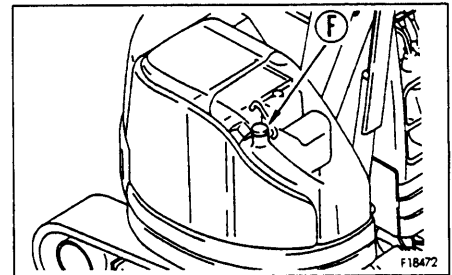
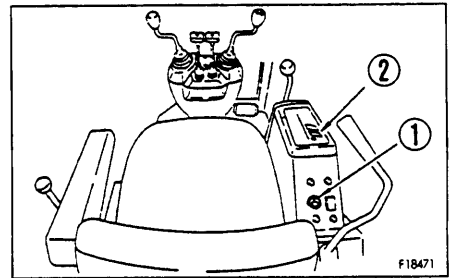
When adding fuel, never let the fuel overflow. This may cause a fire. If spilling fuel, thoroughly clean up any spillage.

1. Insert the key in starting switch ①, and turn it to the ON position to light up the monitor.
2. Check the fuel level on fuel gauge ②. If the fuel level is low, add fuel through fuel filler port ④.

Fuel capacity: 35 ℓ (9.42 US gal, 7.70 UK gal)

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".


3. After adding fuel, tighten the cap securely.

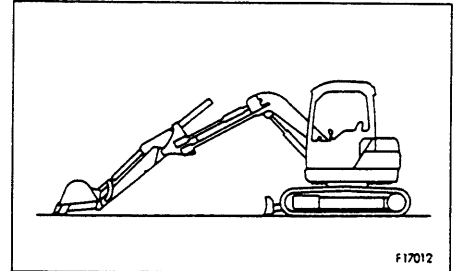


24.3.4 CHECK OIL LEVEL IN HYDRAULIC TANK, ADD OIL

WARNING


When removing the oil filler cap, oil may spurt out, so turn the cap slowly to release the internal pressure before removing the cap.

1. If the work equipment is not in the condition shown in the diagram on the right, run the engine at low speed, lower the blade to the ground, retract the arm and bucket cylinders, then lower the boom, set the bucket teeth in contact with the ground, and stop the engine.
2. Check that the oil level is between H and L line on sight gauge .

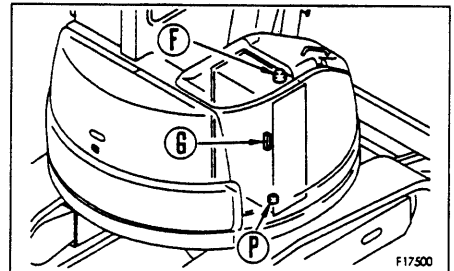


NOTICE

Do not add oil if the level is above the H line. This will damage the hydraulic equipment and cause the oil to spurt out.

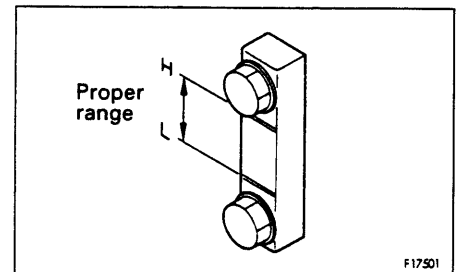
3. If the level is below the L mark, remove the upper cover of the hydraulic tank on the right side of the machine, add oil through oil filler .

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".



WARNING

If oil has been added to above the H mark, stop the engine and wait for the hydraulic oil to cool down, then drain the excess oil from drain plug .



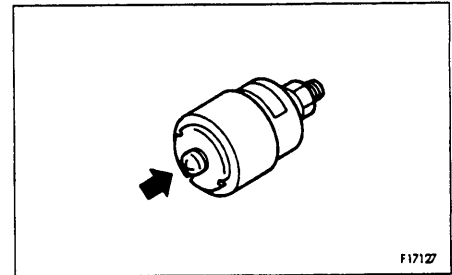
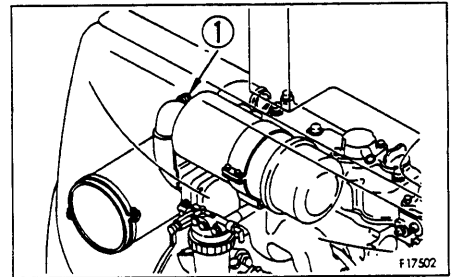
REMARK

The oil level will vary depending upon the oil temperature. Accordingly, use the following as a guide:

- When the oil temperature is close to the ambient temperature (10 to 30°C (50 to 86°F)), the level will be close to bottom line L on the sight gauge.
- When the oil temperature is the normal operating temperature (50 to 80°C (122 to 176°F)), the level will be close to top line H on the sight gauge.

24.3.5 CHECK DUST INDICATOR

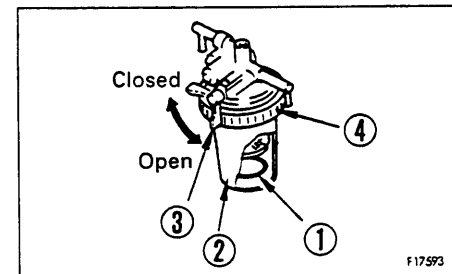
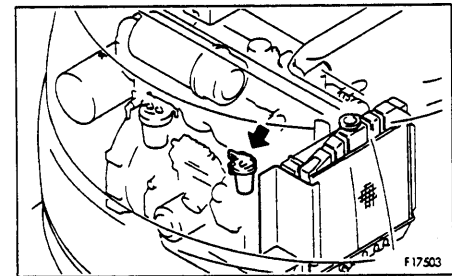
1. Open the engine hood and check that the red piston is not showing in dust indicator ①.
2. If the red piston is showing, clean or replace the element immediately. For details of the method of cleaning the element, see "24.2.1 CHECK, CLEAN, REPLACE AIR CLEANER".
3. After checking, cleaning, or replacing, press the knob of dust indicator ① to reset the red piston to its original position.



24.3.6 CHECK WATER SEPARATOR

If red ring ① of the water separator is at the bottom of case ②, there is not water.
 If red ring ① is floating, there is water up to the bottom of the ring, so drain the water as follows.

- Use a water separator filter wrench.
1. Open the engine hood, and set handle ③ to the CLOSED position.
 2. Using the filter wrench, loosen ring ④, then remove case ② and throw out the water inside it.
 3. Set case ② in position, then tighten ring ④ to install it.
 4. Set handle ③ to the OPEN position.
 5. Drain any water or sediment from the fuel tank. For details, see "24.2 WHEN REQUIRED".



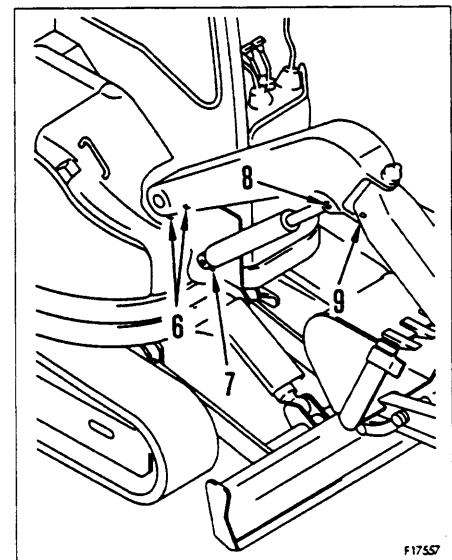
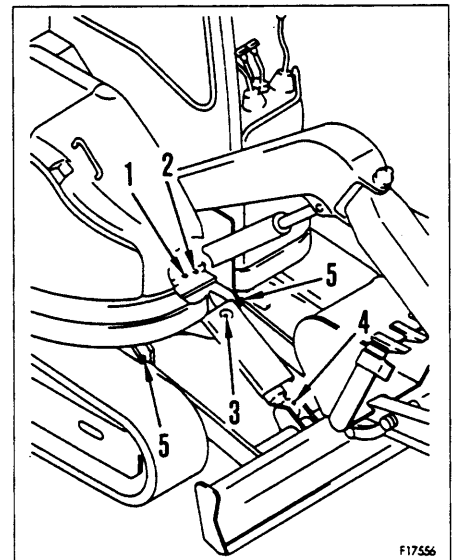
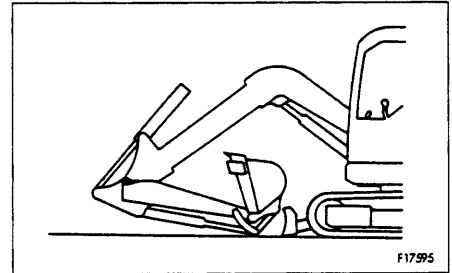
24.4 EVERY 100 HOURS SERVICE

24.4.1 LUBRICATING

WARNING

Never swing the upper structure while greasing the swing pinion.

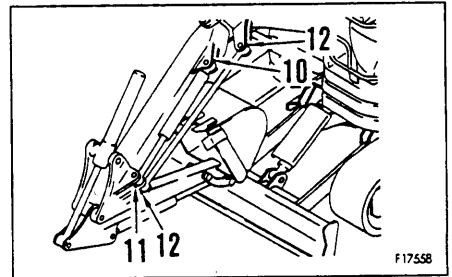
- Prepare a grease gun.
 - 1. Set the work equipment in the greasing posture on the right, then lower the work equipment to the ground and stop the engine.
 - 2. Using a grease gun, pump in grease through the grease fittings shown by arrows.
 - 3. After greasing, wipe off any old grease that was pushed out.
- | | |
|---|------------|
| 1. Swing circle | (1 point) |
| 2. Swing pinion | (1 point) |
| Turn the chassis 90° at a time to set to the position in 4 directions when greasing the swing pinion. | |
| 3. Blade cylinder foot pin | (1 point) |
| 4. Blade cylinder rod end | (1 point) |
| 5. Blade foot pin | (2 points) |
-
- | | |
|--|------------|
| 6. First boom foot pin | (2 points) |
| 7. Boom cylinder foot pin | (1 point) |
| 8. Boom cylinder rod end | (1 point) |
| 9. First boom – Second boom coupling pin | (2 points) |



24. SERVICE PROCEDURE

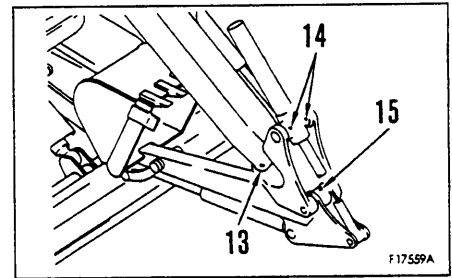
- 10. Offset cylinder foot pin
- 11. Offset cylinder rod end pin
- 12. Sub-link coupling pin

- (1 point)
- (1 point)
- (2 points)



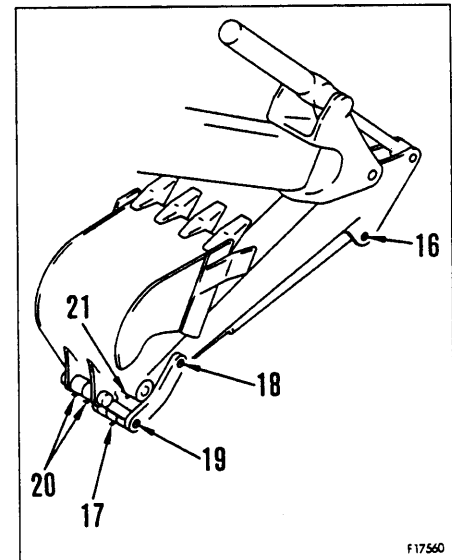
- 13. Second boom – Third bracket coupling pin
- 14. Arm cylinder trunnion pin
- 15. Third bracket – Arm coupling pin

- (2 points)
- (2 points)
- (1 point)



- 16. Bucket cylinder foot pin
- 17. Bucket cylinder rod end pin
- 18. Arm-Link coupling pin
- 19. Link coupling pin
- 20. Bucket-Link coupling pin
- 21. Arm-Bucket coupling pin

- (1 point)
- (1 point)
- (1 point)
- (1 point)
- (1 point)
- (1 point)



24.5 EVERY 250 HOURS SERVICE

24.5.1 CHANGE OIL IN ENGINE OIL PAN, REPLACE ENGINE OIL FILTER CARTRIDGE

⚠ WARNING

The oil is at high temperature after the engine has been operated, so never change the oil immediately after finishing operations. Wait for the oil to cool down before changing it.

Prepare the following.

- Container to catch drained oil: Min 7.3 ℓ (1.93 US gal, 1.61 UK gal) capacity
- Refill capacity: 7.3 ℓ (1.93 US gal, 1.61 UK gal)
- Filter wrench for engine oil filter cartridge

1. Set a container to catch the oil immediately under the drain plug at the bottom of the machine.

2. Remove drain plug **Ⓟ** slowly to avoid getting oil on yourself, and drain the oil.

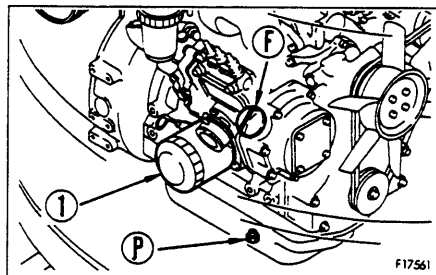
3. Check the drained oil, and if there are excessive metal particles or foreign material, please contact your Komatsu distributor.

4. Install drain plug **Ⓟ**.

5. Using a filter wrench, turn filter cartridge **①** counterclockwise to remove it.

In particular, if this operation is carried out immediately after stopping the engine, a large amount of oil will come out, so wait for 10 minutes before starting the operation.

6. Clean the filter holder, coat the packing surface of a new filter cartridge with engine oil (or coat it thinly with grease), then install it to the filter holder.



24. SERVICE PROCEDURE

7. When installing; tighten until the packing surface contacts the seal surface of the filter holder, then tighten it up 1/2 to 3/4 of a turn.
8. After replacing the filter cartridge, add engine oil through oil filler ⊕ until the oil level is between the H and L marks on the dipstick.
For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
9. Run the engine at idling for a short time, then stop the engine, and check that the oil level is between the H and L marks on the dipstick. For details, see "24.3 CHECK BEFORE STARTING".

NOTICE

Even if the machine has not been operated for 250 hours, the oil and filter cartridge must be replaced when the machine has been operated for 6 months.

If the same way, even if the machine has not been operated for 6 months, the oil and filter cartridge must be replaced when the machine has been operated for 250 hours.

24.5.2 CHECK OIL LEVEL IN FINAL DRIVE CASE, ADD OIL

⚠ WARNING

- The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before starting the operation.
- If there is still pressure remaining inside the case, the oil or plug may fly out.
Loosen the plug slowly to release the pressure.

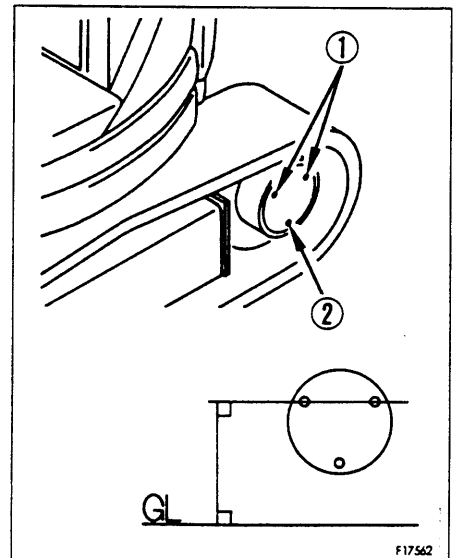
Prepare the following.

- Container to catch drained oil
- Hexagon wrench

1. Set so that the 2 LEVEL plugs ① are horizontal to the ground surface and DRAIN plug ② is at the bottom position.
2. Set a container under DRAIN plug ② to catch the oil.
3. Using the hexagon wrench, remove LEVEL plug ①, and check that the oil level is near the bottom of the plug hole.
4. If the oil level is low, add engine oil through the LEVEL plug hole ①.
Add engine oil until the oil flows out from LEVEL plug hole ①.

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".

5. After checking, install LEVEL plug ①.
Tightening torque of LEVEL plug ①: 29.4 ± 9.81 N·m
(3 ± 1 kgf·m, 21.7 ± 7.2 lbft)

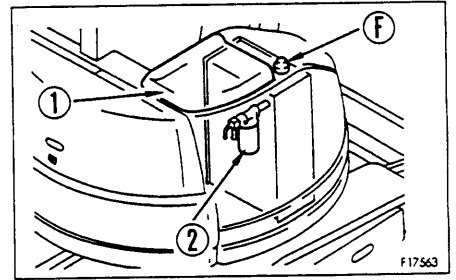


24.5.3 REPLACE HYDRAULIC FILTER CARTRIDGE

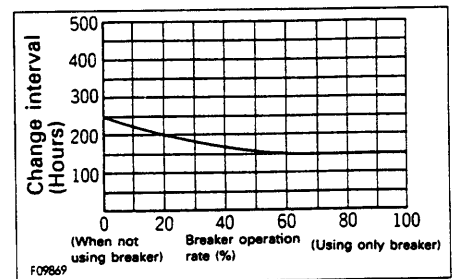
⚠ WARNING

When removing the oil filler cap, turn it slowly to release the internal pressure before removing it.

- Prepare a filter wrench for hydraulic filter cartridge.
1. Remove cover ① at the right side of the machine.
 2. Remove the cap from oil filler ⑥, and release the internal pressure.
 3. Using a filter wrench, turn filter cartridge ② counterclockwise to remove it.
 4. Clean the filter holder, coat a packing surface of a new filter cartridge with engine oil (or coat it thinly with grease), then install it to the filter holder.
 5. When installing, tighten until the packing surface of the filter holder, then tighten it up 1/2 to 3/4 of a turn.
 6. Install cover ①.



If a hydraulic breaker is installed, the hydraulic oil deteriorates far more rapidly than when carrying out normal bucket operations, so set the maintenance interval as follows. On new machines, replace after the first 100 – 150 hours, and after that, replace the element at the interval shown in the graph on the right.



24.5.4 CHECK FAN BELT TENSION, ADJUST**Checking**

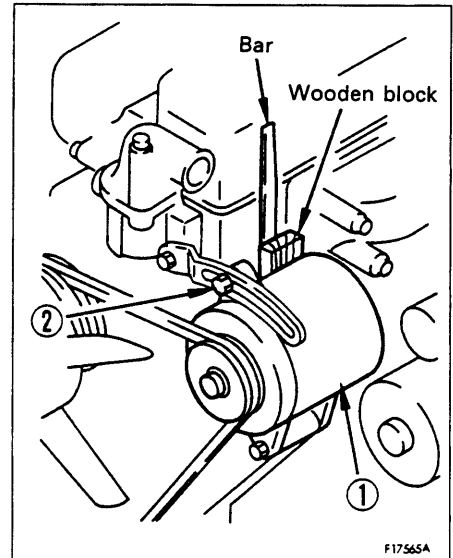
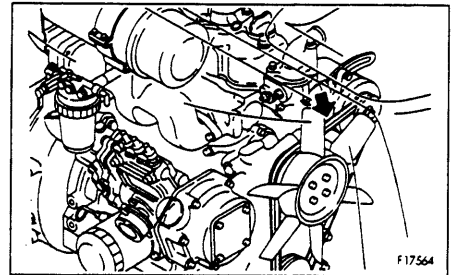
The belt should normally deflect by 10 – 15 mm (0.39 – 0.59 in) when pressed with the finger (with a force of approx. 6 kg (13 lb)) at a point midway between the alternator pulley and fan pulley.

Adjusting

Prepare the following.

- Bar
- Wooden block

1. Insert a bar between alternator ① and the cylinder block to fix alternator ① in position. When fixing alternator ① in position, insert a wooden block between the bar and alternator ① to prevent damage to the alternator.
2. Loosen bolts and nuts ②.
3. Move alternator ① with a bar so that the deflection of the belt is 10 – 15 mm (0.39 – 0.59 in) (approx. 6 kg (13 lb)).
4. Tighten the bolts and nuts ② to fix alternator ① in position.
5. Check each pulley for damage, wear of the V-groove, and wear of the V-belt. In particular, be sure to check that the V-belt is not touching the bottom the V-groove.
6. If the belt is stretched, leaving no allowance for adjustment, or if it is cut or cracked, place contact your Komatsu distributor for replacement.



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24.6 EVERY 500 HOURS SERVICE

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

24.6.1 REPLACE FUEL FILTER CARTRIDGE

⚠ WARNING

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

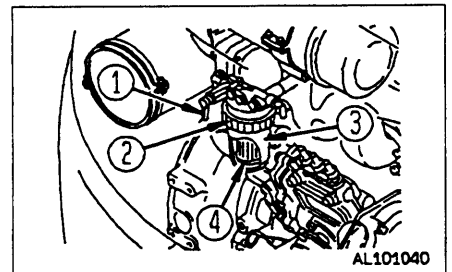
Prepare the following.

- Filter wrench for fuel filter element
 - Container to catch drained oil
1. Set the container to catch the fuel under the filter element.
 2. Close valve ① at the top of the filter.

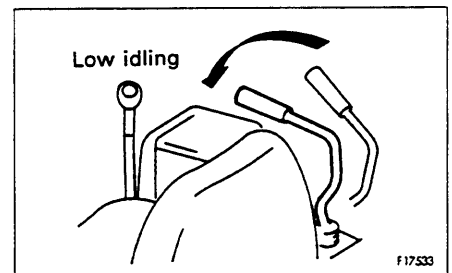
3. Using the filter wrench, loosen ring ②, then remove element cup ③ and take out element ④.
4. Wash element cup ③ in light oil or in a cleaning oil and install a new element.

REMARK

When replacing a fuel filter element, replace the filter O-ring at the same time.



4. Set the fuel control lever to the low idling position.
5. After replacing the fuel filter element bleed the air.



Procedure for bleeding air

1) Fill the fuel tank with fuel.

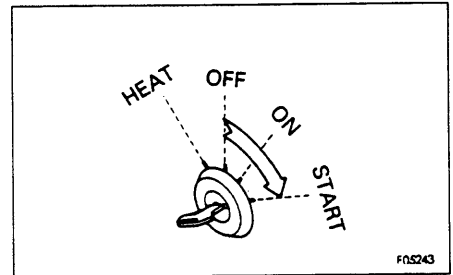
2) Turn the starting switch key to the START position, and turn the starting motor for 10 – 20 seconds to crank the engine. The automatic air bleed device will automatically bleed the air, and the engine will start.

NOTICE

After running the starting motor once, wait for at least 2 minutes before running it again.

REMARK

When the engine has run out of fuel, carry out the same procedure and crank the engine for 15 – 20 seconds. Repeat this operation 2 – 3 times to bleed the air.



24.6.2 CLEAN, CHECK RADIATOR FINS

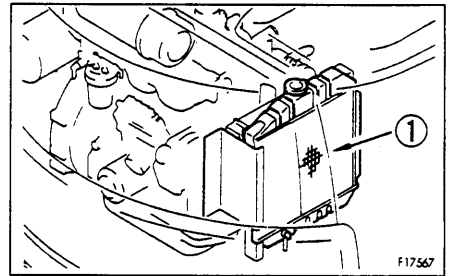
⚠ WARNING

If compressed air, steam, or water hit your body directly, there is danger of injury. Always wear protective glasses, mask, and safety shoes.

1. Open the engine food.
2. Use compressed air to blow off the mud, dirt, or leaves clogging radiator fins ①.

NOTICE

To prevent damage to the fins when using compressed air, do not bring the jet close to the radiator fins.
If the fins are damaged, this will lead to water leakage or overheating.



24.7 EVERY 1000 HOURS SERVICE

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

24.7.1 CHANGE OIL IN SWING MACHINERY CASE

⚠ WARNING

The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before starting the operation.

Prepare the following.

- Container to catch drained oil: Min. 0.9 ℓ (0.24 US gal, 0.20 UK gal) capacity
- Refill capacity: 0.9 ℓ (0.24 US gal, 0.20 UK gal)

1. Set a container to catch the oil under drain plug **(P)** at the bottom of the machine.
2. Remove drain plug **(P)** under the chassis, drain the oil, then tighten the plug again.

Tightening torque of drain plug **(P)**: 29.4 ± 9.8 Nm (3 ± 1 kgm, 21.7 ± 7.2 lbft)

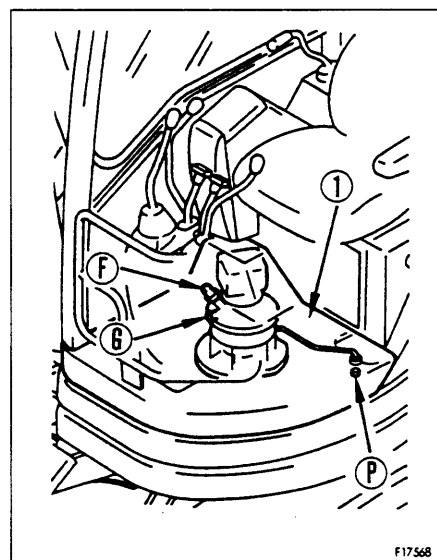
3. Remove floor plate **(1)**, then remove the cap of oil filler port **(F)** and level plug **(G)**. Add engine oil through oil filler port **(F)** to the specified level.

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".

4. Add oil until the oil flows out from the hole for level plug **(G)**, then install level plug **(G)**.

Tightening torque of level plug **(G)**: 14.7 ± 4.9 Nm (1.5 ± 0.5 kgm, 10.9 ± 3.6 lbft)

5. Install cap of oil filler **(F)**.



24.7.2 CHANGE OIL IN FINAL DRIVE CASE

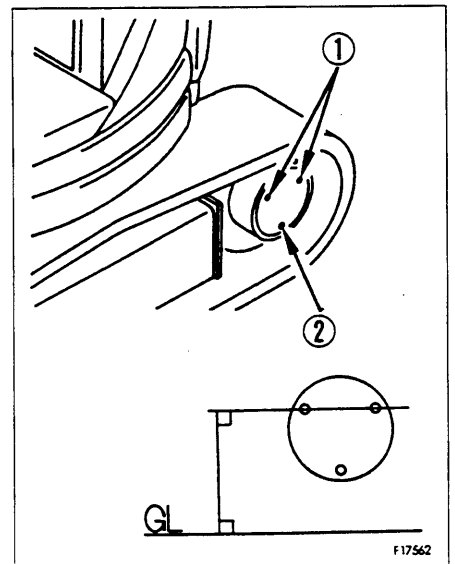
⚠ WARNING

- The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before starting the operation.
- If there is still pressure remaining inside the case, the oil or plug may fly out. Loosen the plug slowly to release the pressure.

Prepare the following.

- Container to catch drained oil: Min. 0.6 l (0.16 US gal, 0.13 UK gal) capacity
- Refill capacity: 0.6 l (0.16 US gal, 0.13 UK gal)
- Hexagon wrench

1. Set so that the 2 LEVEL plugs ① are horizontal to the ground surface and DRAIN plug ② is at the bottom position.
2. Set a container under DRAIN plug ② to catch the oil.
3. Using the hexagon wrench, remove one of plugs ①, and DRAIN plug ②, and drain the oil.
4. Tighten DRAIN plug ②.
5. Refill the specified quantity of engine oil through LEVEL plug ①. For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".
6. When oil comes out from the hole of LEVEL plug ①, install LEVEL plug ①.



24.8 EVERY 2000 HOURS SERVICE

Maintenance for every 100, 250, 500 and 1000 hours should be carried out at the same time.

24.8.1 CHANGE OIL IN HYDRAULIC TANK, CLEAN STRAINER

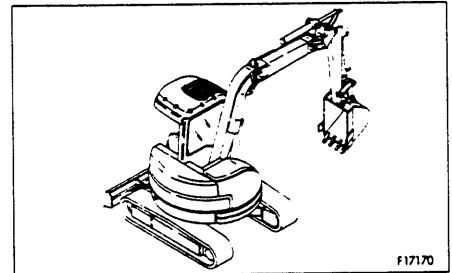
WARNING

The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before changing the oil. When removing the oil filler cap, turn it slowly to release the internal pressure, then remove it carefully.

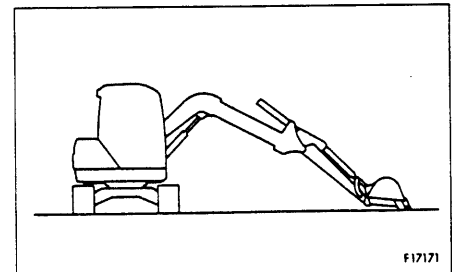
Prepare the followings.

- Container to catch drained oil: Min. 34 ℓ (8.98 US gal, 7.48 UK gal) capacity
- Refill capacity: 34 ℓ (8.98 US gal, 7.48 UK gal)
- Handle

1. Swing the upper structure so that the drain plug under the hydraulic tank is between the left and right tracks.

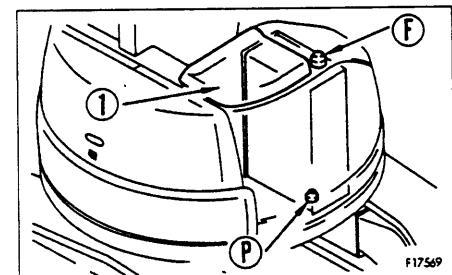


2. Retract the arm and bucket cylinder to the stroke end, then lower the boom and put the bucket teeth in contact with the ground.



3. Lower the blade to the ground and stop the engine.

4. Remove cover ① on the right side of the machine, then remove the cap of oil filler port ②.



24. SERVICE PROCEDURE

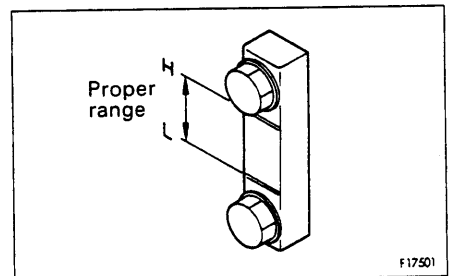
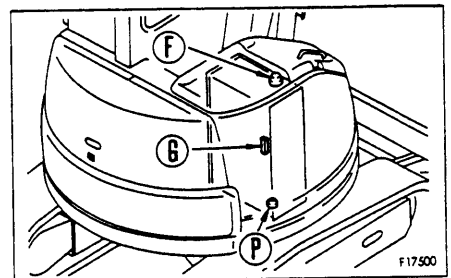
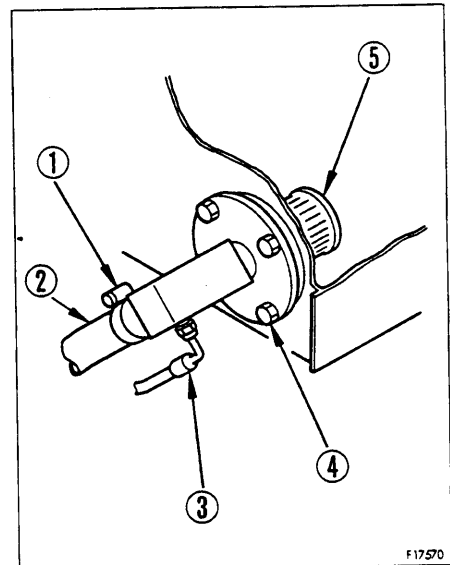
5. Set the oil container under the drain plug under the machine. Using the handle, remove drain plug \textcircled{P} and drain the oil. Check the O-ring installed to plug \textcircled{P} , and if it is damaged, replace the O-ring. After draining the oil, tighten drain plug \textcircled{P} .

Tightening torque: $68.6 \pm 9.8 \text{ Nm}$ ($7 \pm 1 \text{ kgm}$, $50.6 \pm 7.2 \text{ lbft}$)

When removing drain plug \textcircled{P} , be careful not to get oil on yourself.

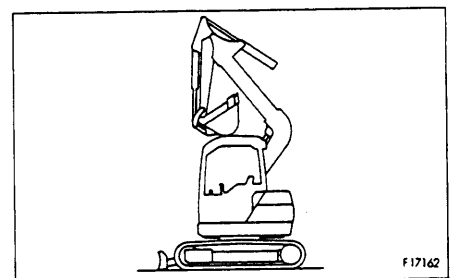
6. Loosen hose band $\textcircled{1}$, remove hoses $\textcircled{2}$ and $\textcircled{3}$, loosen bolt $\textcircled{4}$, then remove strainer $\textcircled{5}$.
7. Remove the dirt stuck to strainer $\textcircled{5}$, then wash it in clean diesel oil or flushing oil. If strainer $\textcircled{5}$ is damaged, replace it with a new one.
8. Secure strainer $\textcircled{5}$ with bolts $\textcircled{4}$, install hoses $\textcircled{3}$ and $\textcircled{2}$, then secure with hose band $\textcircled{1}$.
9. Add engine oil to the specified level through oil filler port \textcircled{F} . Check that the oil level is between the H and L marks on sight gauge \textcircled{G} .

For details of the oil to use, see "20. USE OF FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE".



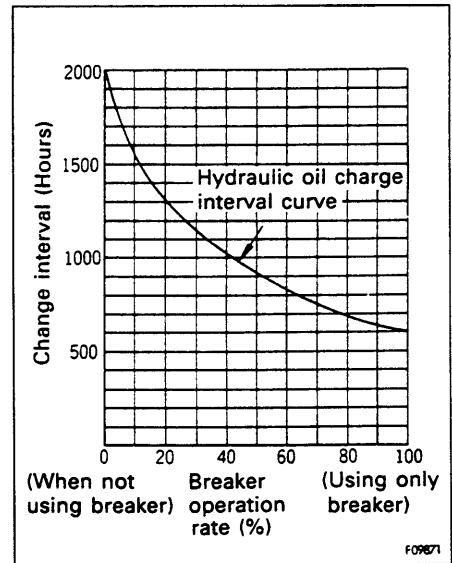
10. Pressurize hydraulic tank

Extend the boom, arm, and bucket cylinders fully as shown in the diagram on the right, remove the oil filler cap, then install the cap and pressurize the inside of the tank.



11. After changing the oil, place all the control levers at neutral, and run the engine at low idling for approx. 2 – 3 minutes before starting work.

If a hydraulic breaker is installed, the hydraulic oil deteriorates far more rapidly than when carrying out normal bucket operations, so set the maintenance interval as shown in the graph on the right.



24.8.2 CHECK ALTERNATOR, STARTING MOTOR

The brush may be worn, or the bearing may have run out of grease, so contact your Komatsu distributor for inspection or repair.

If the engine is started frequently, carry out inspection every 1000 hours.

24.8.3 CHECK ENGINE VALVE CLEARANCE, ADJUST

Contact your Komatsu distributor for inspection or adjustment.

SPECIFICATIONS

25. SPECIFICATIONS

PC28UU-2

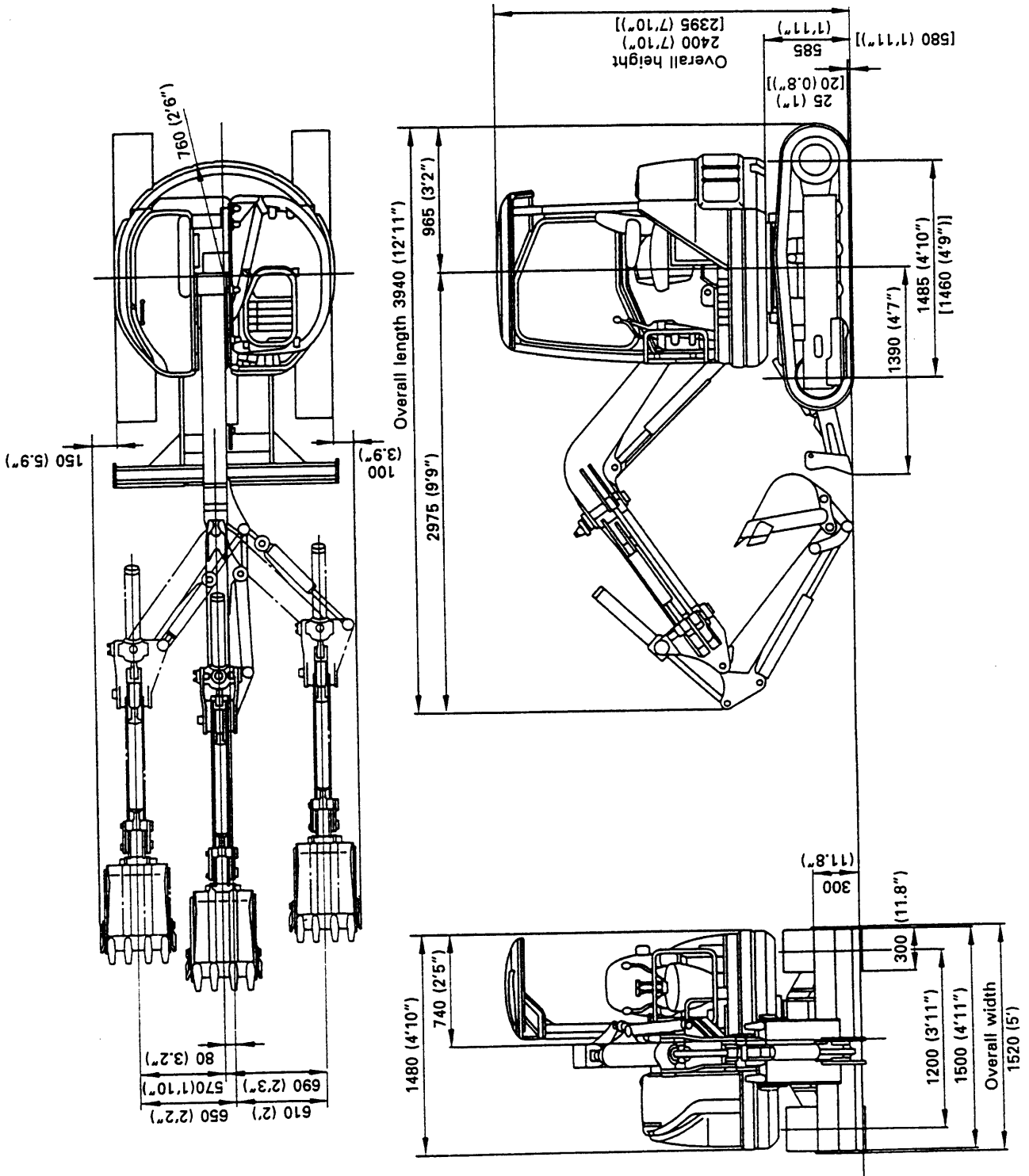
	Rubber shoe, cab	Steel shoe, cab
WEIGHT		
● Operating weight (without operator) (kg)	2740 kg (6042 lb)	2780 kg (6130 lb)
PERFORMANCE		
● Bucket capacity (standard bucket)	0.07 m ³ (0.09 cu.yd)	
● Width of opening	(Standard bucket)	430 mm (16.9 in)
	(With side cutter)	500 mm (19.7 in)
● Travel speed	2.3 km/h (1.4 MPH)	
● Swing speed	10 rpm	
TRACK SHOE		
● Rubber shoe (standard)	Rubber shoe 300 mm (11.8 in)	Double grouser shoe 300 mm (11.8 in)
ENGINE		
● Model	Komatsu 3D82AE diesel engine	
● Flywheel horsepower	17.6 kW (24 HP)/2450 rpm	
● Starting motor	12 V 1.8 kW	
● Alternator	12 V 40 A	
● Battery	12 V 70 Ah x 1 piece	

- Cab, rubber shoe specification machine
- Cab, steel shoe specification machine

The values without parenthese are the values for the rubber shoe specification machine.

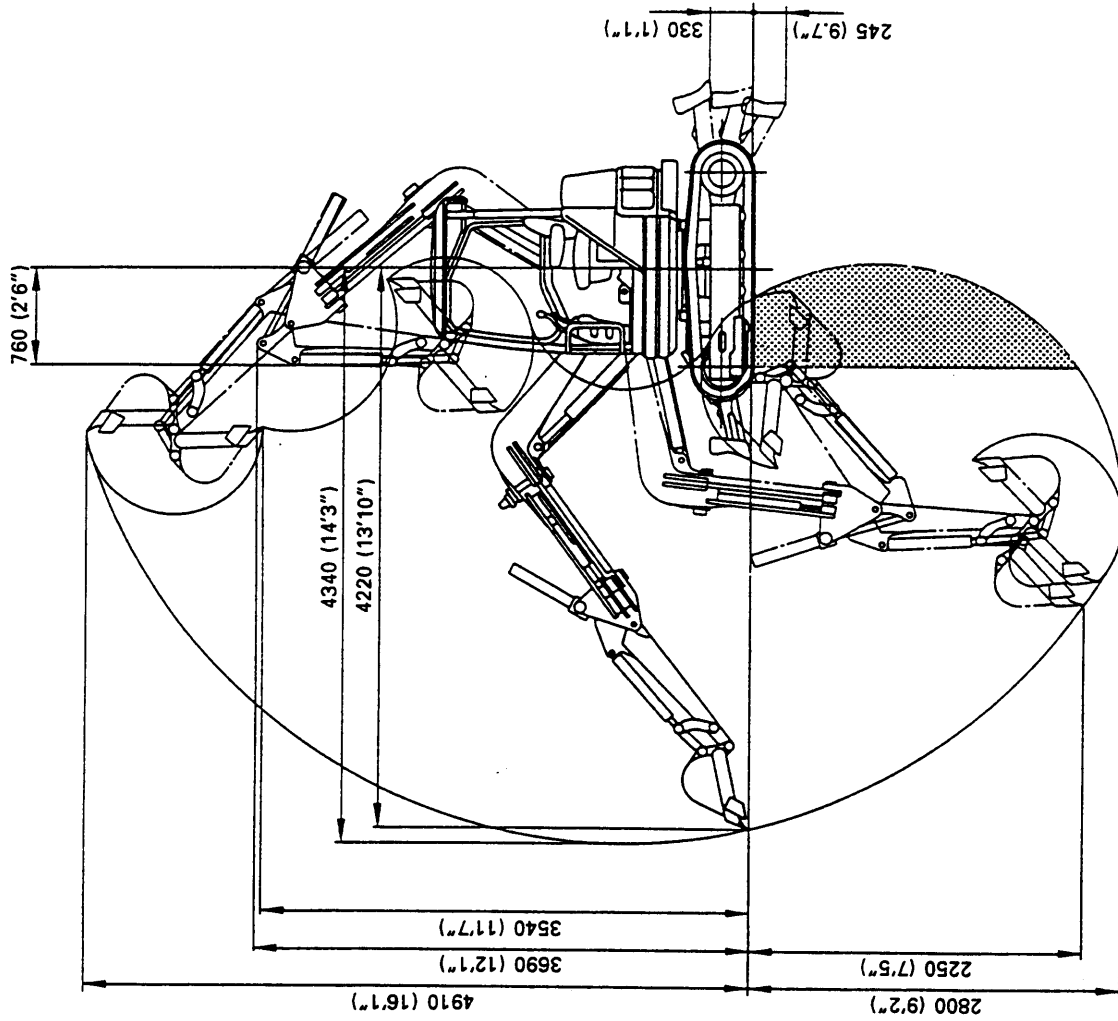
The values inside parenthese are the values for the steel shoe specification machine.

If only one value is given, the value is the same for both the rubber shoe specification and steel shoe specification machines.



25. SPECIFICATIONS

- Cab, rubber shoe specification machine
- Cab, steel shoe specification machine



OPTIONS, ATTACHMENTS



26. GENERAL PRECAUTIONS

26.1 PRECAUTIONS RELATED TO SAFETY

If attachments or options other than those authorized by Komatsu are installed, this will not only affect the life of the machine, but will also cause problems with safety.

When installing attachments not listed in this Operation and Maintenance Manual, please contact your Komatsu distributor first.

If you do not contact Komatsu, we cannot accept any responsibility for any accident or failure.

WARNING

Precautions for removal and installation operations

When removing or installing attachments, obey the following precautions and take care to ensure safety during the operation.

- **Carry out the removal and installation operations on a flat, firm ground surface.**
- **When the operation is carried out by two or more workers, determine signals and follow these during the operation.**
- **When carrying heavy objects (more than 25 kg (55.1 lb)), use a crane.**
- **When removing heavy parts, always support the part before removing it.**
When lifting such heavy parts with a crane, always pay careful attention to the position of the center of gravity.
- **It is dangerous to carry out operations with the load kept suspended. Always set the load on a stand, and check that it is safe.**
- **When removing or installing attachments, make sure that they are in a stable condition and will not fall over.**
- **Never go under a load suspended from a crane.**
Always stand in a position that is safe even if the load should fall.

NOTICE

Qualifications are required to operate a crane. Never allow the crane to be operated by an unqualified person.

For details of the removal and installation operations, please contact your Komatsu distributor.

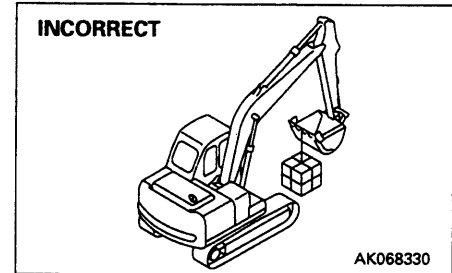
27. HANDLING BUCKET WITH HOOK

27.1 CHECKING FOR DAMAGE TO BUCKET WITH HOOK

Check that there is no damage to the hook, stopper, or hook mount. If any abnormality is found, please contact your Komatsu distributor.

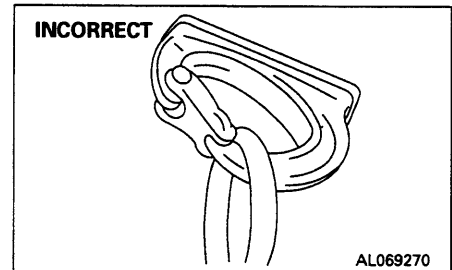
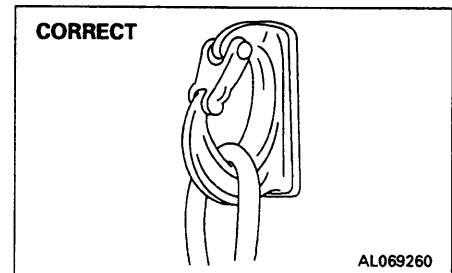
27.2 PROHIBITED OPERATIONS

The standard work equipment must not be used for lifting loads. If this machine is to be used for lifting loads, it is necessary to install the special bucket with hook.



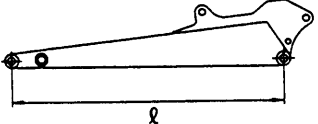
27.3 PRECAUTIONS DURING OPERATIONS

- When carrying out lifting operations, reduce the engine speed.
- Depending on the posture of the work equipment, there is danger that the wire or load may slip off the hook. Always be careful to maintain the correct hook angle to prevent this from happening.
- Never steer the machine while lifting a load.
- If the bucket with hook is turned and used for operations, it will hit the arm during dumping operations, so be careful when using it.
- Loads suspended must not exceed the limit indicated in the "LIFTING CAPACITY TABLE" stuck on the right-side lower portion of the driver's seat.
- If you wish to install a hook in the future, please contact your Komatsu distributor.



28. INTRODUCTION OF ATTACHMENTS

28.1 SPECIFICATION, USE

Name	Specification	
Track shoe	Wide shoe Triple shoe	Width: 350 mm (13.8 in) Width: 300 mm (11.8 in)
Bucket	Narrow bucket Narrow bucket Wide bucket	Width: 250 mm (9.9 in), 0.03 m ³ (0.04 cu.yd) Width: 350 mm (13.8 in), 0.04 m ³ (0.05 cu.yd) Width: 530 mm (20.9 in), 0.08 m ³ (0.10 cu.yd)
Long arm	Distance l between pins 1560 mm (5'1") 	
Telescopic arm	Distance l between pins 1260 mm (4'2") to 1760 mm (5'9")	

Others

- Strengthened bucket
- Power tilt mechanical angle blade

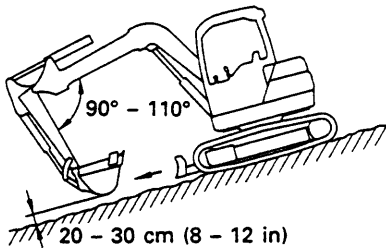
For the above attachments, ask your Komatsu distributor.

28.2 PRECAUTIONS WHEN INSTALLING ATTACHMENTS

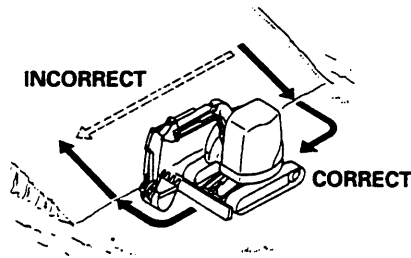
⚠ WARNING

Long work equipment reduces the stability of the chassis, so if the swing is operated on a slope, or when going down a steep hill, the machine may lose its balance and overturn. The following operations are particularly dangerous, so never operate the machine in these ways.

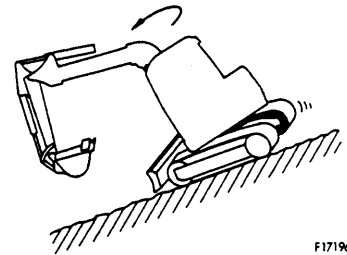
- Going downhill with the work equipment raised



- Traveling across slopes



- Swinging the upper structure on slopes



F17196

⚠ WARNING

- If heavy work equipment is installed, the overrun of the swing becomes greater (the distance from the point where the operator operates the control levers to stop the swing to the point where the upper structure stops completely), so there is danger of mistaking the distance and hitting something.

Always operate so that there is an ample margin to the stopping point.

Furthermore, the hydraulic drift also becomes larger (when the work equipment is stopped in mid-air, it will gradually move down under its own weight).

- Always follow the correct procedure when installing the boom and arm. If the correct procedure is not followed, this may lead to serious damage or injury, so please consult your Komatsu distributor before carrying out installation.

⚠ WARNING

If long work equipment is installed, the working range will suddenly become larger, so there is danger of mistaking the distance and hitting something.

Always operate the work equipment so that there is ample space from any obstacles in the area.

28.3 HANDLING POWER TILT, MECHANICAL ANGLE BLADE

With this blade, it is possible to carry out tilting and lifting operations with the blade control lever, and it is also possible to change the left and right angle by changing the position of the connection for the blade rod.

28.3.1 LIFT, TILT OPERATION

Operate with the blade control lever.

LIFT OPERATIONS

- ① RAISE
- ② LOWER

TILT OPERATIONS

- ③ RIGHT TILT
- ④ LEFT TILT

Amount of tilt

Right tilt : 180 mm (7.1 in)

Left tilt : 180 mm (7.1 in)

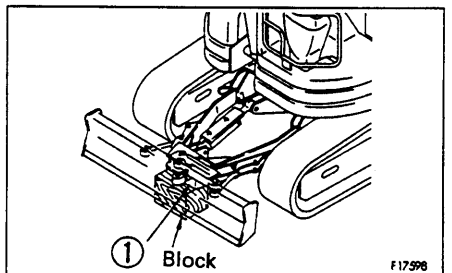
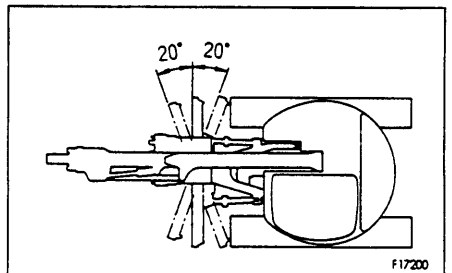
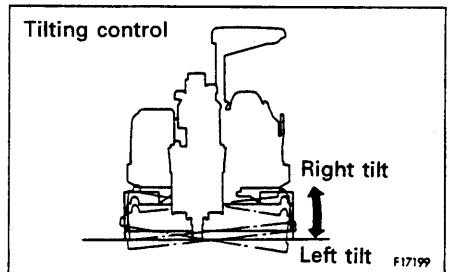
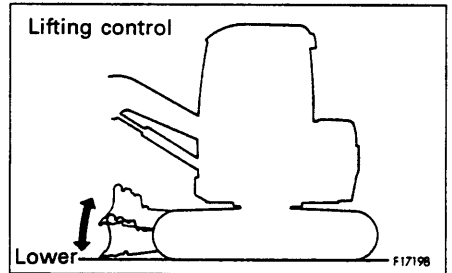
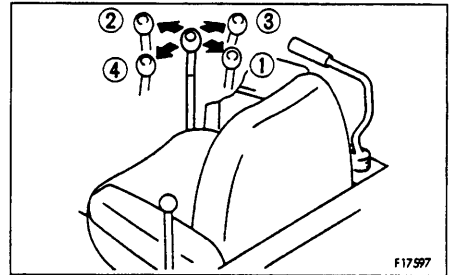
28.3.2 METHOD OF ANGLING

When dumping the soil to one side, set the blade at an angle.

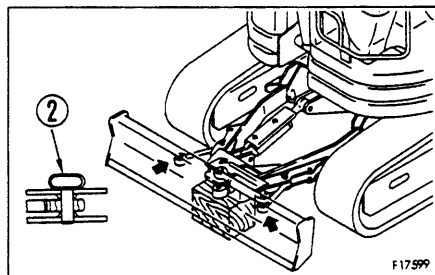
Amount of angling

Left, right: 20°

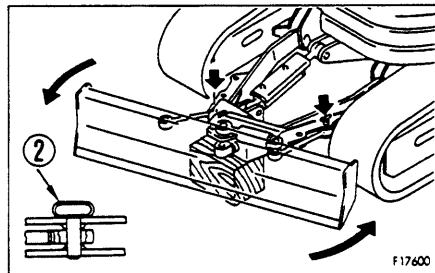
1. Raise the blade approx. 200 – 300 mm (8 – 12 in), then set a block under the bottom of frame ①.



2. Remove lock pin ② of left and right rod.



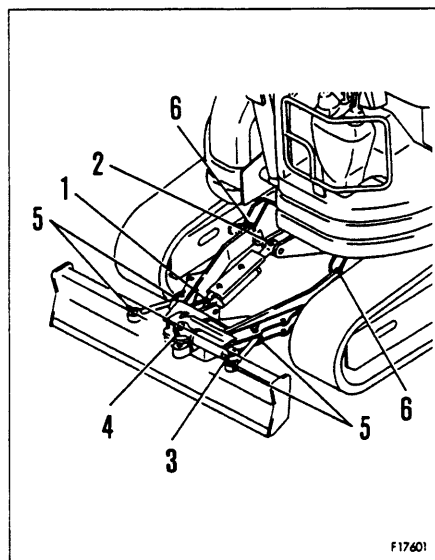
3. Angle the blade to the left or right, then install lock pin ② again.



28.3.3 OPERATING PROCEDURE (EVERY 100 HOURS SERVICE)

LUBRICATION

1. Using a grease gun, pump in grease at the grease fittings marked by arrows.
2. After greasing, wipe off all old grease that is pushed out.
 1. Lift cylinder foot pin (1 point)
 2. Lift cylinder rod end (1 point)
 3. Tilt cylinder foot pin (1 point)
 4. Tilt cylinder rod end (1 point)
 5. Angle rod pin (4 points)
 6. Blade foot pin (2 points)



28.3.4 SPECIFICATION

- Blade width 1725 mm (5'8")
- Blade height 350 mm (1'2")
- Amount of raise Rubber shoe 355 mm (1'2")
- Steel shoe 360 mm (1'2")
- Amount of lower Rubber shoe 285 mm (11.2")
- Steel shoe 290 mm (11.4")
- Amount of angle (Left, right) 20°
- Amount of tilt (Left, right) 180 mm (7.1")

PC28UU-2 HYDRAULIC EXCAVATOR

Form No. SEAM034800

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Printed in Japan 08-99 (01-1)
